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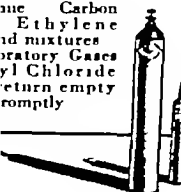
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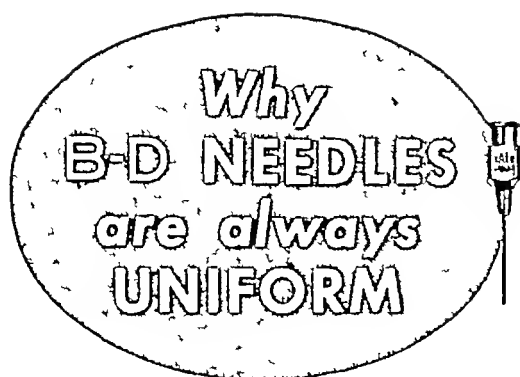
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# SURGERY

## GYNECOLOGY AND OBSTETRICS

VOLUME 89

JULY, 1949

NUMBER 1

### THE RELIEF OF PAIN IN CHRONIC (CALCAREOUS) PANCREATITIS BY SYMPATHECTOMY

BRONSON S RAY, M D, and A DALE CONSOLE, M D, New York, New York

CHRONICALLY recurring pancreatitis may cause a wide variety of signs and symptoms but calcareous deposits in the parenchyma of the organ, demonstrable by roentgenograms, and pain are the features common to almost all cases as borne out by the recent reviews (2, 7, 8, 16). The pain which is chiefly in the midline of the upper abdomen may be referred to either or both upper abdominal quadrants and to the back. It is recurring or constant often becoming intolerable and in such cases constitutes the dominant problem in the treatment of the disease. Total or near total pancreatectomy has been recommended and employed by some (Whipple, Clagett (15), Zininger, Parsons), but the operation is formidable, even unfeasible in some cases. Since relief of pain is the primary purpose of surgical treatment, the interruption of pain pathways from the pancreas may be considered as an alternate and relatively safe means of accomplishing the same end.

In 1945 Mallet-Guy, Jeanjean and Serretaz performed unilateral subdiaphragmatic splanchnicectomy in 11 patients for relief of pain from chronic pancreatitis. In these patients 10 operations were done on the left side, 1 on the right. Seven had complete relief of pain during follow-up periods varying from 6 to 35 months. Four had one or more attacks

of pain after operation. Smithwick reported complete relief of pain 6 months after resection of the right sympathetic chain from the third to the twelfth thoracic and right splanchnicectomy in 1 case. Fontaine, Forster, and Stefanini reported 1 case of "bilateral splanchnicectomy" for "chronic sclerosing pancreatitis" which seemed to have been effective in relieving pain. Reinhoff and Baker in 1 case performed bilateral resection of the sympathetic chains from the twelfth thoracic to the second lumbar, bilateral splanchnicectomy, and bilateral vagotomy with relief of pain and no recurrence after 10 months. Grimson, Hesser, and Kitchin treated 1 patient by removal of both celiac ganglia and of the superior mesenteric ganglion, but the pain returned after 5 months. deTakats and Walter performed a right splanchnicectomy and resection of the right sympathetic chain from the ninth to the twelfth thoracic in 1 patient with relief of pain and no recurrence after 6 months. Ray and Neill, in 1 patient, obtained partial relief of pain after resection of the right greater splanchnic nerve and the ganglionated chain from the seventh thoracic to the third lumbar but total relief after a similar procedure was performed on the left side.

The diversity of these procedures is confusing and leaves unsettled whether unilateral or bilateral deafferentation is required, whether the vagi may play any role in the transmission of pain impulses from the pancreas and how

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extensively the sympathetic system need be resected for relief of pain. In this report, the case already referred to (11) will be described more fully and 4 additional cases of intractable pancreatic pain (3 cases of calcareous pancreatitis and 1 of pancreatic carcinoma) treated by sympathectomy will be added. Still another type of sympathectomy was employed in the latter cases than any heretofore described and since this might serve only to add to the confusion the available data regarding visceral pain pathways in man will be reviewed in an attempt to arrive at a rational approach to the problem.

#### CASE REPORTS

**CASE 1** C T (No 465637), a 37 year old housewife and mother of 5 children, was admitted to the New York Hospital complaining of pain in the upper abdomen and back beginning 3 years before. At first the pain came in attacks lasting 2 to 4 days at intervals of 3 to 4 weeks, but gradually periods of freedom from pain diminished and for about 6 months pain had been constant. She had been confined to bed and had required daily doses of morphine for several months before admission to the hospital. The pain was described as severe, aching and boring in the epigastrium extending toward the right and left hypochondria and through to the back. Vomiting was frequent and there had been a weight loss of 20 pounds. There was no history of alcoholism and at another hospital an exploratory operation a year before had disclosed a normal gall bladder and common bile duct.

The abdomen was scaphoid, which facilitated the palpation of a moderately enlarged, hard, fairly movable and tender pancreas. Laboratory findings including the following were within normal limits: blood counts, urine, stool, serum protein, albumin-globulin ratio, blood amylase, glucose tolerance, gastric analysis, cholecystogram, and gastrointestinal roentgenograms. The abnormal laboratory findings included marked deficiency in amylase, lipase, and protease in the duodenal contents and evidence of extensive calcareous deposits throughout the entire pancreas on roentgenogram.

On January 15, 1947 a right sympathectomy was performed which included resection of the ganglionated chain from the seventh thoracic to the third lumbar and of the greater splanchnic nerve from the celiac ganglion to a point above the contribution of the seventh thoracic ramus.

Following operation she was relieved of her spontaneous pain although pressure over the head and body of the pancreas gave rise to moderate pain in the left upper abdomen. Thirteen days later, exploratory celiotomy under local anesthesia was performed; a biopsy of the pancreas taken and studies made on visceral pain sensation. Aside from the

pancreatitis no abnormalities were found. Stimulation of the head and body of the pancreas either by pressure or faradic current resulted in pain referred to the upper abdomen always to the left of the midline. This and other studies which have been reported (13) indicate that the pancreas has a bilateral sensory innervation.

The patient returned to her home, began to gain weight and take up her household duties. She was free of pain for 6 weeks after the first operation, then began to experience mild pain in the left upper abdominal quadrant. This gradually increased in intensity but never attained the degree of her original pain and was not attended by nausea and vomiting as before. The pain in the mid-epigastrium, right hypochondrium, and back did not recur.

On May 5, 1947, three and one half months after right sympathectomy, a left sympathectomy of similar extent was performed for relief of her residual pain. Following this operation her abdominal pain and tenderness were completely eliminated. She gradually resumed normal activity requiring several weeks to accommodate for a moderate grade of postural hypotension. She gained 20 pounds in weight and when last seen in June 1948 had remained asymptomatic.

**CASE 2** C B (No 322099), a 47 year old woman (referred by Doctors William H. Lewis, Seward Erdman, and Allen O. Whipple), was admitted to the New York Hospital for the third time in 2 years complaining of abdominal pain. For 2½ years she had been subject to attacks of pain lasting from 1 to 10 days at intervals at first of several months but more recently of only a few weeks at the most. The pain was a severe deep aching sensation felt principally in the midepigastrium but also across the entire abdomen above the umbilicus and in the back at the upper lumbar level, it was accompanied by nausea and vomiting and required frequent doses of morphine for relief. There was a history of chronic alcoholism. In May 1945 and again in November 1946 the abdomen had been explored, each time disclosing normal abdominal viscera except for firm enlargement of the pancreas and several small 1 to 2 centimeter cysts in the head and body of the organ. A biopsy did not show malignancy of the pancreas.

Examination showed evidence of weight loss and a tender, firm palpable mass in the upper abdomen in keeping with a moderate enlargement of the head of the pancreas. The following laboratory findings did not show significant deviation from normal: blood counts, urinalysis, stool, serum protein, albumin-globulin ratio, blood urea nitrogen, blood amylase, glucose tolerance, cholecystogram, and gastrointestinal roentgenograms. However, roentgenograms of the abdomen showed extensive calcareous deposits through the entire pancreas (Fig 1).

On June 28, 1947, one stage bilateral sympathectomy was performed which included resection of the ganglionated chains from the eleventh thoracic to the first lumbar and of the distal 6 centimeters of the greater splanchnics (preserving the celiac ganglion).

Recovery from operation was prompt and her abdominal pain and tenderness were completely relieved. For the first 6 months she resumed normal activity, gained weight, and with the exception of 1 short episode of low grade fever and nausea 2 months after operation, which may have represented a painless recurrence of pancreatitis, she remained free of symptoms until December 1947. Then she developed persistent fever and a painless mass of gradually increasing size in the epigastrium. Abdominal incision disclosed the presence of an infected pancreatic multiloculated cyst and a fistulous tract has resulted. However, the patient has maintained a fair degree of nutrition and has remained free of pain for over a year.

**CASE 3** A S (No 479792), a 43 year old woman, was admitted to the New York Hospital complaining of recurring bilious attacks for 2½ years. The attacks were characterized at first by nausea, vomiting, and pain across the upper abdomen, lasting from several hours to several days and occurring every 4 to 8 weeks. Six months before coming to the hospital she had a particularly severe attack with pain and tenderness across the upper abdomen and pain also across the back at the same level. She had low grade fever, a leucocytosis of 11,000 to 16,000 and signs of fluid in the abdomen. The attack gradually subsided but she was never wholly free of pain thereafter. She lost 12 pounds in weight, became semi-invalid and required opiates for the periods of more severe pain. At no time had she been jaundiced. She had been a moderate alcoholic for many years.

Examination showed evidence of moderate weight loss and tenderness without spasm on palpation across both sides of the upper abdomen. There was no fever. The following laboratory examinations did not show any abnormality: blood counts, urine, stool, serum protein, albumin-globulin ratio, blood amylase, glucose tolerance, cholecystograms, and gastrointestinal roentgenograms. But roentgenograms of the abdomen showed small calcific shadows scattered throughout the head and body of the pancreas.

On December 24, 1947 one stage bilateral sympathectomy was performed which included resection of the ganglionated chains from the eleventh thoracic to the first lumbar and of the distal 6 centimeters of the greater splanchnics (preserving the celiac ganglia). Recovery from operation was prompt and the relief of her former pain and tenderness was immediate.

On January 6, 1948 an exploratory celiotomy was performed. A light anesthesia of nitrous oxide was administered while the abdomen was opened and the pancreas exposed. The margins of the wound were infiltrated with procaine and the patient allowed to waken. Pressure, manipulation, and faradic stimulation of the head and body of the pancreas failed to elicit any pain. The pancreas was diffusely enlarged in moderate degree and unusually firm. The capsule of the gland was tough and incision into the gland for biopsy disclosed grayish, firm fibrotic tissue.



Fig 1 Roentgenogram in Case 2 showing extensive calcareous deposits in the pancreas outlining the entire organ. Similar deposits were demonstrated by roentgenogram in the other cases of pancreatitis.

Aside from these changes in the pancreas no other abnormalities of the abdominal viscera were observed on exploration. The biopsy of the pancreas showed "pancreatic tissues extensively fibrosed and the parenchyma distorted."

The patient left the hospital 3 weeks after the second operation. She has remained free of pain or digestive complaints, has gained weight and resumed her normal activities. She was last examined in July 1948.

**CASE 4** L B (No 498521), a 45 year old male, was admitted to the New York Hospital complaining of recurring attacks of severe epigastric pain of 7 years' duration. The attacks were sudden in onset, frequently associated with nausea and vomiting, and occurred at least once each day. The pain frequently radiated to the back. He had consulted several physicians and had had 2 abdominal operations at one of which a biopsy of the pancreas was taken. The pathologist reported this as definite chronic pancreatitis. At the second operation a subtotal gastric resection was done presumably as a first stage procedure in removal of the pancreas. No ulcer was found.

The patient was a chronic alcoholic and a confirmed morphine addict. He had been eating poorly for several months, had lost a considerable amount of





formation makes it possible to set certain anatomic limits within which afferent nerves from the pancreas for example can be expected to pass.

Most nerves supplying the abdominal viscera traverse the celiac plexus which includes the celiac and mesenteric ganglia. Pathways for connections between the celiac plexus and the paravertebral ganglionated chains include the splanchnic nerves and a plexus about the thoracic aorta. Of the splanchnic nerves by far the most constant in structure and probably the most important from the standpoint of the transmission of afferent impulses is the greater splanchnic on each side. The lesser and least splanchnic nerves have an inconstant anatomic arrangement in man and are represented by a variable number of nerves which connect the celiac plexus to the upper lumbar and lower thoracic portions of the sympathetic chains, they may be conveniently referred to as the lesser splanchnic nerves. In addition to these pathways there may be direct connections between the viscera and the sympathetic chains which do not traverse the celiac plexus. Upon reaching the ganglionated chains, individual visceral pain fibers leave the chains at the same or at higher levels by way of the rami communicantes leading to the posterior (sensory) roots and to the cord.

A schematic diagram (Fig. 2) of the courses that pain fibers from the pancreas may take through the sympathetic system includes several possibilities.

Pathway *A* passes from the pancreas through the celiac plexus to the ipsilateral celiac ganglion. From that point it joins the greater splanchnic nerve or any lesser splanchnics through which it reaches the ipsilateral ganglionated chain and thence the cord.

Pathway *B* differs from *A* only in that it fails to pass through the celiac ganglion and passes directly from the celiac plexus to the thoracic ganglionated chain via the splanchnics. Such nerve fibers are seen occasionally during surgical operations in this region and while proof is lacking there is a good possibility that some are afferent fibers. Their presence might explain in part the failure of celiac and mesenteric ganglionectomy to relieve pancreatic pain as reported by Grimsor.

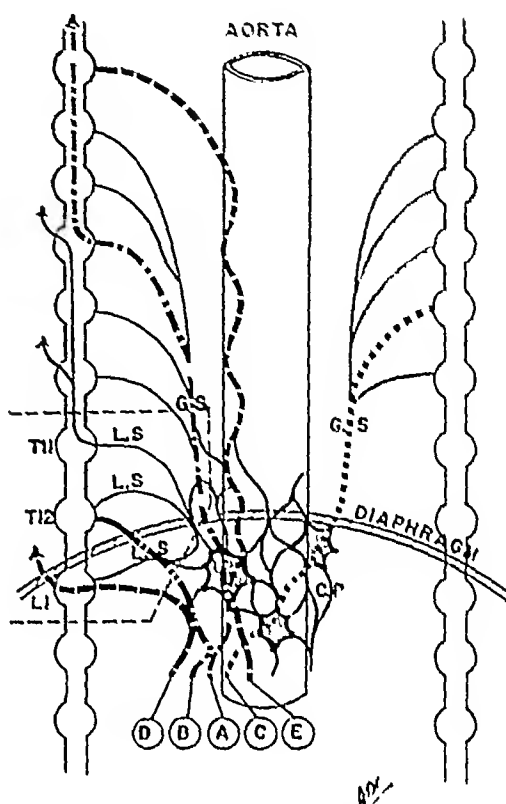


Fig. 2 Schematic diagram of pain pathways from the pancreas (P), celiac plexus (C), greater splanchnic nerves (GS), lesser splanchnic nerves (LS). Area within interrupted lines indicates the extent of proposed resection.

Pathway *C* passes through the celiac plexus but joins the contralateral ganglionated chain via the contralateral splanchnic nerves. That such pathways exist and provide a bilateral sensory innervation to the pancreas has been adequately demonstrated in previously reported studies (13).

Pathway *D* passes through nerves that may or may not traverse the celiac plexus but join the lumbar portion of the ganglionated chain and leave the chain at one of the lumbar levels without ascending to the thoracic levels. That such pathways exist has been proved at least for the ureter though not yet established for the pancreas.

Pathway *E* passes through the celiac plexus and ascends with the plexus about the thoracic aorta, leaving the aorta at various levels to join the thoracic ganglionated chain. If such a sensory pathway actually exists it is

likely that connections between the aortic plexus and the ganglionated chain occur through the greater splanchnic nerve though theoretically nerves apart from the splanchnic might connect with the chain in the upper thoracic levels as indicated in Figure 2, *L*. Since bilateral thoracolumbar sympathectomy from the seventh thoracic to the third lumbar and resection of the greater splanchnic nerves to a point above the contribution of the seventh thoracic rami apparently eliminate sensation in the upper abdominal viscera separate afferent pathways above the seventh thoracic level either do not exist or are not important in pancreatic pain.

The vagus nerves possess afferent fibers that have been thought by some to be visceral pain fibers though Cannon concluded from animal experimentation that these fibers are part of a visceral reflex arc and not pain fibers. The operation of bilateral sympathectomy and bilateral vagotomy employed for the relief of pancreatic pain by Richhoff and Baker suggests that they considered the possibility of the transmission of pain impulses via the vagi. The observations of Ray and Neill conclude that abdominal visceral pain sensation is mediated wholly by the sympathetic system. The aggregate observations of Grimson and associates also indicate that the vagus nerves do not play a role in the transmission of abdominal visceral pain.

Thus from these considerations it may be concluded that abdominal visceral analgesia and more particularly analgesia of the pancreas can be achieved by bilateral interruption of all splanchnic nerves. The term splanchnic nerves however is a loose one and includes the greater splanchnic nerves and all other nerve fibers connecting the celiac plexus with the lower thoracic and upper lumbar sympathetic chains. The most practical means of accomplishing interruption of the splanchnics is through the operation employed in all but Case 1, namely, bilateral resection of the greater splanchnics and of the sympathetic chains from the eleventh thoracic to the first lumbar.

The operative procedure is as follows. The patient is placed either in prone or lateral position; the latter is preferred. The twelfth rib

is resected, the pleura is reflected from the vertebral bodies and the crus of the diaphragm detached. The greater splanchnic nerve is divided at its junction with the celiac ganglion and freed upward for 8 to 10 centimeters where it is again divided (or avulsed) and the segment removed. The ganglionated chain is then identified and the rami communicantes proximal to the eleventh and twelfth thoracic and the first lumbar ganglia are divided. The chain is divided above the eleventh thoracic and below the first lumbar ganglia and the segment removed. In the process of resecting the greater splanchnic and the ganglionated chain numerous lesser splanchnic nerves connecting them with the celiac plexus or with the pancreas directly will have been divided. The same procedure is carried out on each side and may be done at the same time or in two separate stages. Unless the patient's condition is especially precarious, both sides may safely be done at the same operation.

This operation may not represent the ultimate refinement in producing pancreatic analgesia but it is a relatively limited resection of the sympathetics and should be attended by a minimum of operative risk. With more experience it may be found necessary to remove more of the ganglionated chain for consistent results but it is more likely that less of it will require removal. If additional experience for example should show that there are no sensory fibers from the pancreas traversing the lumbar posterior (sensory) nerve roots then it would be unnecessary to resect the first lumbar sympathetic ganglion and the operation could be done entirely above the diaphragm. The operation then would be much like that employed by Peet for the treatment of vascular hypertension. Our experience however has shown that division of the attachment of the diaphragm adds no inconvenience and affords better exposure of the upper lumbar portion of the chain, the twelfth thoracic rami and of the lesser splanchnic nerves.

Although it is evident that bilateral sympathectomy is necessary in order to produce analgesia of the pancreas the reports of successful relief of pain by unilateral sympathectomy suggest that in some patients a unilateral operation may be adequate for the im-

vidual needs. Our experience in Case 1, however, indicated that right-sided sympathectomy cannot be relied upon to relieve all the pain permanently, even though the early result appeared satisfactory, and that for total relief of pain and tenderness in the pancreas a bilateral operation was ultimately necessary. Similarly, a patient (No 73332, Hospital of the University of Pennsylvania) with chronic calcareous pancreatitis upon whom Dr J E Rhoads performed a right splanchnicectomy and resection of the ganglionated chain from the tenth thoracic to the second lumbar had relief of pain for 1 month only. After left sympathectomy relief of pain was complete. Eckel and Dickinson at the Bronx Veterans Hospital performed a right splanchnicectomy and resection of the ganglionated chain from the seventh thoracic to the second lumbar on a patient with chronic calcareous pancreatitis. Pain relief was partial and transient and left sympathectomy will be done at a later date.

It is difficult to reconcile these reports and our experience with the reports of Mallet-Guy and associates, Smithwick, and deTakats. Each of these has reported lasting and complete relief of pain with unilateral sympathectomy (4 of the 11 patients reported by Mallet-Guy and associates, however, had recurrence of pain). The fact that either right or left deafferentation appears to be equally efficacious in these reports tends to confirm the impression that the pancreas has bilateral sensory innervation and suggests that either unilateral operation is an incomplete deafferentation. It must be concluded, then, that absolute analgesia of the pancreas can be achieved only by bilateral sympathectomy. Partial deafferentation in some patients, however, may be sufficient to give relief of pain.

The question of possible unwelcome effects from bilateral sympathetic resection may aptly be raised for it must be appreciated that any operation in which nerves are cut in order to relieve pain imposes a certain degree of compromise by which one undesirable situation is to be replaced by another which is less undesirable but still acceptable. A sympathectomy of the extent proposed may produce some alteration in blood pressure even in normo-

tensive people but after the initial postoperative period in which symptoms may occur from postural hypotension there should be no notable untoward effects from this source. Also, a sympathectomy to deafferent the pancreas cannot be made selective enough to avoid producing the same effects in other abdominal viscera, chiefly the gastrointestinal tract. Thus, as a result of the operation the visceral pain component of certain abdominal diseases, such as peptic ulcer, cholecystitis, and appendicitis is eliminated. But other symptoms and signs of acute abdominal diseases such as fever, leucocytosis, nausea, vomiting, distention, jaundice, and pain and tenderness from parietal peritoneal irritation (via somatic afferent nerve pathways) would still be present to provide as much warning to the alert physician as exists in some unsympathectomized people with the same diseases. The operation which has been proposed does not affect other gastrointestinal functions or the sexual and reproductive functions of either male or female.

#### SUMMARY AND CONCLUSIONS

Chronic (calcareous) pancreatitis is often accompanied by pain so intolerable that some surgical measure is necessary for relief. Total or near total pancreatectomy is one method of treatment but it is not always feasible and at best is accompanied by a considerable operative risk and further deprivation of endocrine and enzyme products. The alternative procedure of interruption of the pain pathways from the pancreas is a safer method and the side effects of the operation are not serious.

A review of the several reports of differing procedures for interruption of the pain pathways from the pancreas, together with our own experience in 5 cases of intractable pancreatic pain (4 cases of chronic calcareous pancreatitis and 1 pancreatic carcinoma) has led to the following conclusions.

- 1 Pain sense from the pancreas is mediated by visceral afferent nerves that traverse the celiac plexus, the splanchnics, and the sympathetic chains on both sides.

- 2 The vagus nerves play no part in the transmission of pain sense from the pancreas.

3 The principal pathway traversed by pain fibers from the pancreas is via the greater splanchnic nerves, but lesser splanchnic nerves the lower portion of the thoracic chains and possibly the upper portion of the lumbar chains may also serve as pathways

4 The minimal operation thus far found to provide total analgesia of the pancreas and the one proposed as most suitable is bilateral resection of the ganglionated chains from the eleventh thoracic to the first lumbar and of lowest 8 centimeters of the greater splanchnic nerves

5 Unilateral, right or left, sympathectomy may in some patients provide interruption of enough of the sensory supply to afford relief of pain

6 While the operation is well suited to the relief of intractable pain of chronic pancreatitis it is of limited value in carcinoma of the pancreas chiefly because of the tendency of the disease to spread outside the organ to pain sensitive areas supplied by somatic sensory nerves

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# BLOOD AND "AVAILABLE FLUID" (THIOCYANATE) VOLUME STUDIES IN SURGICAL PATIENTS

## Part I Normal Patterns of Response of the Blood Volume, Available Fluid, Protein, Chloride, and Hematocrit in the Postoperative Surgical Patient

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THE blood, protein, and crystalloid requirements of the surgical patient are usually estimated on the basis of the history and the values for the hematocrit, protein, and chloride. In states of dehydration, normal values for the laboratory determinations may mask a severe, underlying depletion of the total amount of red cells, protein, or chloride in the body. Conversely, in overhydration and hemodilution with or without the presence of clinically detectable edema, abnormally low values may be found for the concentration of these substances in the blood even though the total amount in the body may be at or close to normal levels. The obvious importance of changes in the size of the blood volume and available fluid in the interpretation of such concentration measurements is not generally appreciated.

The studies in this series represent further efforts to establish the patterns of response of the blood and available fluid volumes in the postoperative patient and in addition to suggest correlations that may exist between such total volume changes and the usual concentration measurements. Through such a program not only will the limitations of the routinely employed laboratory tests be more clearly defined, but in addition their proper interpretation in the assessment of the requirements

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of the postoperative patient for blood, protein, and crystalloids may be established.

### MATERIAL AND METHODS

Twenty patients, from the ward and private surgical services of the Massachusetts Memorial Hospitals, were subjected to a variety of major general surgical procedures. All patients were considered to be in normal nutritional and fluid balance prior to operation and, except where specifically noted (Table I), received 2000 to 3000 cubic centimeters of 5 per cent glucose in water on the operative day, followed by oral fluids and house diet as tolerated on succeeding days. Blood loss occurring during operation was measured as described in a separate communication (22). Replacement of operative blood loss was withheld in 10 patients. Three to 10 sets of detailed observations were carried out in the preoperative and 10 day postoperative period (Table I).

Plasma volume was determined by a 0.1 per cent solution of Evans blue dye (T1824) according to the method of Gibson and Evans, adapted (10) and modified (11) for use with the Coleman junior spectrophotometer. Dyed samples were corrected for fluid shifts as suggested by Gregerson. Plasma protein concentration was determined by the falling drop method of Barbour and Hamilton. The total blood volume and red cell volume were computed from the hematocrit and plasma volume (13) and the total circulating protein from the plasma volume and plasma protein concentration. Plasma and urine chlorides were determined by the Van Slyke and Hiller modifi-

TABLE I—RESULTS OF DETAILED STUDIES IN 20 PATIENTS UNDERGOING  
MAJOR GENERAL SURGICAL PROCEDURES

Case Age Sex	Operation	Days*	Plasma volume c.c.	Red cell volume c.c.	Total blood volume c.c.	Avail able fluid c.c.	Hema to crit mm %	Plasma protein concentration gm %	Total circulat ing protein gms	Comment
1 45 F	Cholecystectomy and appendectomy	-0	2640	1900	4540	14 400	40.8	6.2	163	No transfusion
		+1	2680	1840	4520	16 800	40.7	5.8	161	
		+2	2970	1800	4770		37.8	6.15	182	
		+3	3090	1840	4850	16 500	36.4	5.9	182	
		+6	2830	1840	4670		39.4	6.4	180	
		+8	2730	1840	4570		40.3	6.4	175	
2 38 M	Cholecystectomy	-0	2640	2320	4960	17 000	46.2	6.9	163	No transfusion
		+1	2575	2265	4840		46.8	6.4	164	
		+3	2890	2270	5160	20 800	44	6.5		
		+7	2610	1900	4510	18,400	42	6.5	170	
		+11	2625	1915	4540	17,850	42.2	6.7	167	
3 35 F	Cholecystectomy	-1	2200	1420	3620	14 400	39.2	7.1	155	No transfusion
		+2	1880	1220	3100	13 800	39.4	6.9	130	
		+7	1880	1200	3080	14 500	39	6.9	137	
		+10	1940	1165	3110	15 000	37.4	6.9	134	
4 38 M	Lumbodorsal splanchnicectomy	-0	3095	2705	5800	22 175	46.6	6.3	195	No transfusion
		+0	2690	2535	5235		48.5	6.1	165	
		+1	2688	2202	4890	26 050	45	6.3	169	
		+6	3650	2240	5890		37.8	6.1	223	
5 66 M	Transurethral prostatectomy	-0	3210	2030	5240	19 200	38.9	5.9	190	Postoperative nausea and vomiting
		+0	3040	1980	5020		38.5	6.1	184	
		+1	3030	1800	4830		38.3	6.2	184	
		+2	3010	1790	4800	18 500	37.3	6.0	182	Received 500 c.c. of blood between (+2) and (+4)
		+4	3160	1990	5150		38.9	5.9	186	
6 64 M	Transurethral prostatectomy	-1	2040	2540	5480	19 000	46.4	6.6	193	Unexplained excessive urine volume postoperatively
		+1	2760	2200	4960	17 650	44	6.4	177	
		+7	2625	1985	4610	18 000	43	6.2	162	No transfusion
		+11	2890	2080	4970	17 900	41.9	6.5	181	
7 48 M	Subtotal gastrectomy	-0	3400	2490	5890	18 700	42.3	5.4	182	Gastric suction inadequately replaced
		+0	2490	2340	4830	17 100	48.5	6.25	156	
		+4	2230	2100	4330	18 700	48.5	6.9	154	
		+8	3020	2070	5090	19 900	40.5	5.9	176	Received 500 c.c. of blood at operation
		+12	2880	1960	4840	19 200	40.5	5.9	172	
8 38 M	Trans thoracic vagotomy	-0	2750	2070	4870	21 800	42.8	6.7	185	Received 500 c.c. of blood at operation
		+0	2910	2200	5180		44	6.7	196	
		+1	2380	2200	4580		47.9			
		+4	3300	2200	4530	22,300	39.8	6.45	215	
		+8	3160	1930	5090	22 800	37.8	5.6	180	

TABLE I.—RESULTS OF DETAILED STUDIES IN 20 PATIENTS UNDERGOING  
MAJOR GENERAL SURGICAL PROCEDURES—Continued

Case Age Sex	Operation	Days*	Plasma volume c.c.	Red cell volume c.c.	Total blood volume c.c.	Avail able fluid c.c.	Hema tocrit mm %	Plasma protein concen tration gm %	Total circulat ing protein gms	Comment
9 40 M	Lumbodorsal splanchnicectomy	-0	3610	2630	6240	19 400	42.1	5.9	212	No transfusion
		+0	3350	2540	5880		43	6.3	212	
		+1	3910	2530	6440	21 800	39.3	5.9	220	
		+3	3980	2260	6240	21,800	36.2	6.2	244	
		+5	4160	2260	6420		35.2	6.1	245	
		+7	3520	2270	5790	18 500	39.2	6.1	216	
		+10	3520	2200	5720	20 800	38.4	5.8	203	
10 43 M	Lumbodorsal splanchnicectomy	-0	3700	3150	6850	25,600	46	7.0	258	No transfusions
		+0	3220	2650	5870		46	6.8	217	
		+1	3650	2650	6300		42.5	6.6	241	
		+3	4050	2650	6500	25 600	39.5	6.7	257	
		+5	4060	2650	6510	34 500	40.7	6.5	264	
		+10	3420	2670	6090	32 200	43.7	7.25	258	
11 42 M	Lumbodorsal splanchnicectomy	-0	3410	2490	5900	18 250	42.3	6.4	218	Received 800 c.c. of red cells suspended in saline between (+3) and (+5)
		+0	3060	2290	5350		42.8	6.9	212	
		+1	3010	1800	4810	17 700	37.5	6.1	184	
		+3	3590	1630	5220	21 500	31.1	6.3	228	
		+5	4090	2560	6600	21 700	38.7	6.4	260	
		+10	3300	1600	5900	21 700	44	6.7	220	
12 40 M	Lumbodorsal splanchnicectomy	-0	3050	2500	5500	16 780	44.5	6.4	195	Received 1500 c.c. of normal saline and 1500 c.c. of 5% glucose in water in first 24 hours following operation
		+0	3010	2440	5450		44.8	6.6	196	
		+1	3020	2070	5070	21 200	40.8	6.0	176	
		+3	3080	2010	5070	20 700	39.2	6.1	187	
		+5	2770	2000	4770		41.9	6.7	185	
		+8	2860	1980	4840	19 480	40.9	6.9	197	
13 32 M	Lumbodorsal splanchnicectomy	-0	2675	2150	4825	14 500	44.6	6.2	165	No transfusion
		+1	2825	2065	4890		42.2	5.7	161	
		+3	2955	2055	5010	16 500	40.7	6.1	180	
		+8	2945	1900	4820		39	5.9	173	
14 66 M	Transurethral prostatectomy	-0	3520	1960	5480	19 000	35.7	6.4	227	Received 500 c.c. of blood between (+0) and (+1)
		+0	3530	1860	5390		34.5	6.4	218	
		+1	3810	2000	5810	15,400	34.4	5.6	212	
		+3	3560	1900	5460	26 900	33.6	5.9	210	
		+9	4340	1840	6180	26 900	29.7	6.1	260	
15 54 F	Exploration of knee joint	-0	1795	1405	3200	15 600	43.5	7.4	133	No transfusions
		+1	1965	1335	3300		41.5	7.1	140	
		+5	2215	1315	3530	16 500	37.2	7.0	155	
16 19 M	Mid thigh amputation	-0	2880	2610	5490	19,300	48	6.8	196	Received 500 c.c. of blood at operation Severe nausea and vomiting for 24 hours postoperatively
		+1	2160	1960	4120	17 200	47.5	6.8	148	
		+10	2060	1750	3753	17 900	45	7.2	148	



TABLE I—RESULTS OF DETAILED STUDIES IN 20 PATIENTS UNDERGOING MAJOR GENERAL SURGICAL PROCEDURES—Continued

Case Age Sex	Operation	Days*	Plasma volume c.c.	Red cell volume c.c.	Total blood volume c.c.	Avail- able fluid c.c.	Hema- tOCRIT mm %	Plasma protein con- cen- tration gm %	Total circulat- ing protein gms	Comment
17 50 F	Hysterectomy	-0	2890	1870	4760	19 700	45.2	6.6	190	Received 500 c.c. of blood at operation
		+1	2530	1780	4310	24,400	40.2	6.1	162	
		+5	3150	1800	4950	25,400	36	6.1	194	
		+9	3370	1780	5150	21 700	35	6.0	201	
18 42 M	Herniorrhaphy	-0	2550	1840	4390	15 060	42.1	5.9	151	No transfusions
		+2	2380	1810	4190	16 950	44.3	6.5	154	
		+7	2490	1810	4300		42.1	6.1	152	
19 36 M	Lingulectomy	-0	2610	2185	4795	19 800	45.5	6.8	177	Received 1000 c.c. of blood at operation
		+1	2095	1680	3775		44.5	6.6	138	
		+3	2860	1735	4595	22,400	37.8	6.4	183	
		+6	3320	1720	5040		34.5	7.0	237	
		+10	3630	1890	5520	20,350	34.3	6.6	240	
20 68 M	Exploratory thoracotomy	-0	4230	2140	6370	25,300	33.6	6.5	272	Received 1000 c.c. of whole blood at operation
		+1	3660	2480	6140	7 580	40.2	6.9	251	
		+5	2750	2160	6410	28,400	32.8	6.0	250	
		+9	4440	2090	6500	27 450	32.2	5.9	46	

\*Days—(-0) = Preoperative determinations

(+0) = Determinations within 4 hours postoperatively

(+1) (+2) (+3) etc. = Determinations on first second third etc. days postoperatively

cation of the Sendroy method (18). As described elsewhere (11), a 5 per cent solution of sodium thiocyanate was injected intravenously to measure the "available fluid" volume. The thiocyanate ion permeates the plasma and extracellular water, and, in addition, a small amount enters the red cells. In effect it measures the volume of the total extracellular fluid compartment including the plasma volume. In this paper the terms "available fluid," "extracellular fluid," and "thiocyanate space" are used synonymously and refer to the total extracellular compartment of the body water as determined by the thiocyanate method.

## RESULTS

*Available fluid and chloride concentration.* Changes in "available fluid" volume following operation paralleled and were related to the degree of hydration. In 16 cases increases in the available fluid volume of from 16 to 26 per cent were noted by the third postoperative day, representing additions of from 2 to 5 liters of fluid to this compartment (Fig. 1). In

7 cases the "available fluid" was determined within 24 hours following operation and in 6 of these increases in the "available fluid" volumes were observed to have already occurred. Although tending to return slowly toward preoperative values after the fourth day, the "available fluid" compartments generally remained enlarged above preoperative levels for at least 2 weeks following surgery. The greatest increase (26 per cent) in "available fluid" observed in the series occurred in the 1 patient who received normal saline parenterally (Table I, Case 12).

Postoperative decreases in the "thiocyanate space" were noted in 4 of the 20 cases (Fig. 2). Three of these patients were in negative water balance in the early postoperative period (Table I, Cases 5, 6, and 7). In 2, extrarenal water and salt losses through vomiting and gastric suction were unreplaced, and in the third, a 64-year-old man subjected to a transurethral prostatic resection, there was an excessive urine volume which equalled the fluid intake. The fourth patient underwent a high

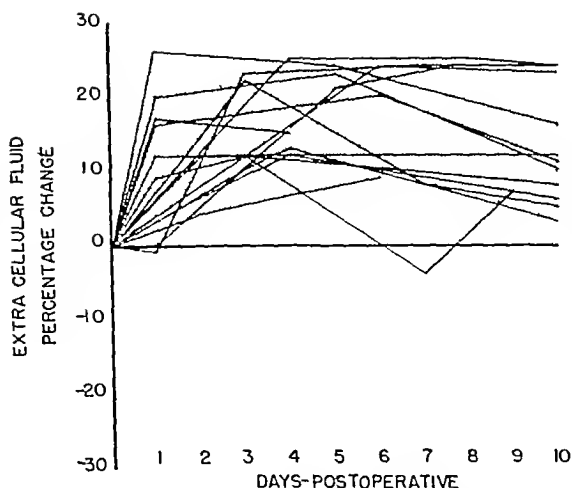


Fig 1 Illustrates the percentage increases above preoperative (normal) values in extracellular fluid in the postoperative period in 16 of the 20 cases of this series. All 16 cases were in positive fluid balance.

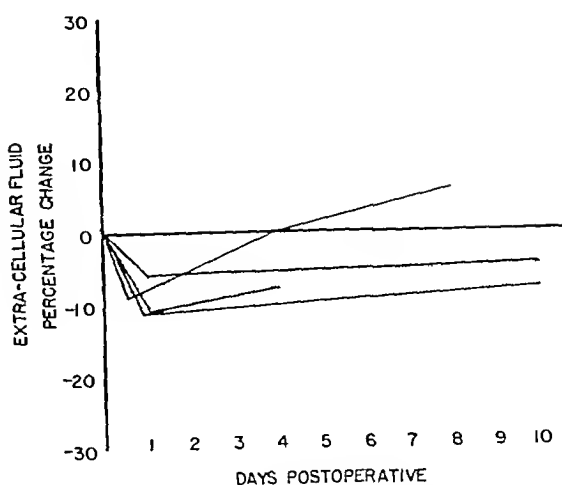


Fig 2 The percentage decrease in extracellular fluid in 4 cases known to be in negative fluid balance postoperatively. Note consistent decrease as opposed to increase when patient is adequately hydrated, e.g., Figure 1.

high amputation which of necessity resulted in the loss of a significant portion of the extracellular space.

Plasma and urine chlorides were determined daily in 5 cases which showed simultaneous postoperative increases in the available fluid volume. All exhibited decreases in the plasma chloride concentrations of from 7 to 12 milliequivalents per liter coincident with the increase in the "available fluid" volume (Fig 3). Plasma chloride concentration tended to return to preoperative levels about the fifth day. Oral salt intake was not limited save during the period of obligatory intravenous therapy, yet daily total salt outputs in the urine were low, ranging from 1.5 to 3.7 grams on the operative and first 3 postoperative days. Retention of salt also occurred in the 1 patient (Table I, Case 12) who received parenteral saline on the first postoperative day, the intake being 13.5 grams and output 3.36 grams of salt.

In addition to retention of salt, retention of water occurred as indicated by a low urine volume in relation to the fluid intake. The 24 hour urine volumes ranged from 600 to 1000 cubic centimeters during the first 48 hours following operation despite the administration by mouth or parenterally of 3 to 5 liters of fluid during this period.

Therefore, in all cases presumed to be in positive water balance following operation, evidence of fluid retention was manifested by increased "available fluid" volumes, depression of the plasma chloride concentrations,

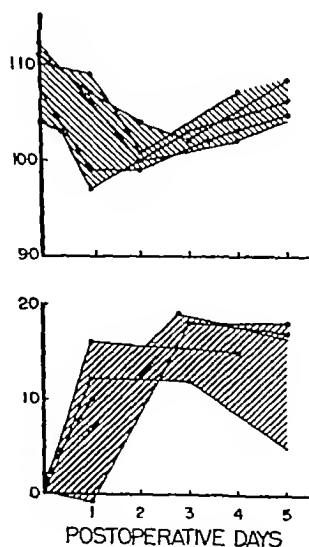


Fig 3 Illustrates percentage change in available fluid, below, and the decrease in plasma chloride concentration, above, noted in 5 cases following operation and demonstrates decrease in chloride concentration accompanying "available fluid" space increases. Chlorides expressed as milliequivalents per liter and available fluid as per cent change from preoperative (control) value.

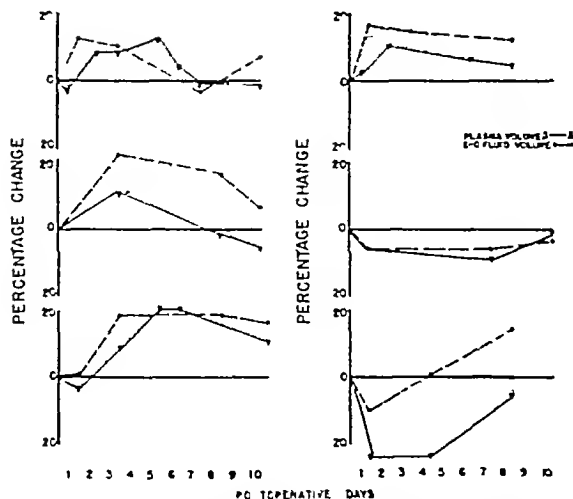


Fig 4 Illustrates parallel changes in extracellular fluid and plasma volume. Note that plasma volume is below the preoperative level in both instances in which the extracellular fluid was below preoperative values.

and decreased urinary output of water and salt. In cases known to be in negative water balance postoperatively, corroborative evidence of inadequate hydration was afforded by the decreases observed in the "available fluid" volume during this period.

**Plasma volume.** Plasma volume changes in general tended to reflect the changes in "available fluid" (Fig 4). In addition the degree of change was closely related to the extent of blood loss. It is noteworthy that following operative blood loss, plasma volume replacement did not take place in any case in the series unless the "available fluid" volume was equal to, or above, the preoperative level.

In the 10 patients who received no operative blood replacement, the pattern of change of plasma volume over the 10 day observation period followed remarkably similar trends. The general pattern of change is demonstrated by the following 2 cases (Figs 5 and 6). In the first case (Fig 5), a cholecystectomy had been performed with a blood loss of 150 cubic centimeters. Restoration of plasma volume did not begin until after the fourth postoperative hour, but at the 24th hour, operative plasma losses amounting to 90 cubic centimeters had been replaced. The plasma volume in this case continued until the third day, overshooting by 17 per cent at this time and declining toward the preoperative value over the suc-

ceeding 7 days. Similar plasma volume changes following a larger uncompensated blood loss of 1080 cubic centimeters are charted in Figure 6. After the fourth hour, and before the 24th hour, the plasma volume increased by 690 cubic centimeters, returning to preoperative levels. Plasma volume continued to increase, the maximum point of overshoot occurring on the third day and finally returned to the preoperative value on the fifth day.

The plasma volume changes in the 10 untransfused, but adequately hydrated, patients are plotted in Figure 7. Four trends can be observed in the 9 cases which exhibited increased "available fluid" volumes: (a) little to no plasma volume replacement occurred within the first 4 postoperative hours, (b) replacement of plasma losses of all magnitudes observed in this study tended to occur by the 24th hour, (c) the maximum point of plasma volume "overshoot" was reached on the third day, and (d) plasma volume decreased after the third day, tending to return to preoperative levels by the 10th and 14th day. By contrast, in the single patient of this group in whom the "available fluid" volume was decreased after operation, the plasma volume remained 6 to 10 per cent below the preoperative level for 7 days, showing no attempt toward restoration to the preoperative level thus illustrating the dependence of the plasma volume on the state of hydration as manifested in the available fluid volume.

**Red cell volume.** In the adequately hydrated patient, while the replacement of plasma and available fluid volumes following the blood loss associated with surgery was rapid, the red cell volume usually failed to change significantly from the level observed immediately after operation throughout the period during which the extracellular fluid and plasma volumes were increased. However, in several cases in which postoperative blood loss occurred, the red cell volumes exhibited further postoperative decreases reflecting the extent of blood loss after operation. The significance of uncompensated operative and postoperative depletion of red cell volume following certain types of operative procedures is discussed in another communication (22).

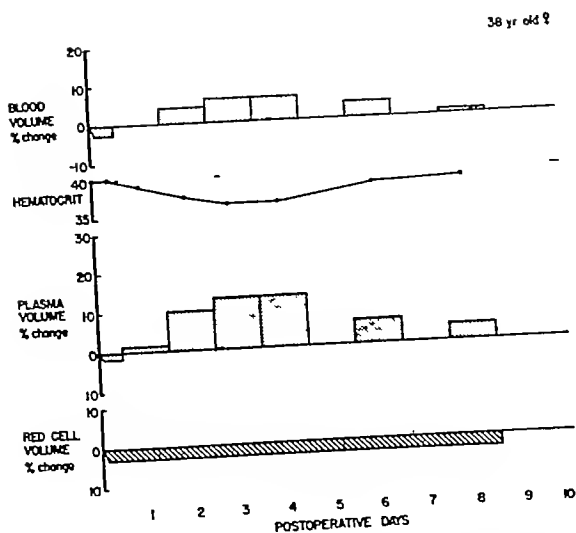


Fig 5 Illustrates in detail postoperative plasma volume increase after cholecystectomy in patient with blood loss of 150 cubic centimeters. Note concomitant hematocrit decrease and total blood volume increase.

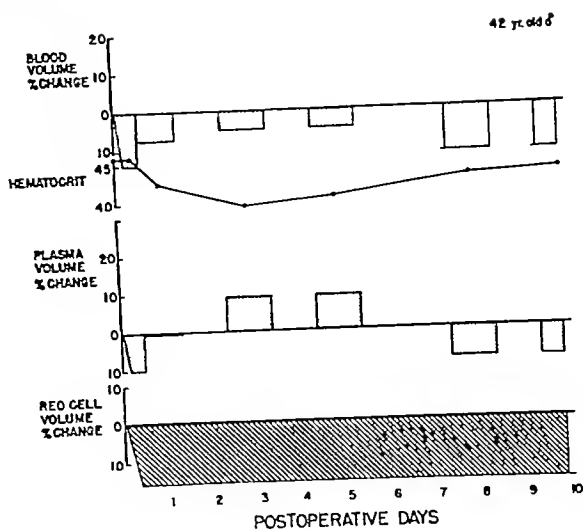


Fig 6 Plasma volume increase after uncompensated blood loss of 1100 cubic centimeters after 1st stage lumbo-dorsal splanchnicectomy. Plasma volume overshoot failed to restore total blood volume to preoperative levels.

**Total blood volume** Since the red cell volume showed little fluctuation following the period of actual blood loss the total blood volume change closely reflected the fluctuations previously noted in plasma volume. As with plasma volume, blood volume losses tended to remain unreplaced during the first 3 or 4 hours postoperatively. The point of maximum blood volume increase usually occurred on the third post-blood-loss day (Figs 5, 6), corresponding to the point of maximal plasma volume increase, then gradually receded during the succeeding 7 days as the plasma volume returned toward preoperative levels.

Blood volume responses could be divided into two groups in relation to the amount of blood loss (Fig 7). Group A with blood losses of less than 400 cubic centimeters exhibited plasma volume "overshoots" adequate to replenish completely both plasma and red cell losses, and to restore blood volume to preoperative levels by the third postoperative day. Group B in which blood loss was in excess of 400 cubic centimeters produced plasma volume increases which were in general greater than those of group A and completely restored the plasma volume losses. However, plasma volume overshoots in group B were insufficient to compensate completely for the excessive red

cell loss. In group B, therefore, the total blood volume was not restored to the preoperative values.

**Hematocrit** Within the first 3 to 4 hours following operation the hematocrit varied negligibly from preoperative values. Subsequently, it fell steadily for 3 days reflecting the plasma volume increase. Minimum hematocrit values were recorded between 70 and 80 hours following blood loss corresponding with the time of maximum plasma volume increase. With blood losses of less than 200 cubic centimeters the maximum hematocrit fall at 24 hours was 2.4 millimeters per cent and at 72 hours 4.4 millimeters per cent. Where blood loss was from 200 to 500 cubic centimeters, the maximum 24 hour reduction was 3 millimeters per cent and the 72 hour fall 4 millimeters per cent. With uncompensated blood losses of between 500 and 1500 cubic centimeters the hematocrit decrease at the end of 24 hours ranged from 4 to 6 millimeters per cent and at the end of 3 days from 5.5 to 11 millimeters per cent. In general, therefore, in the group in which the blood loss was great the extent of the hematocrit fall at the end of 72 hours was directly related to the amount of blood loss, provided the patient was in positive fluid balance.

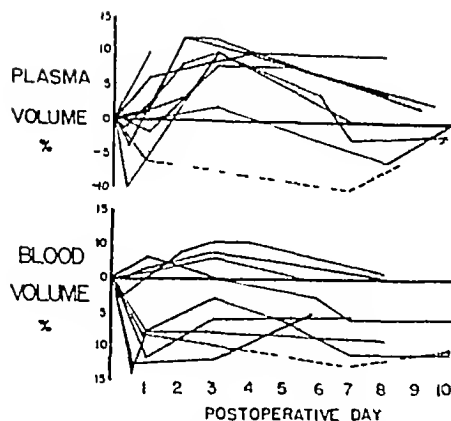


Fig 7 Illustrates percentage changes in plasma and total blood volume. The two distinct patterns of blood volume response are related to the amount of blood loss. Total blood volume was completely restored by plasma volume overshoots in cases in which blood loss was less than 400 cubic centimeters. With blood loss in excess of 400 cubic centimeters plasma volume overshoots were insufficient to restore total blood volume to preoperative values. Dotted line represents the only patient in this group who was in negative fluid balance and blood volume, plasma volume, and "available fluid" were below preoperative values.

From the third to the tenth days, the hematocrit value tended to rise as plasma volume overshoots were dissipated. However, in no case did the hematocrit return to preoperative levels by the tenth day unless the red cell volume had been restored completely by transfusion.

**Circulating protein.** Changes in total circulating protein closely paralleled those of plasma volume (Fig 8). The decreases in total circulating protein within the first four postoperative hours were consistent with the amount of blood loss. Following this period, and within 24 hours, additions of from 5 to 25 grams of protein occurred, usually restoring the total circulating protein to within 3 per cent of the preoperative values. The addition of protein to the plasma most often continued until the third day with overshoots of 5 to 15 per cent, representing daily gains of 12 to 25 grams of protein to the circulation. After the third day the total circulating protein diminished toward normal preoperative levels, continuing to parallel plasma volume changes.

As with the hematocrit, plasma protein concentration varied negligibly from preoperative levels during the first 3 to 4 postoperative hours. However, in contrast to the sub-

sequent increases in total circulating protein, the plasma protein concentration fell 2 to 15 per cent by the 24th hour, reflecting in some degree the simultaneously occurring plasma dilution. This decreased plasma protein concentration was maintained in 15 of the 20 cases during the first 5 postoperative days, and in more than 10 cases throughout the 10 day period of observation. At no time was it possible to judge the amount of the total circulating protein, or recognize increases in total circulating protein above preoperative levels by observation of the plasma protein concentration alone.

#### DISCUSSION

Data gathered in this study indicate that postoperative changes in the blood, and extracellular fluid volumes as well as in the hematocrit and protein follow a number of well defined patterns. (1) Retention of water and salt in the extracellular compartment tends to occur in the patient in positive fluid balance and is manifested by a decreased urine volume and an increased "available fluid" volume, with dilution of the extracellular salt, and consequent decrease in the plasma chloride concentration. (2) Changes in plasma volume tend to parallel and depend upon changes in the "available fluid." (3) Total circulating protein usually varies with plasma volume. (4) Plasma protein concentration usually decreases and tends to remain low due to plasma dilution even though total circulating protein values rise well above preoperative levels. (5) When uncompensated blood loss has occurred, the hematocrit tends to fall significantly for 3 days and reflects the increase in plasma volume. (6) If adequate hydration is maintained, the hematocrit value in the presence of uncompensated blood loss ordinarily does not return to preoperative levels within the 10 day convalescent period.

**Retention of water and salt.** The tendency of surgical patients to excrete a small volume of urine despite a large fluid intake in the early postoperative period is a common clinical observation. Detailed fluid balance studies have demonstrated that even the well hydrated surgical patient tends to retain both salt and water after operation (1, 6, 23). Enlargement

of the "available fluid" compartment as measured by thiocyanate has been observed following various types of disease and operation (11, 15, 16, 20). Eighty per cent of the cases in the present study exhibited similar increases in the "available fluid" volume which took place within 24 to 72 hours following surgery. That such increases in "available fluid" volume were most probably dependent on the state of hydration is demonstrated by the 3 cases in the series who were in negative fluid balance following operation and in whom the "available fluid" fell below the preoperative values. Depression of urinary water and salt output was consistently observed in the 5 patients subjected to special chloride studies, confirming the reports of Collier and of Abbott.

**Plasma volume** Plasma volume recovery following surgical blood loss occurred in this series only in the 16 patients who were in positive fluid balance and exhibited normal or enlarged "available fluid" compartments. The dependence of plasma volume upon the "available fluid" volume and state of hydration has been noted previously under experimental conditions in dogs by Mellors, Muntwyler, Mautz, and Abbott (17). Furthermore, following acute hemorrhage in dogs, plasma volume replacement is greatest and most rapid in animals given infusions of crystalloids (19). Warren and his co-workers maintained plasma volume and prevented shock in dogs following extensive plasmapheresis by the administration of crystalloid solutions to the point of edema formation, and on this basis have suggested that interstitial fluid pressure, a function of the extracellular fluid volume, is the agent of importance in maintaining or increasing plasma volume under these conditions.

In the present studies the pattern of time relationships of plasma and "available fluid" volume responses suggests that in the adequately hydrated postoperative patient a similar mechanism for the preservation of blood volume may be activated in man. Following a latent period of 3 to 4 hours after operation there began a simultaneous increase in "available fluid" volume and plasma volume (as well as total circulating protein) which uniformly reached a maximum on the third day.

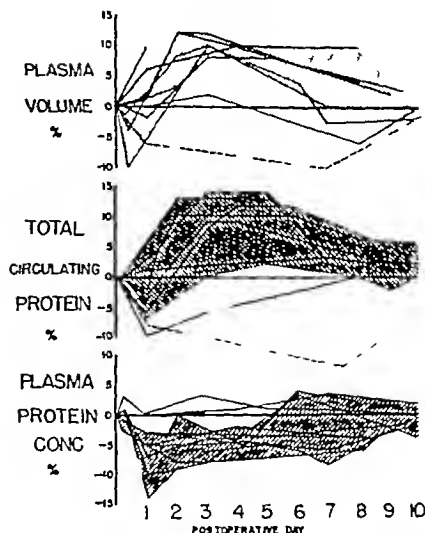


Fig 8 Illustrates percentage changes in plasma volume, total circulating protein, and plasma protein concentration. Note predominant decrease in plasma protein concentration in spite of increase in total circulating protein accompanying plasma volume increases.

A similar 3 day pattern has been noted following large venesections in both animals (9, 19, 24) and man (8). Rapid recovery of plasma volume and associated circulating protein has been noted following war wounds where blood losses of as much as 2000 cubic centimeters occurred on the battlefield (4). Likewise, Co Tui and associates consistently observed that in man plasma volume appeared to be completely restored between large venesections repeated at weekly intervals.

The remarkable ability of plasma volume to restore itself within 24 hours and then to overshoot after surgical blood loss of from 100 to 1500 cubic centimeters was a consistent observation in this study. It is interesting to note that in the patient who suffered further blood loss on the second postoperative day, the point of maximal increase was delayed for an additional 3 days, suggesting that the 3 day pattern of response may be expected to occur after postoperative as well as operative blood loss.

**Plasma protein** In patients who were well nourished and hydrated prior to surgery, plasma protein synthesis and transfer from body stores were more than adequate to replenish all operative plasma protein losses ob-

served in this series. As much as 70 grams of protein were added to the plasma in the first 72 hours after operation. The minimum response observed was usually sufficient to restore the total circulating protein to preoperative levels by the 48th hour.

Despite the postoperative increases in total circulating protein noted in the present study, the plasma protein concentration decreased by from 0.2 to 1.0 gram per cent in three-fourths of the cases studied. Such decreases usually appeared within the first 24 hours following operation, simultaneously with the addition of large amounts of protein and fluid to the circulation, and reflected plasma dilution.

Decreases of as much as 0.5 gram per cent in the plasma protein concentration have been noted following many general surgical procedures (5). These findings confirm parallel observations in dogs subjected to hemorrhage (19, 24) and suggest that plasma protein concentration is an unreliable index of the amount of total circulating protein during the period of recovery from acute blood loss. Abbott (2) has previously suggested the unreliability of the plasma protein concentration as a guide to the nutritional status of the postoperative patient and suggested that the measurement of the total amount of circulating protein may be more reliable. In the present study decreases in plasma protein concentration were a normal occurrence in the adequately hydrated patient following surgery and the plasma protein concentration gave no indication of the relatively large increase in total circulating protein which frequently occurred in the postoperative period.

*Hematocrit and red cell volume.* In contrast to the rapid synthesis of plasma protein and the remarkable restoration of plasma volume in the adequately hydrated postoperative patient, the replacement by the body of major acute depletions of the red cell volume was severely limited. Though reticulocytosis was repeatedly demonstrated in cases in which blood losses were 500 cubic centimeters or more, none the less restoration of the red cell volume by hematopoiesis was slow and often imperceptible during the 10 day period following such loss. Additional experience (21)

has demonstrated that in certain cases where extensive depletion of the red cell volume occurred through either operative or postoperative blood loss, restoration of red cell volume may be incomplete, even 6 to 8 weeks after operation. The recognition of this fact has suggested that since plasma volume and circulating protein most often recover rapidly following operation, attention to, and restoration of, a depleted red cell volume by means of infusions of red cells suspended in saline may be worthy of consideration in specific instances.

A consistent finding in this study, 3 days after an uncompensated operative or postoperative blood loss, has been the fall in hematocrit which usually reflects both a deficit in red cells and an increase in plasma volume. A hematocrit that continues to fall after the third day suggests postoperative blood loss. In the present study, hematocrit decreases of 4 millimeters per cent or more within the first 24 hours, and 6 millimeters per cent or more by the third day could not be accounted for on the basis of increase in the plasma volume alone and indicated uncompensated blood loss in excess of 500 cubic centimeters (22). Furthermore, because of the tendency of plasma volume to decrease after the third postoperative day and to stabilize at its approximate preoperative level by the tenth day, a decreased hematocrit 10 days after surgery, at the time when most patients leave the hospital, is indicative of a depleted red cell volume. In our experience the most reliable simple laboratory test for the recognition of uncompensated red cell loss was a decrease of 5 millimeters per cent or more in the basal hematocrit drawn on the third postoperative day.

#### SUMMARY

Twenty patients, the subjects of major surgical procedures, were studied preoperatively and throughout an 8 to 10 day period following operation. Definite patterns of response were noted postoperatively in the blood, "available fluid," plasma, and red cell volumes as well as in the plasma protein concentration, hematocrit, and total circulating protein. The influence of the state of hydration and amount of blood loss on the patterns

of response of these volumetric compartments and concentration measurements is described, and the significant interrelationships are discussed

#### CONCLUSIONS

1 Following blood loss, the mechanism for the preservation or restoration of the total blood volume appears dependent upon a state of positive fluid balance

2 With patients in negative fluid balance following operation, recovery of the "available fluid," plasma, and total blood volumes is delayed until a state of positive fluid balance is established

3 In the absence of excessive extrarenal water and salt loss, a daily ration of 2 to 3 liters of 5 per cent glucose in water under the conditions of this study was adequate to establish positive fluid balance and to insure plasma volume recovery

4 When depleted through either operative or postoperative blood loss, the red cell volume shows little tendency to recover spontaneously within the first 10 days following operation

5 In the adequately hydrated patient, serial determinations of the basal hematocrit offer the most useful index of uncompensated blood loss

6 Postoperative decreases in the plasma protein concentration of from 0.2 to 1.0 gram per hundred cubic centimeters are not necessarily indicative of either inadequate nutrition or a depleted total amount of circulating protein

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# CLINICAL STUDIES OF THE HEPARIN COFACTOR

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THE fact that some surgical patients develop postoperative venous thrombosis whereas others do not remains a challenging problem in spite of the formidable array of facts available concerning the coagulation of blood and the peripheral circulation. There is little doubt that disturbances of the peripheral venous circulation and the coagulation of the blood are the principal factors involved in the pathogenesis of venous thrombi. The coagulability of the blood may be increased theoretically by any means whereby the total production or the rate of production of thrombin is increased. One manner in which the amount of effective thrombin may be increased is by a reduction in the quantity of thrombin-inactivating agents in the blood. This study was undertaken to determine whether operative procedures altered the thrombin-inactivating substances of the blood and whether any such alteration could be related to the development of venous thrombosis.

Thirty years ago, Howell (7) demonstrated that heparin itself is not an antithrombin agent in that it did not prevent the conversion of fibrinogen to fibrin in the presence of thrombin. The addition of a cofactor found in plasma or serum, however, rendered the heparin strongly antithrombogenic. These observations were confirmed by Quick (11).

The heparin cofactor is designated throughout this paper as the substance in the circulating blood which develops strong antithrombin capacity when heparin is added to it. The heparin cofactor has been designated by a variety of terms such as thrombin co-inhibitor (2), albumin X (12), proantithrombin (18), and heparin complement (19). Its composition is unknown. It is known, however, to be intimately associated with the blood proteins

(7, 11). More specifically, it is most closely associated with the serum albumin. Ziff and Chargaff (19) observed in a study of the heparin cofactor by means of electrophoresis that the fast and middle fractions of the albumin were most active as cofactors. Chargaff, Ziff, and Moore (3) also demonstrated some cofactor activity in some globulin fractions. Crystalline albumin has been found to be completely inactive as a cofactor (5). Howell (6) and Quick (11) found cofactor activity to be present in serum as well as plasma in various experimental animals. Astrup and Darling (2), on the contrary, found no thrombin co-inhibitor (heparin cofactor) activity in serum prepared from ox blood by either recalcification of plasma, removal of fibrinogen by the addition of a small amount of thrombin, or by denaturation of fibrinogen by heating to 56 degrees C for 3 minutes. Quick (11) found that both antithrombin and the heparin cofactor were destroyed at 67 degrees C and postulated that the two were identical. The addition of heparin according to Quick intensified the activity of the natural antithrombin of the blood.

Seegers and associates (14) demonstrated clearly that heparin acts as a catalyst in inactivating thrombin, and that it does not increase the capacity of plasma for neutralizing thrombin. It merely accelerates the process. If given sufficient time, the cofactor inactivates the same amount of thrombin without the assistance of added heparin.

Reasonably accurate measurements of the antithrombin activity of plasma or serum have been possible only since the purification and standardization of thrombin. Measurements of antithrombin activity are made by determining the amount of thrombin inactivated in a thrombin-plasma or thrombin-serum mixture under standard conditions. Heparin cofactor measurements are determined in a similar fashion except that heparin is added to the plasma or serum prior to the addition of

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TABLE I—RELATIONSHIP BETWEEN TIME OF INCUBATION OF SERUM AND DESTRUCTION OF HEPARIN COFACTOR

Time of incubation	Heparin cofactor units
None	97.2
10 min at 56° C	96.2
30 min at 56° C	0

thrombin. Methods for assaying the anti-thrombin activity of the blood have been devised by Wilson (18), Astrup and Darling (1), Seegers and Smith (13), and Hurn and Mann (9).

The heparin tolerance test (coagulability of the blood after the intravenous injection of 10 mgm of heparin) described by deTakats (4) and the *in vitro* test of the coagulability of the blood (17) after varying quantities of heparin are added probably represent in part the quantity of heparin cofactor available in the blood. Other factors such as the amount of thromboplastin and thrombin and the rate of conversion of prothrombin to thrombin may contribute to variations in the results of the tests.

Volkert and Piper (16) found an increase of antithrombin in the blood of patients with multiple pulmonary embolism, but normal values were found in patients with minor or moderate thrombotic disorders. They also observed no change in 21 patients who underwent various surgical procedures and developed no thromboembolic complications. Nielsen found antithrombin activity within normal limits in 6 patients with thrombotic diseases. Hurn, Barker, and Mann (8) performed antithrombin determinations on 57 patients who had evidence of either venous or arterial thrombosis and found an average value approximating that of normal individuals. Of the 57 patients, 18 had values above 120 per cent or below 80 per cent of normal. No mention is made of the interval lapsing between the onset of the thrombosis and the time of the antithrombin assays. Volkert (15) found in a study of rabbits that a coagulative irritant such as a silk suture in the wall of a vein elevated the blood antithrombin whether thrombosis occurred or not.

#### MATERIALS AND METHOD

**Heparin.** Various commercial heparin preparations were used, all of which contained 10

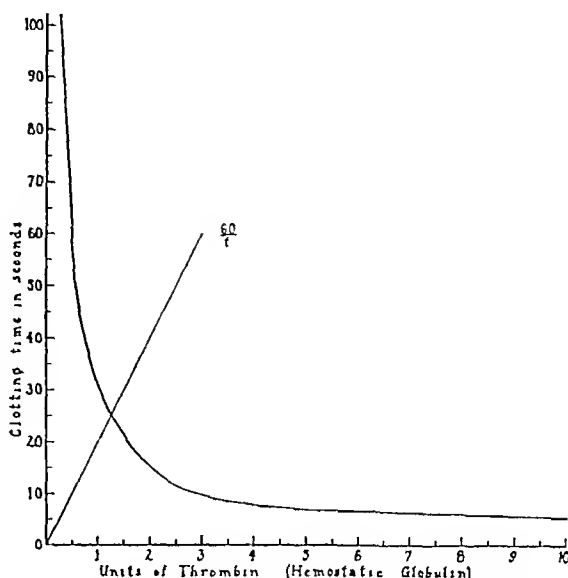


Fig 1 Relationship between the clotting time in seconds and the concentration of thrombin in units. The clotting time is also expressed as reciprocal minutes  $\frac{60}{r}$ .

milligrams per milliliter. The heparin was kept in a refrigerator and a 1/100 dilution was made each day. One-tenth milliliter containing 0.01 milligram was used for each determination of the heparin cofactor.

**Thrombin.** Hemostatic globulin was used undiluted. The thrombin was assayed by comparing its activity to a standard thrombin preparation of known strength.

**Fibrinogen.** Fraction I was prepared each day so that a 1.65 per cent solution in normal saline was obtained. The fibrinogen was used within 2 hours after being put into solution.

**Saline.** Normal saline was used to adjust the mixtures to a constant volume.

**Serum.** Serum was obtained from whole blood drawn during a fasting state. It was inactivated at 56 degrees C for 10 minutes, 0.1 milliliter of undiluted serum was used for each determination. Contrary to Astrup and Darling's (2) observation that heating of the serum to 56 degrees C for 3 minutes destroyed the cofactor, we found but slight inactivation when the serum was heated for 10 minutes at 56 degrees C. When heated at this temperature for 30 minutes, however, complete inactivation resulted (Table I). In spite of the fact that a small amount of cofactor activity

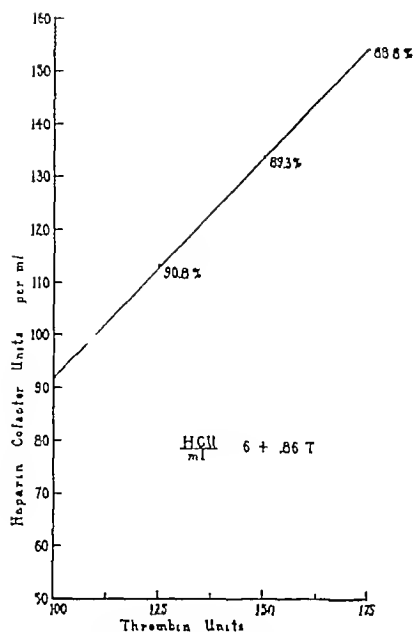


Fig 2 Relationship between the percentage destruction of thrombin and the amount of thrombin added to the serum

was destroyed by incubating the serum for 10 minutes at 56 degrees C, it was considered advisable to continue using this incubation period because of the complete inactivation of any remaining thrombin or prothrombin in the serum

By using serial dilutions of thrombin, the curve shown in Figure 1 was plotted. The abscissa represents dilutions of thrombin and the ordinate the clotting time in seconds. The thrombin was mixed with 0.8 milliliter of saline and 0.1 milliliter of inactivated serum. One-tenth milliliter of the 1.65 per cent fibrinogen solution was quickly added and a stop watch started. End points were distinct and determined by the first actual flocculation of fibrin. All determinations were done between 24 and 28 degrees C. Variations in the clotting times were found beyond this temperature range. By converting the clotting times in seconds to reciprocal minutes  $\frac{60}{t}$ , a linear relationship may be established between clotting times and concentrations of thrombin throughout the ascending part of the curve. This relationship is also represented in Figure 1. A linear relationship in this same part of the curve may also be obtained by plotting the logarithms of

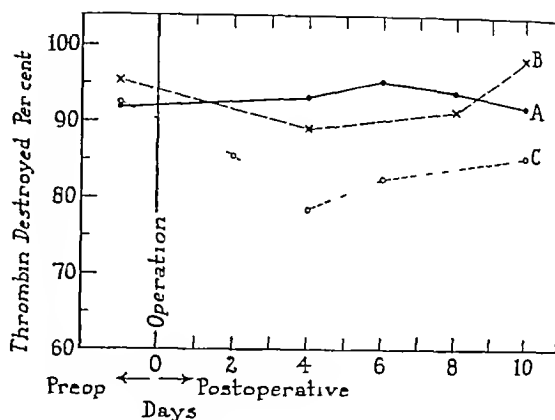


Fig 3 A represents the heparin cofactor activity of a group of surgical patients who developed no thromboembolic complications. B and C represent the activity of 2 patients who developed venous thrombosis.

the clotting times and the concentrations of thrombin. We prefer to read the concentration of thrombin remaining, after inactivation by the heparin cofactor, directly from the curve after noting the clotting time.

It is obvious that significant determinations fall only within clotting times of 10 to 60 seconds. For this reason the amount of thrombin placed in the original mixture is varied in order that the amount remaining may be accurately determined. Figure 2 shows that a linear relationship exists between the amount of thrombin destroyed or heparin cofactor units and the amount of thrombin placed in the serum. This linear relationship does not hold for larger or smaller amounts of thrombin. The equation representing this curve is also shown in Figure 2. By using either the graph or the equation, percentages of normal cofactor activity may be determined and variations from the normal may be compared.

The test is performed as follows: 0.1 milliliter of inactivated serum is added to 0.8 milliliter of normal saline, 0.1 milliliter (0.01 mgm) of heparin is added and the mixture allowed to incubate for 2 minutes. Ten units of thrombin are then added and incubation is continued for 5 minutes. One-tenth milliliter of a 1.65 per cent fibrinogen solution is quickly added and a stop watch started. The clotting time is determined. The clotting time depends upon the amount of thrombin remaining (Fig 1) in the mixture and since the amount of thrombin

added is known, the amount destroyed by 0.1 milliliter of serum is easily determined by subtraction. The amount destroyed by 1.0 milliliter of serum is determined by multiplying by 10. A heparin cofactor unit is the quantity necessary to inactivate 1 unit of thrombin. Results may be expressed as either heparin cofactor units or as percentage of thrombin destroyed. Since it is sometimes necessary to use larger quantities of thrombin to obtain significant clotting times, it is preferable to express results as percentage of thrombin destroyed compared to the normal.

Heparin cofactor assays were performed on 67 normal fasting individuals. Destruction of thrombin varied from 83.5 per cent to 97.5 per cent with an average value of 92.0 per cent. Although some variation existed from one individual to another, repeated determinations on the same individual never varied more than 2 per cent. Determinations were completed on 22 patients who underwent major surgical procedures. Tests were performed preoperatively and for the most part every other day postoperatively. Of the 22 patients, 20 developed no thromboembolic complications. They also developed little change in the heparin cofactor activity of their blood. There was an average increase of 3.7 per cent. Three of the patients showed reductions of 0.2 per cent, 0.3 per cent, and 0.4 per cent. The other 2 patients, who developed postoperative venous thrombosis, developed reductions in cofactor activity of 5.8 per cent and 15.0 per cent several days prior to the development of a clinically recognized thrombosis (Fig. 3).

Assays were performed on 6 patients with hypoalbuminemia. Three of the patients had cirrhosis of the liver, 2, pyloric obstruction, and 1, malnutrition. Percentage destruction of thrombin was recorded after several determinations as 80.8, 87.5, 84.5, 82.5, 81.6, and 82.2 with an average value of 83.1 compared to 92 for the control group. In the patient with nutritional hypoproteinemia, as the protein de-

pletion was restored to normal, the heparin cofactor activity rose from 82.5 per cent to 92.5 per cent.

#### SUMMARY

In this small group of patients the significant observations were that there was very little alteration in the cofactor activity of the serum when no thromboembolic complications occurred. On the other hand, when they did occur, in 2 patients, there were appreciable reductions in the cofactor activity. Whether the latter is cause or effect remains to be demonstrated. It obviously will require a survey of several hundred patients to determine the true significance of these findings.

The observation that hypoalbuminemic patients have a consistently reduced cofactor activity verifies the association of the blood albumin and the thrombin inactivating agents. It also suggests one additional reason for correcting a hypoproteinemic state before surgery.

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# CYTOLOGIC DIAGNOSIS OF CANCER OF THE DESCENDING COLON AND RECTUM

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**I**N recent years exfoliation of neoplastic cells has been noted from many types of malignant epithelial tumors. This method promises to have diagnostic applications particularly for carcinomas arising in internal organs. Although sporadic reports of finding tumor fragments in a variety of body fluids have appeared over a period of many years, it was not until Papanicolaou's work (9) that really serious consideration was given to diagnosis of malignant tumors by cytological examination of human secretions. The vaginal smear technique has had the greatest clinical trial thus far. Diagnosis of cancer of the uterus by means of smears from this site appears most reliable, though the method has been extended to study of secretions arising elsewhere in the body in an attempt to improve early diagnosis of cancer. For example, considerable success has been attained in the diagnosis of lung tumors by examination of either sputum or bronchial aspirations.

Our studies of the past 2 years have centered about the diagnosis of neoplasms in the gastrointestinal tract including stomach, biliary tract, and colon. It is the purpose of this paper to present our experiences with the study of smears taken at proctoscopy and sigmoidoscopy from the large bowel and rectum with special reference to the diagnosis of malignant epithelial tumors.

## REVIEW OF LITERATURE

At the time of our preliminary report (12) on the diagnosis of malignant lesions of the rectum and sigmoid colon by cytologic studies of exfoliated cells, we could find only one

reference, that of Altgauzen, reporting the use of fresh smears taken at proctoscopy for the diagnosis of malignancy. However, in this report very little definite information was available on the criteria used by him or the results obtained. Since that time Hunter and Richardson have mentioned the use of cell blocks and smears of rectal discharges for this purpose.

The cytologic study of rectal discharges in the diagnosis of diverse diseases of the large bowel is not new, the first reports dating back to the early part of this century. The most practical use of this technique has been in the rapid differentiation between bacillary and amebic dysentery, especially in military service. A number of studies (2, 5, 6) have appeared with special reference to this problem describing the cytology of stained and unstained preparations in considerable detail.

In more recent years Bercovitz (3, 4) has made a study of the cytology of rectal discharges after saline purges in both normal and a variety of abnormal conditions. It was his conclusion that discharges from normal bowel contained few, if any, cells whereas cells of various types and in variable proportions and numbers were present in many pathological conditions. In fact, in one paper (4) he presented a photomicrograph of "degenerating epithelium" from a case of carcinoma in which as well as could be determined from the illustration, the cells had many of the characteristics seen in those coming directly from malignancies of the large bowel. It is not unlikely that he had observed exfoliated malignant cells without being aware of it.

## MATERIALS AND METHODS

Patients selected for the present study included those suspected of having carcinoma, those with diverse gastrointestinal complaints

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Fig 1

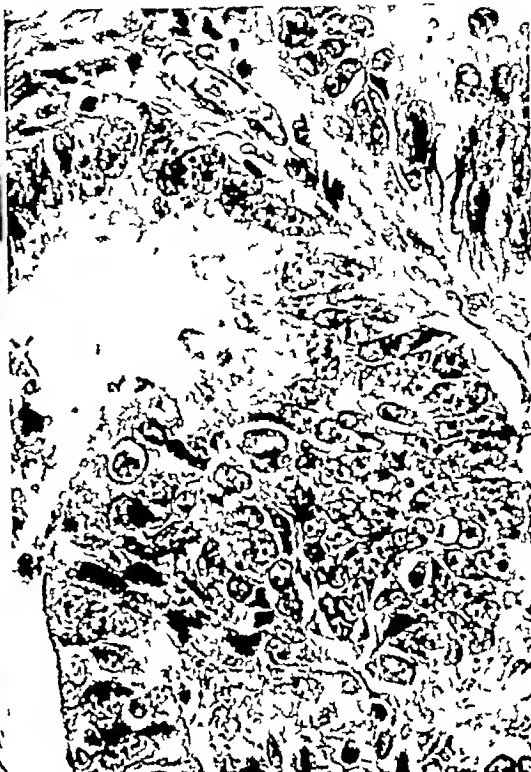


Fig 4



Fig 2



Fig 3

Fig 1 Sheet of normal mucosa. Note regular size, shape, and arrangement of nuclei.

Fig 2 Smear from patient with ulcerative colitis. Note the large nuclei with dark staining coarse chromatin. Also note polymorphonuclear cells.

Fig 3 Exfoliated malignant cells from case of adenocarcinoma of sigmoid. Note variation in size of nuclei and coarse dark staining chromatin.

Fig 4 Section of resected specimen from same patient as in Figure 3. Note similarity in type of nuclear structure.

and diagnostic problems. While most of the patients were from the wards of the Massachusetts Memorial Hospitals, a number were derived from neighboring institutions and from the private patients of hospital staff members. All patients received at least one sigmoidoscopy, most, barium enemas, and

others, biopsy. In the majority of suspected cases exploration and resection or biopsy were performed giving pathologic confirmation of the diagnosis. Whenever possible, an attempt was made to establish the diagnosis by older conventional methods in addition to the smear technique.

TABLE I — DISTRIBUTION OF CASES AS TO FINAL DIAGNOSIS

	No cases
Carcinoma of rectum	8
Carcinoma of rectosigmoid and sigmoid	13
Carcinoma of colon (other)	7
Carcinoma elsewhere in body	11
Ulcerative colitis	5
Functional bowel disturbance	13
Diverticulosis and diverticulitis	11
Amebic colitis	1
Acute gastroenteritis	2
Miscellaneous	39
Total	110

Patients were prepared for sigmoidoscopy with cleansing saline enemas. Material collected on cotton swabs during the examination was smeared onto glass slides immediately and was fixed in chilled acetone before drying had taken place. If the lesion was visible, smears were taken directly from its surface. In those cases in which the lesion was not visible specimens consisted of exudate and mucus clinging to the bowel wall. Bloody mucus seen coming from above the proctoscope tended to be particularly rich in exfoliated cells. Slides thus obtained were stained by the Papanicolaou technique (8). The diagnosis of malignancy was made upon finding groups or clumps of cells whose characteristics will be described in the following.

#### CYTOLOGY OF THE SMEARS

The types of cells found in rectal discharges and stools, especially in cases of dysentery, have been described in considerable detail (2, 3, 4, 5, 6). However, since in the present study the method of sampling differed from those previously described and since the emphasis is placed on the diagnosis of cancer, some discussion of cell types and other structures is warranted.

Smears may contain variable amounts of fecal material depending upon the thoroughness of preparation of the patient for examination. Bacteria, yeast cells, spores, vegetable cells and starch granules, and undigested meat fibers may be encountered. Though such objects are usually quite easily distinguished, on rare occasions a group of cells which are derived from ingested material may cause some confusion.

Mucus is encountered frequently. It is homogeneous in structure, but it may stain in a variable manner depending upon the thickness. Cells may be found imbedded in it.

Squamous epithelial cells are not infrequently found in smears even from the sigmoid to which location they probably are carried on the end of the sigmoidoscope as it is passed from the anus.

Red blood cells are readily recognized (Fig 8). They may be derived from lesions intrinsic in the bowel, or they may appear as the result of instrumental trauma or vigorous swabbing. Lymphocytes, mononuclear cells, and plasma cells may appear in variable proportions and numbers (Figs 7 and 8). Polymorphonuclear cells, though not usually seen in normal smears, may be seen in large numbers in some diseases of the large bowel (as ulcerative colitis) (Figs 2 and 7). Their presence in any numbers is usually significant. Macrophages may be numerous. They are usually large cells containing dark-staining eccentric pyknotic nuclei and may contain vacuoles filled with ingested cells or cell fragments. Karyorrhexis may be prominent with nuclear material represented by numerous small fragments of dark-staining material. Occasionally grouping of the macrophages may occur (5) (Fig 8). Other mononuclear cells of undetermined origin are not infrequent. Eosinophils have been noted in moderate numbers in several cases, though their significance has not been determined accurately. "Ghost cells" and pyknotic bodies may be observed.

The trophozoites of *Endamoeba histolytica* were found in considerable numbers in the one case of acute amebic colitis examined by us (Fig 7). Though the nuclear detail was not as good as is seen in preparations stained with iron hematoxylin, no difficulty was experienced in identifying the parasites in the smears.

The presence of normal or nonmalignant epithelial cells is not unusual. Their number may vary depending upon the friability of the mucosa and the vigor of swabbing (Fig 1). In general, they are not difficult to distinguish from typically malignant cells. The nuclei are round to oval and quite regular in size.

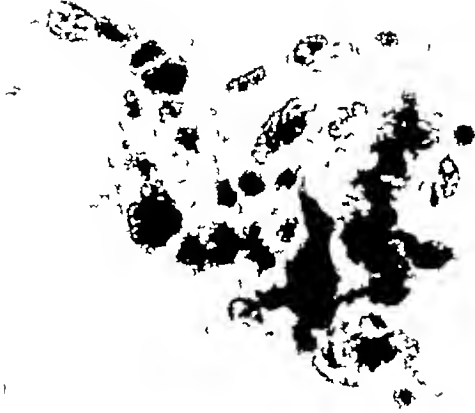


Fig 5



Fig 6



Fig 7

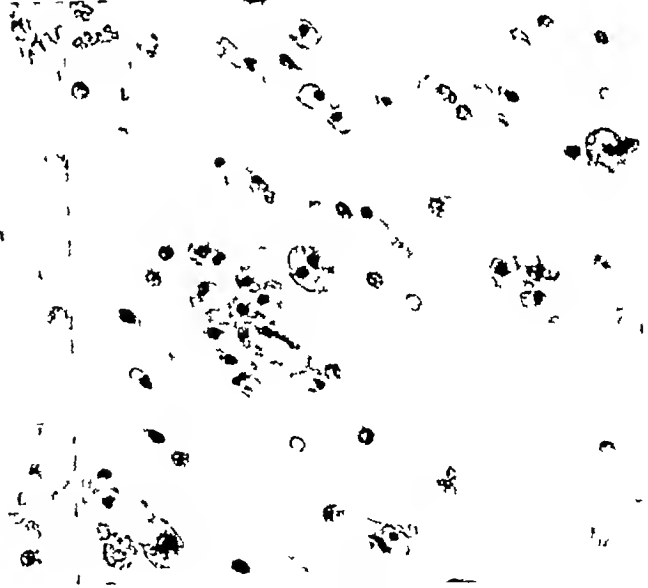


Fig 8

Fig 5 Exfoliated malignant cells in sigmoidoscopic smear from patient with adenocarcinoma of sigmoid. Visualization of the lesion was not possible by sigmoidoscopic examination.

Fig 6 Exfoliated malignant cells in smear from patient with adenocarcinoma of rectosigmoid.

Fig 7 Trophozoites of *Endamoeba histolytica* in smear from patient with amebic colitis, acute. Note polymorphonuclear and mononuclear cells in exudate.

Fig 8 Smear from patient with "mucus colitis." Note red blood cells (probably due to trauma), macrophages, lymphocytes, plasma cells, and other mononuclear cells.

and staining reaction. There is a well defined nuclear membrane. Chromatin is diffusely scattered throughout in fine granules. There

are usually one to three larger dark-staining granules, inconspicuous to moderately prominent. The columnar cells may appear in a



TABLE II — SMEAR READINGS COMPARED TO FINAL DIAGNOSIS

Positive	Negative	False positive	False negative
9	75	1	12
7	6	Questionable smears*	

\*In this column the smears read as questionable are listed under positive or negative with respect to final diagnosis

palisaded arrangement when viewed from the side, or they may appear in sheets of a mosaic pattern if viewed from above. Occasionally entire glandular crypts are found more or less intact. In these, large goblet cells may be seen with ease. Drying, pressure during smearing, and degeneration may alter the appearance markedly. In such instances the cells and nuclei may vary in size and shape, and the nuclei acquire a pale homogeneous "washed out" appearance.

Anderson noted the effect of osmotic pressure on epithelial cells causing them to assume distorted shapes. He also recognized that large numbers may be desquamated during certain phases of bacillary dysentery. Manson-Bahr (11), in discussing scrapings from the rectal mucosa in the diagnosis of amebiasis, stated that in his experience normal cells had well defined outline and structure whereas in certain pathologic conditions they were indistinct and poorly defined. He also made note of increased numbers of swollen goblet cells in cases of mucus colitis.

Bercovitz (3) described four main types of cells derived from scrapings of the bowel mucosa (obtained at post mortem): (1) large wedge-shaped cells with granular cytoplasm and large oval nuclei composed of heavy rings and containing granules, (2) tall columnar cells with finely granular cytoplasm and large oval nuclei with heavy rings and containing granules, (3) cells irregular in shape with granular cytoplasm and oval to round nuclei having delicate rings which constitute the nuclear membrane with granules included, and (4) square cells with granular cytoplasm and small round solid nuclei. However, in our stained preparations, cytoplasmic granules were not encountered.

X-irradiation seems to alter the appearance of the mucosal cells. In 1 case of rectal ric-

TABLE III — RESULTS OF SMEARS ON PROVED CARCINOMAS WITH RESPECT TO THE LOCATION OF THE TUMOR IN THE BOWEL

Location of tumor	Positive	Questionable	Negative
Rectum and rectosigmoid	4	3	2
Sigmoid colon	5	4	3
Other (ascending, transverse, etc.)	0	0	7

ture following radiation therapy for carcinoma of the cervix, the cells appeared larger, somewhat more basophilic, with heavy staining nuclei.

In 1 case of chronic ulcerative colitis a group of cells were observed having some of the nuclear changes seen in malignant cells such as increased size and moderately heavy chromatin aggregates (Fig. 2). It is possible that they were merely regenerating epithelial cells under the influence of an inflammatory process, such as we have observed in gastric epithelium.

Cells considered to arise from malignancies occurred either singly or in groups. A positive diagnosis was not made if only single suspicious cells were found. Clumps were composed mainly of cells arranged in an irregular fashion. Occasionally the arrangement was fairly orderly, however, in most of these instances cellular morphology was so characteristic that malignancy could be diagnosed. In a number of tumors removed surgically, smears were made directly from the lesion in order to compare known malignant cells with those found in the sigmoidoscopic smears (Figs. 3 and 4).

In general cells exfoliated from tumors of the large bowel showed similar deviations from normal as have been observed in malignant cells arising from tumors in other parts of the body, namely, great variation in size and shape of both the cytoplasm and nucleus with an increase in the nuclear-cytoplasmic ratio. Malignant cells were frequently observed to be considerably larger than normal mucosal cells, while the nuclei were also greatly enlarged in a majority of cases (Figs. 5 and 6). Occasionally giant nuclei were observed, at times with only a small ring of cytoplasm. Binucleate cells occurred in smears from several tumors. Mitotic figures

TABLE IV—CLINICAL DATA ON PATIENTS WITH SUSPICIOUS SMEARS AND NO PROOF OF CARCINOMA OF BOWEL

Age	Smear diagnosis	Pertinent history	Proctoscopy	Barium enema	Final diagnosis
54	Positive repeat smear questionable	Adenoca of cecum resected 4 years before	Mucosa slightly inflamed with a few bleed ng points	Negative	Committed to mental hospital for paranoid psychosis no evidence of recurrence of tumor
70	Questionable		Granular mucosa at 7.5-17.5 cm from anus with numerous hemorrhages	Negative	Chronic lymphatic leucemia with acute polyn neuritis
65	Questionable	Hypertrophic and ulcerative proctitis 6 years	Indurated rectal ulcer and leukoplakia	Diverticulosis with narrowing of sigmoid and rectum	Biopsy leukoplakia, no evidence of malignancy
43	Questionable	Adenoca of cervix treated with deep x ray and radium 11 months before	Stricture at 15 cm	Not done	Curettage recurrent carcinoma of cervix rectal stricture presumed secondary to irradiation
40	Questionable		Negative	Negative	Acute and chronic alcoholism
67	Questionable	Epigastric pain 9 weeks with 15 Lgm weight loss	One area of granular mucosa	Negative	Peritoneoscopy with biopsy metastatic adenocarcinoma to liver source unknown
62	Repeat smear negative	Sudden onset lower abdominal cramps a few hours before	Negative	Negative	Transient intestinal obstruction secondary to incarcerated hernia

were rare. Two rather distinct types of chromatin arrangement were observed: (1) large to variable nuclei with heavy irregular deposition about the nuclear membrane and large aggregates of chromatin within and (2) large nuclei with diffusely arranged chromatin simulating a fine reticular network. The former was by far the more common. The chromatin tended to take a rather heavy hematoxylin stain. As was expected, gradations between obviously benign and obviously malignant cells were observed. The smears were read as negative, questionable, or positive for malignancy.

#### RESULTS

The results of this study as it pertains to the diagnosis of cancer of the large bowel are recorded in Tables II and III. In 9 cases of carcinoma the smears were read as definitely positive and in 7 they were read as questionable. Twelve cases of carcinoma were missed. There was 1 false positive result. Six of the questionable smears proved to be from patients without ascertainable large bowel carcinomas although possible sources for abnormal cells were present in most instances (Table IV).

Summarizing these tables it will be noted that in 16 of 28 carcinomas smears were read as positive or questionable, three-fourths of the tumors of the rectum and sigmoid were either correctly diagnosed or suspected on the

basis of the smears whereas all the tumors of the ascending and transverse portions of the colon were missed. In 110 cases there was one false positive and three-quarters of all cases were diagnosed correctly. It is of interest to note that both of the tumors of the rectum that were missed completely were reported by the pathologists as early or low grade malignant changes in rectal polyps. This is not unexpected since there is considerable discussion among pathologists as to what constitutes early malignant change in polyps even in tissue sections. There were also 4 cases of obstructive lesions of the colon, 1 in the splenic flexure, 3 in the sigmoid, all of which had negative smears, and which were proved to be inflammatory in nature. Two of these cases were associated with diverticulosis of the sigmoid.

#### DISCUSSION

Up to this time two principal methods have been available for the diagnosis of malignancy of the large bowel: namely, (1) radiologically by means of the barium enema and double contrast studies and (2) direct visualization through the sigmoidoscope with biopsy. When the latter is possible, there remains little to be desired with the exception that biopsies, especially of polyps, may be unsatisfactory. At times the sigmoid may be difficult to visualize by means of x-ray examination. In one series of cases (10) 9 per cent of the tumors

of the sigmoid were missed by x-ray examination. This is exemplified by 1 of our patients in whom both the initial barium enema and sigmoidoscopy were negative. Smears taken at the sigmoidoscopic examination however, were read as positive. Subsequent sigmoidoscopy and barium enema both revealed the lesion which was removed surgically and was proved to be an adenocarcinoma of the sigmoid.

In analyzing the results of this study it becomes obvious that the usefulness of this method lies in the diagnosis and confirmation of diagnosis of malignancies of the lower colon that is the rectum sigmoid, and lower descending colon. It should be emphasized that the tumors need not be seen at the time the smears are made for definite tumor cells were found in 5 cases of carcinoma of the descending and sigmoid colon in which the lesions were not visible. X-ray studies failed to reveal only 1 of these. In 1 case of carcinoma of the rectosigmoid, stricture of the rectum prevented visualization of the tumor by any means but rectal swabbings repeatedly revealed the presence of many neoplastic cells (fig. 6).

The accuracy of the methods available for the diagnosis of malignancies of the sigmoid colon and rectum in this series was as follows: (1) sigmoidoscopic examination 67 per cent accurate; (2) x-ray examination 79 per cent accurate; and (3) cytologic study of smears

Application of the smear technique to other conditions affecting the large bowel has not been investigated fully by us at this time. However observations such as large numbers of polymorphonuclear cells in certain phases of ulcerative colitis, their sparsity in mucous colitis, and the identification of *Entamoeba histolytica* in a case of amebic colitis suggests that routine preparation of smears at the time of sigmoidoscopy may serve as a valuable adjunct to other diagnostic procedures.

#### SUMMARY

1. A method for the detection of cancer of the large bowel based upon the cytologic recognition of exfoliated malignant cells in smears taken at sigmoidoscopy is described.

2. The cytology of such smears is discussed briefly.

3. The range of usefulness was found to be limited to the rectum sigmoid colon, and lower descending colon where from two thirds to three-fourths of the tumors were detected or suspected on the basis of the smears.

4. In this region the smear method compared favorably with x-ray examination and sigmoidoscopy with biopsy.

5. It was possible to detect malignant cells from tumors which could not be seen through the sigmoidoscope.

6. The use of smears in the study of conditions other than malignant is suggested.

# ABDOMINOPERINEAL REMOVAL OF LOW LYING CANCER OF THE RECTUM

## FIVE YEAR CURES AND LOCAL RECURRENCES

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IN the surgical treatment of low lying carcinoma of the rectum the literature has shown an increasing interest in operations which we consider less radical than the one stage abdominoperineal operation of Miles. In this communication we should like to discuss this problem again from the pathological and anatomical viewpoint as well as from that of the 5 to 10 year cure of the patient.

It seems to us that the principle involved is to determine what surgical procedure gives the patient the best chance for a long term cure and not whether certain operations are technically possible or that continuity of the intestinal tract, however desirable, can be maintained. In the consideration of such a principle, published studies should insist upon *unselected* material, careful pathological consideration of the type of the cancer based on accepted classifications such as those of Broders and Dukes but also on the percentage of involvement of regional lymphatics in cleared specimens, distant metastases, the resectability rate, the operative mortality, and the *five year plus* survival rate. It is only by some such scheme that comparable statistics can be obtained and reasonable conclusions can be drawn.

We have previously reported (2) the 5 to 10 year cures and local recurrences in 167 unselected patients with cancer of the rectum and sigmoid with a resectability of approxi-

mately 75 per cent. A careful study was made of the location of the tumor and lymph node involvement (3). One hundred and twelve of these rectal carcinomas were at or below the peritoneal reflection between the anterior wall of the rectum and bladder, and 55 were in the rectum above this junction and in the lower sigmoid.

We have used as a criterion of malignancy of cancer the involvement by cancer of the regional lymph nodes which we consider a most important factor. While the degree of differentiation of the tumor cells (Broders' classification) is generally accepted to be an index of the grade of malignancy, we believe that the degree of invasion and metastasis is a better one and lacks in large part the fallacy of personal judgment in determining grades of histological differentiation of cancer cells. Dukes' classification is also an important means of grading the malignancy of the tumor and stresses the involvement of the regional lymphatics in grade III, the most malignant grade.

A study of our unselected cases is submitted which indicates the grade of malignancy of the tumors as judged by Broders' and Dukes' classification. These figures show that in the Broders' classification grades I and II in general have better prognoses than grades III and IV but that again regional lymph node involvement plays the important role in progn-

TABLE I — 112 EXTRAPERITONEAL RECTAL CARCINOMAS

	Num ber	Per cent
Alive 5 to 10 years	58	51.8
Postoperative deaths	12	10.7
Lymph node metastases	69	61.9
Of 69 with node metastases, alive 5 years	26	37.5
Of 43 without node metastases, alive 5 years	32	74.4

TABLE II — 112 EXTRAPERITONEAL RECTAL CARCINOMAS

Recurrence	69 with node metastases		43 without node metastases	
	No.	Per cent	No.	Per cent
Local	16	23.2	2	4.6
Liver	11	15.9	2	4.6
Lung, bone, general	3	4.3	1	2.3
	30	43.5	5	11.6

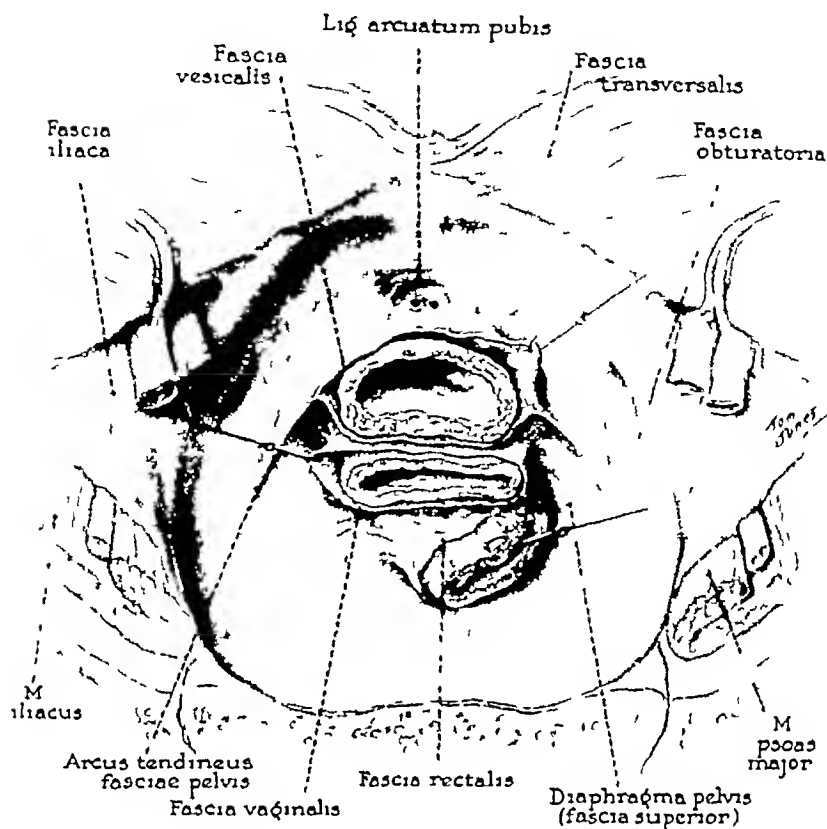


Fig 1 Anterolaterally the layers of the abdominal wall have been turned forward along a medial cut, posterolaterally, the alae of the ilium have been cut horizontally, together with the iliopsoas muscles and fasciae, posteriorly the sacrum has been transected at the same horizontal level. All of the peritoneum and the subserous tissue have been removed to expose the fascia of the pelvis. Within the lesser pelvis, the organs have been transected, together with reflections of the diaphragmatic fascia, the endopelvic fascia. The vesical, vaginal, and rectal tubes of endopelvic fascia have been freed from their respective viscera and retracted. (Courtesy of Arthur H. Curtis, Barry J. Anson, and Chester B. McVay. *Surg Gyn Obst* 1939 68: 161-166)

nosis. The Dukes' classification also substantiates this view.<sup>1</sup>

The peritoneal reflection from the anterior wall of the rectum to the bladder was selected as a dividing line in our study because of the regional anatomy of the rectum below this point and because in the experience of a considerable group of surgeons interested in this field of surgery the abdominoperineal opera-

tion is regarded as the most radical operation for the removal of the cancer and the tributary lymphatics and therefore the procedure which is most likely to result in a long term cure (4).

The importance of the regional anatomy of the rectum below the peritoneal reflection concerns itself with the fascial and muscular attachments and contiguity of the rectum to the base of the bladder, the seminal vesicles, the prostate, posterior urethra, and vagina in an anterior and lateral plane and to the sacrum and coccyx posteriorly.

This intimate relation of the bowel to these structures allows for early invasion and at

<sup>1</sup>Duke's classification as modified by Drs. Kirklin, Dockerty, and Waugh.

Grade A: Invasion limited to mucosa.

Grade B: Invasion extending into muscularis propria but not perforating it.

Grade C: Invasion penetrating through the muscularis propria.

Grade D: Invasion extending beyond the muscularis layer into lymph

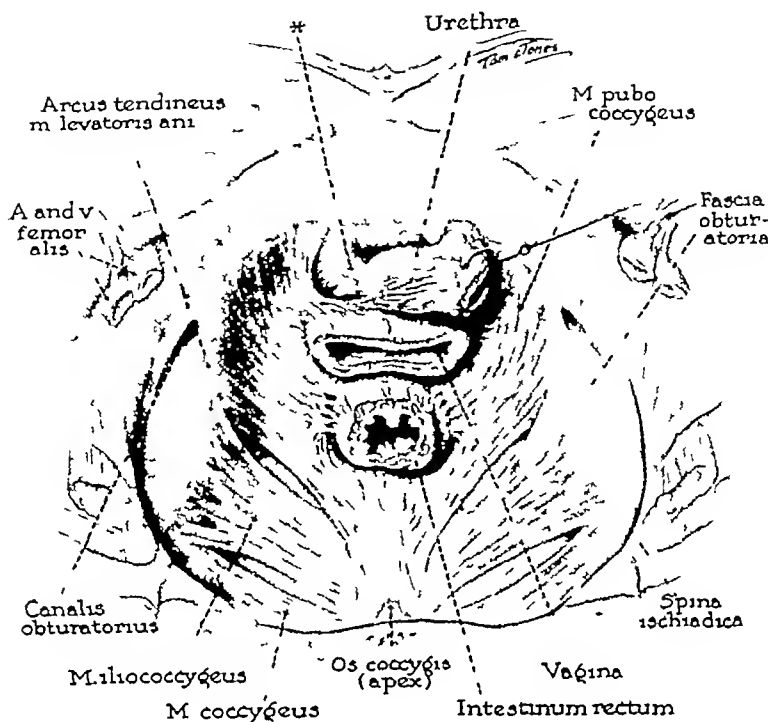


Fig 2 The fascial layers illustrated in Figure 1 have been removed and the viscera excised to a lower level, in order to demonstrate the muscular constituents of the pelvic floor and the relations of these to the viscera. The urethra has been pulled aside to show the course of the levator fibers on its posterior aspect and the nature of the "pubourethral ligament," indicated by an asterisk. (Courtesy of Arthur H Curtis, Barry J Anson, and Chester B McVay *Surg Gyn Obst*, 1939, 68: 161-166)

tachment of cancer of the rectum to structures contiguous to it and for extension through lymphatic pathways where the pectinate line, vagina, prostate, or levator muscles are involved, some of which as the vaginal lymphatics run to the vaginal portion of the base of the bladder or those along the levator muscles to the obturator glands which are difficult or impossible to remove. In this extraperitoneal location of the cancer the encircling bony pelvis makes widespread removal of soft parts around the rectum more difficult than in the case above the peritoneal reflection where there is a well developed mesentery of the bowel containing the lymphatics and where the bowel is freely movable. Not only is it more difficult to perform a radical operation for an intrinsic cancer of the rectum below the peritoneal reflection but the occasional

necessity of finding it necessary to remove part of the base of the bladder, seminal vesicles, the posterior portion of the prostate, a section of the posterior urethra, a part of the vagina or some of the presacral fascia indicates a definite risk of local recurrence. At the same time, this radical approach is important because it increased the resectability rate and resulted in more 5 year cures than a more conservative approach (1). Twenty patients with low rectal cancer of the 112 studied had either presacral fascia, a portion of the base of the bladder, a portion of the vagina, urethra or prostate removed because of involvement by the cancer of the rectum. Seven of these lived more than 5 years. Five of the 20 patients had a local recurrence.

A glance at Table I will show that of 112 extraperitoneal cancers of the rectum which

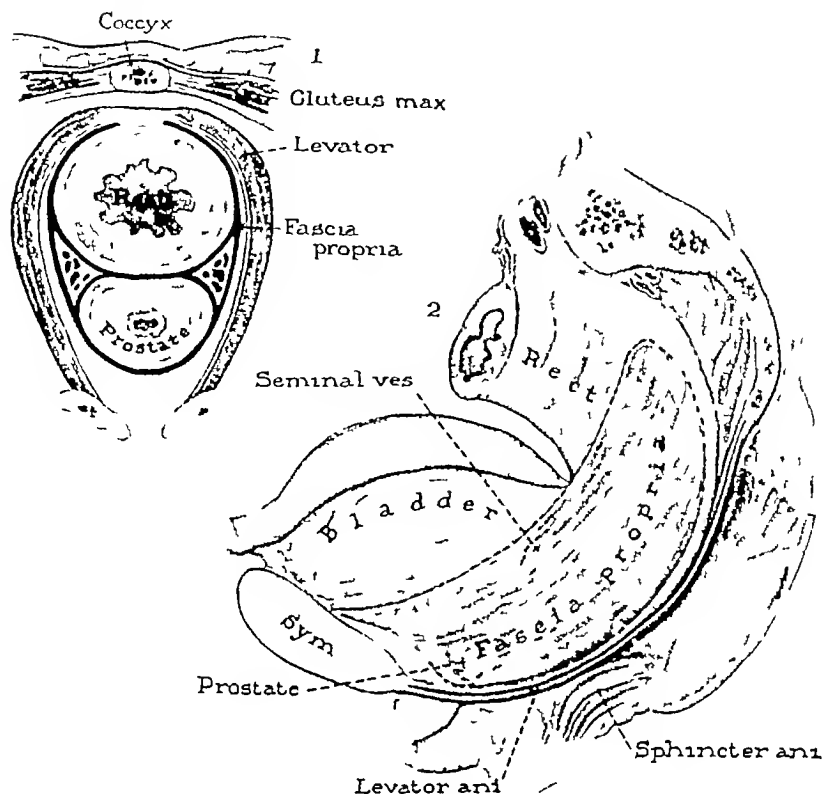


Fig 3 Relation of fascia propria to rectum and prostate 1, Schematic cross section showing continuation of fascia propria around the rectum and prostate This fascia must be cut to allow separation of the rectum from the prostate 2, Schematic lateral view of the bowel, showing the origin and extent of the fascia propria indicated by dotted line (Courtesy W F Prior Company From Chapter VI, Volume 2, *Surgery of the Rectum and Anus* by Vernon C David in Dean Lewis' *Practice of Surgery*)

were removed by abdominoperineal resection, 51 per cent were alive and free of cancer 5 to 10 years after operation compared to 65 per cent of intraperitoneal cancers of the rectum and lower sigmoid, one-half of which were removed by abdominoperineal resection and one-half by obstruction resection with subsequent establishment of continuity

Comparing the two groups below and above the peritoneal reflection, about the same number had carcinomatous lymph node involvement (61 per cent and 63 per cent) However, below the peritoneal reflection only 37 per cent with node involvement were alive 5 years or more after operation compared to 51 per cent above the peritoneal reflection

In the group below the peritoneal reflection without node involvement, 74 per cent were

alive 5 years or more after operation compared to 90 per cent of the group above the peritoneal reflection

Local recurrence in the pelvis after operation on cancer of the rectum below the peritoneal reflection with involved nodes was 23 per cent as compared to 3.6 per cent in the group above the peritoneal reflection

It appears from these facts that cancer of the rectum below the peritoneal reflection treated by abdominoperineal resection has a definitely lower rate of long term cure and a far greater incidence of local recurrence after operation than in cancer of the upper rectum and lower sigmoid treated either by abdominoperineal resection or obstruction resection It would also appear obvious that any operation on cancer of the rectum which makes a com-

TABLE III — 55 INTRAPERITONEAL RECTAL AND SIGMOID CARCINOMAS

	No	Per cent
Alive 5 years	36	65.4
Postoperative deaths	4	7.2
Deaths not due to carcinoma	3	5.5
No follow up	2	3.6
Node metastases	35	63.3
Alive 5 years	18	51.4
No node metastases	20	
Alive 5 years (1, no follow up 1, postoperative death)	18	90.0
Obstruction resections	27	
Alive 5 years	18	66.6
Node metastases	16	
Alive 5 years	9	56.2
Postoperative deaths	2	
Short follow up	1	
No node metastases	11	
Alive 5 years	9	81.9
Postoperative death	1	
No follow up	1	

TABLE IV — RECURRENCES IN 55 INTRA-PERITONEAL TUMORS

	No patients	Per cent
Local	2	3.6
Liver	6	10.9
Lung or general	2	3.6
Total	10	18.1

promise with radicability should be avoided. In this connection it is hoped that similar studies of patients treated by other operations which we consider less radical should be published.

A recent article (5) has categorically denied the difference in prognosis after operation in cancer below the peritoneal reflection as compared to cancer above the peritoneal reflection. We suggest some difference in viewpoint. Their conclusions were based on a *selected* group of 137 patients all *graded group II* of Broders' classification. All patients who died during the postoperative period of hospitalization were omitted from their study.

If our figures omitted the patients lost to follow-up, those who died of other causes without recurrent carcinoma and those who died postoperatively (all of which we believe is contrary to sound statistics), 65.2 per cent of the cancers below the peritoneal reflection lived 5 years or more compared to 75 per cent above the peritoneal reflection. Of those having regional involvement of lymph nodes, their method would give us a 5 year survival

TABLE V — COMPARISON OF 5 TO 10 YEAR SURVIVAL RATE IN CASES OF CARCINOMA ABOVE AND BELOW THE PERITONEAL REFLECTION ACCORDING TO GRADE

Broders type	Lesions above the level of the peritoneal reflection		Lesions below the level of the peritoneal reflection	
	Patients studied No	Lived 5 or more years post operatively No Per cent	Patients studied No	Lived 5 or more years post operatively No Per cent
I	4	4 100.0	6	6 100.0
II	40	25 62.5	62	40 64.5
III	10	6 60.0	41	11 26.8
IV	1	1 100.0	3	1 33.3
	55	36 65.4	112	58 51.8

TABLE VI — COMPARISON OF 5 TO 10 YEAR SURVIVAL RATE IN CASES OF CARCINOMA ABOVE AND BELOW THE PERITONEAL REFLECTION ACCORDING TO GRADE

Dukes grade	Lesions above the level of the peritoneal reflection		Lesions below the level of the peritoneal reflection	
	Patients studied No	Lived 5 or more years post operatively No Per cent	Patients studied No	Lived 5 or more years post operatively No Per cent
A	3	3 100.0	5	3 60.0
B <sub>1</sub>	1	1 100.0	5	5 100.0
B <sub>2</sub>	16	14 87.5	33	24 72.6
C	35	18 51.4	69	26 37.5
	55	36 65.4	112	58 51.8

rate of 49.1 per cent below the peritoneum compared to 60 per cent above it.

In their study (5), all cases were omitted involving the pectinate line as well as those in whom the surgeon felt that the operation might be a palliative one. Study of regional lymph node involvement was made largely on fixed specimens by making numerous cross sections, and the percentage of node involvement by this method gave an incidence of 35 per cent below the peritoneal reflection and of 53 per cent above it. This compares with 61 per cent and 63 per cent in our group. While importance of the resectability rate was stressed it was not given. The importance of the height of the cancer above the anal region was stressed and the choice of the peritoneal reflection as a landmark was depreciated.





# THE DIAGNOSIS AND REPAIR OF PSEUDARTHROSIS OF THE SPINE

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THE operation of spinal fusion for any purpose is followed in some cases by the development of pseudarthrosis, or fusion failure (1, 2, 3, 4, 6). This fact is not always recognized in evaluating the end-results of this operation. The fusion operation by whatever technique employed can be expected to achieve the desired therapeutic effect only if it results in solid bone fusion of properly designated spinal segments. Failure to secure fusion then can only mean failure to secure the therapeutic result desired. It is therefore important that we recognize as early as possible in the postoperative course the development of fusion failure so that it may be corrected.

In reviewing all cases of spinal fusion performed at the New York Orthopaedic Dispensary and Hospital during the 10 year period of 1936 through 1945, certain features contributing to the diagnosis of pseudarthrosis are evident and should be emphasized. The original fusion procedures followed the Hibb's technique.

## DIAGNOSIS OF PSEUDARTHROSIS

The diagnosis of pseudarthrosis can be made only when the surgeon is aware that the problem of pseudarthrosis does exist and is to be ruled out in each case following operation. The staff at this hospital has realized this problem for many years and has assumed in each case that fusion has failed until proof to the contrary is shown.

Essentially, pseudarthrosis of the spine produces the same symptoms and physical findings as pseudarthrosis elsewhere in the body. However, those as related to the spine are frequently more difficult to elicit. In addition, these findings may frequently be similar to those first presented by the patient preceding spinal fusion.

From the New York Orthopaedic Dispensary and Hospital

The effectiveness of the operation of spinal fusion in the treatment of any of the clinical conditions in which it has been used cannot be stated until we are certain that the procedure really has resulted in fusion of the spine. Sometimes it may be impossible to answer this question until the fusion area has been exposed surgically and direct examination of the bone mass performed. Usually, however, by careful attention to the postoperative history, physical findings, and roentgenographic examination, a close estimate of the state of fusion may be arrived at prior to resorting to such exploration.

*1 Local pain and tenderness.* Pain and tenderness sharply localized over any fusion area suggest pseudarthrosis. A patient with lumbosacral strain and instability may present these findings preoperatively and we are aware that a successful spinal fusion does not result in relief of symptoms in all such cases even though they have been carefully selected for this operation. However, the patient that continues with low back pain and solid fusion does not show the sharp localization of pain and tenderness over the fusion plate, demonstrable in pseudarthrosis. Tenderness is best demonstrated with the patient in the prone position, completely relaxed. On deep pressure with the thumb, a limited area is found over the fusion plate that is quite tender, with no radiation of pain from this point. Pressure elsewhere along the spine may show minor degrees of tenderness but on returning repeatedly to the involved area, exquisite tenderness is again elicited, at the same point on each occasion.

Local pain and tenderness are commonly found preoperatively in patients with tuberculosis of the spine. At this hospital these patients are maintained postoperatively at complete bed rest until evidence of arrest of the disease is obtained. This arrest of disease is



Fig 1 a, Tuberculosis of the spine involving the first and second lumbar vertebrae. Spinal fusion, eleventh dorsal to fourth lumbar performed on May 22, 1942. b, Further bone destruction and deformity with pseudarthrosis at level of first to second lumbar. Pseudarthrosis repaired on April 28, 1943. c, Further bone destruction and deformity with pseudarthrosis still apparent. Although the defect is quite visible in the fusion plate, this may not always be demonstrable. If it were not, the presence of a pseudarthrosis would still be indicated by the progressive deformity.

determined by clinical and roentgenographic examination and by the return of the blood erythrocyte sedimentation rate to normal. Should the patient at any time preceding or following ambulation develop localized pain in the area of fusion and should local tenderness be demonstrable, pseudarthrosis is suggested, and further study to determine the presence of such is indicated.

Pain and tenderness are especially helpful findings toward the diagnosis of pseudarthrosis following fusion for scoliosis. They are uncommonly present preoperatively and when found after ambulation with all support removed are indicative of fusion failure.

2 *Progression of deformity or disease.* Surgical fusion of the spine means that the spine is fixed by a continuous column of bone that allows no motion in any plane of the body throughout the vertebral segments involved. Collapse of vertebral bodies and further anterior angulation in tuberculous disease of the spine is not consistent with solid fusion. It is recognized that angulation may take place before the fusion matures, and in such a case progression of deformity may be noted for some time following operation. However, continued and progressing deformity over a prolonged period of time means failure of fusion. Such evidence of delayed or faulty fusion is especially useful in areas of the spine where the fusion mass itself is difficult to visu-

alize roentgenographically. On the lateral films evidence of further destruction and collapse of the vertebral bodies may be demonstrable, a factor indicating failure of fusion (Fig 1).

Development or progression of paralysis in the lower extremities may also indicate the presence of pseudarthrosis following fusion for tuberculosis, and should always be considered as a possible cause of such, as well as cord compression by tuberculous granulations or abscess uncomplicated by pseudarthrosis. The pseudarthrosis permits continued activity of the disease and so indirectly may contribute to the development of neurological changes in the extremities. Of the 21 patients who developed pseudarthrosis following fusion for tuberculosis during the period of this study, progression of spasticity was prominent in 5, and in them was considered the main clinical feature warranting exploration.

Following spinal fusion for scoliosis, progression of the lateral deformity indicates failure of fusion. Some error must be allowed for placement of the patient for roentgenography and for measurement of the curve. After final removal of plaster jacket any increase in curvature beyond 5 degrees should be regarded suspiciously and failure of fusion should be considered (Fig 2). This loss of correction is even more significant if it can be shown to have occurred at a single intervertebral level.

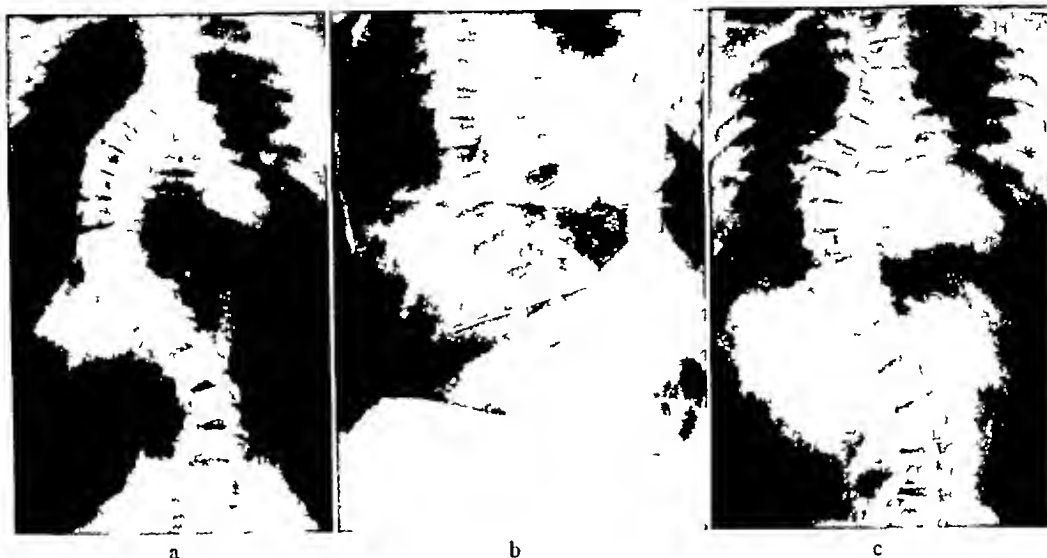


Fig 2 a, Scoliosis Original curve from the fifth dorsal to second lumbar measured 64 degrees b, Corrected to 32 degrees and fused c, Loss of correction to 43 degrees noted at 9 months postoperative No definite defect apparent by x ray examination Because of loss of correction and localized tenderness, fusion plate explored and pseudarthrosis found at level of seventh to eighth dorsal vertebrae

and not throughout the length of the fusion mass

**3 Roentgen examination** The usual roentgenographic examination of any fusion area, including oblique as well as anteroposterior and lateral views, may or may not show a pseudarthrosis when such is present. When it is demonstrable it is seen as an irregular line of translucency extending across the fusion plate in one or all films. The immediately adjacent bone mass may show an increase in density. Such a line of fibrous union may extend completely across an interlaminal space with solid bone fusion present across one or both articular facets. This latter may be difficult to demonstrate roentgenographically. In such a case the roentgen examination will indicate failure of fusion while actually fusion is solid. Quite frequently the line of fusion failure will extend across the plate in an oblique direction in both the coronal and sagittal planes with solid bone mass overlapping above and below as well as in front and behind. Such a line cannot be clearly demonstrated by roentgenographic examination, so that the usual views which are taken in this situation mean nothing in determining the presence or absence of pseudarthrosis.

At this hospital in cases of suspected fusion failure roentgenograms are taken in the lateral position with the spine placed first in maximum extension and then in maximum flexion. Such technique has been especially useful in the study of fusion in the lumbosacral spine. When the films are superimposed over a strong light, variation in the height of the intervertebral disc space at the level of the pseudarthrosis is demonstrable, together with variation in the alignment of the anterior borders of the vertebral bodies (Fig 3). In addition, in the flexed position, separation of the fusion plate at the level of the pseudarthrosis may be demonstrable.

**4 Exploration** In certain cases the diagnosis of pseudarthrosis cannot be made definitely until the fusion area is exposed surgically. It is our feeling that when doubt as to the diagnosis exists and the clinical picture warrants, exploration is indicated. Adoption of such an attitude will mean that some patients will be subjected to exploration that reveals solid fusion. However, a greater number of patients will benefit from such an exploration.

At exploration the fusion mass is exposed through the line of the old incision. If any

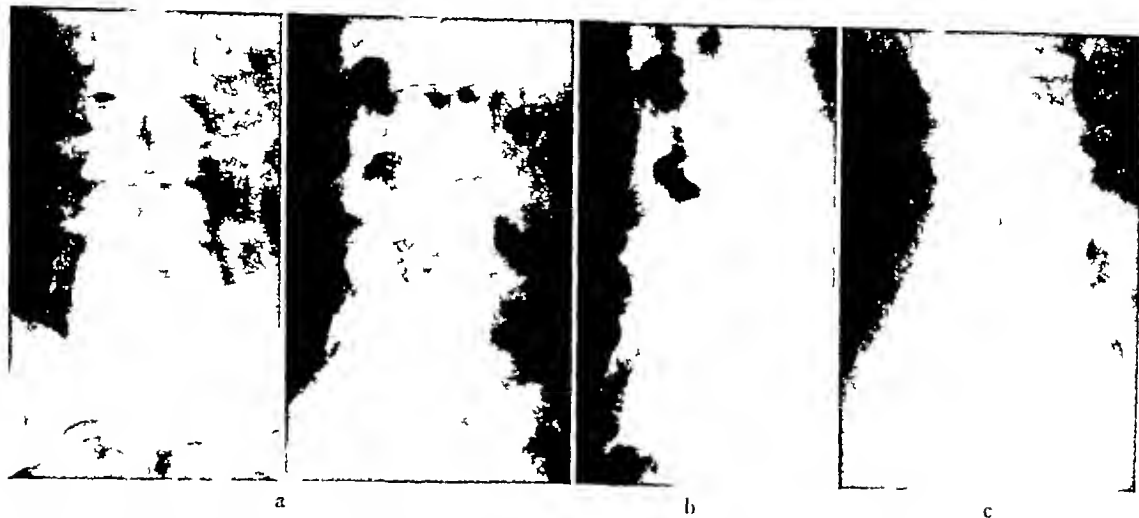


Fig 3 a, Roentgenograms taken a year following spinal fusion of fourth lumbar to sacrum. These suggest fusion failure at fourth to fifth lumbar level. b, and c, Lateral views, taken in flexed and extended positions show failure

at both the fourth to fifth lumbar level and the fifth lumbar to sacrum level. Note the differences in height of the disc spaces. Also note difference in alignment of anterior borders of bodies of fourth and fifth lumbar vertebrae and sacrum.

doubt as to the location or the number of defects exists, the entire plate should be explored. The area is carefully exposed subperiosteally. If the defect is wide with interposition of considerable fibrous tissue, the stripping will proceed with difficulty across it. This may not be demonstrable if the defect is narrow. If the defect is quite narrow considerable search may be required before it can be demonstrated. The surface of the plate is frequently quite irregular and each indentation must be thoroughly cleaned of fibrous tissue. The defect is then demonstrable as a thin line of fibrous tissue, with the adjacent superior and inferior borders of bone mass moving slightly with respiration or on pressure with some blunt instrument. Movement even though barely perceptible is always demonstrable and failure to demonstrate this means that solid union is present.

#### REPAIR OF PSEUDARTHROSIS

The defect in the fusion plate is carefully exposed as described previously. The line is followed across the width of the plate and laterally it will be found to extend into the apophyseal joints. The joint spaces are carefully explored and any remnants of articular cartilage not removed at the primary operation are excised with the fibrous tissue present.

If the defect in fusion is wide with free motion across it, the fibrous tissue filling it is excised to a depth of  $\frac{1}{8}$  or  $\frac{1}{4}$  inch, entirely across the plate. As in the primary fusion, care must always be taken to protect the underlying dura and cord. If the defect is narrow with little motion across it, the surgeon may prefer to limit this excision of interposing fibrous tissue as some degree of fixation is lost through the wide removal of such. At both sides of the midline narrow troughs measuring  $\frac{1}{4}$  inch in width and  $\frac{1}{4}$  inch in depth are gouged. These are extended across the defect well above and below into healthy bleeding bone. The troughs are then filled with cancellous bone chips obtained either from the fusion mass itself or from the ilium. Chips are also wedged into the joint spaces after these have been thoroughly cleansed of fibrous tissue or cartilage. Over an area extending across the entire width of the fusion mass and several inches above and below the defect bone chips with their bases undetached are reflected. These are fashioned in the caudad mass with their bases attached caudally and in the cephalad mass with their bases attached cephalad. Healthy bleeding cancellous bone is thus exposed underneath. Multiple small free bone transplants are then placed in longitudinal fashion to bridge the line of pseudarthrosis with both ends of each

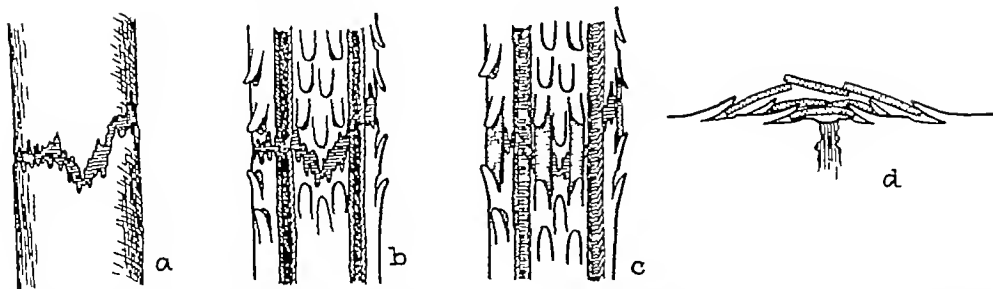


Fig 4 a, The line of pseudarthrosis is shown, extending across the fusion plate. The articular facets are not represented in this diagram. b, Narrow troughs have been fashioned across the defect, to be filled later with small free bone transplants. Cortical bone chips with bases unde-

tached have been turned up. c, Free transplants are shown wedged underneath the previously reflected bone above and below the defect. d, Longitudinal section showing how the free transplants may be placed in multiple layers and interlocked.

transplant wedged beneath the edge of the bone previously reflected from the plate. Other free transplants may be superimposed in a similar manner. The fusion mass will usually offer a considerable quantity of transplants or they are easily removed from the ilium. The conclusion of the procedure will show a mass of bone transplants wedged onto cancellous bone above and below the defect and extending across it in the longitudinal axis of the fusion plate (Fig 4).

The previously stripped periosteum is allowed to fall over the bed of bone transplants, sutured, and the incision closed. Depending on the indications for primary fusion, the patient is immobilized with a spine brace or a plaster jacket incorporating both thighs and is kept at absolute bed rest for 8 to 12 weeks. A careful search is then made for possible failure of repair. If fusion has been obtained the patient is allowed up with brace or with an ambulatory jacket. If there is suggestion of failure, immobilization in bed is continued for another 4 weeks. If failure is definitely present, another attempt at repair is then advised.

#### END-RESULTS

During the period of 1936 through 1945, 1,250 patients underwent operation for spinal fusion. Careful follow up study for at least 1 year after operation was carried out in 1,096 patients. Of this group, the diagnosis of pseudarthrosis was made in 182 patients. The diagnosis was confirmed by exploration of the fusion area in 152 patients. In the remaining 30 patients the diagnosis was established only

by applying the standards listed previously, without exploration. In these patients, exploration was advised, but permission was not granted.

During this same period, 23 patients underwent exploration of the fusion mass for failure of fusion, and solid fusion was found. Thus, of 175 patients subjected to exploration, positive evidence of fusion failure was found at operation in the 152 patients remaining or in 86.8 per cent.

One hundred fifty-two patients underwent operation for repair of pseudarthrosis of the spine. All cases have been followed by clinical and roentgenographic examination for at least 1 year. The method of repair which is here described, with minor variations, has been used in the treatment of all patients. Repair was successful primarily in 119 cases, or 78.3 per cent (Table I).

TABLE I — REPAIR OF PSEUDARTHROSIS

Diagnosis at original fusion	No patients undergoing repair of pseudarthrosis	No patients with successful primary repair	Per cent
Scoliosis	51	42	82.3
Lumbosacral instability	51	42	82.3
Lumbosacral instability internal fixation used at primary fusion	23	17	73.9
Tuberculosis	18	11	66.1
Spondylolisthesis	9	7	77.7
Total	152	119	78.3

Of the 33 cases in which repair was not successful, 16 patients underwent a second attempt at repair and this was successful in 13 cases.

## SUMMARY

1 The following findings aid in the diagnosis of pseudarthrosis following the operation for spinal fusion (a) localized pain and tenderness, (b) progression of deformity or disease, (c) roentgenographic demonstration of fusion failure

2 In certain cases the diagnosis cannot be established until the fusion plate is explored. We believe that exploration is indicated in every case in which operation did not accomplish the result anticipated

3 By the technique described, repair of pseudarthrosis is successful primarily in 75 per cent of cases

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# AUREOMYCIN TREATMENT OF URINARY TRACT INFECTIONS

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MUCH progress has been made in recent years in the management and cure of many serious conditions along the urinary tract by minimizing or eliminating the factor of infection. The use of acid forming drugs and, more recently, the widespread use of antibacterial agents, particularly the sulfonamides, penicillin, and streptomycin, all of which are excreted into the urine in high concentration and in an active form, have made it possible to limit or eradicate infection in the genito-urinary tract without resort to local instillations. It has thus become possible to minimize the need for many of the manipulations and instrumentations which cause additional trauma and may result in the introduction or the further spread of infections.

Failures of chemotherapy and antibiotics are still the rule, however, in severe and long standing infections, especially when there is interference with the free flow of urine or when there are anatomic defects or localized foci of infection within the urinary tract which constantly predispose to reinfection. In addition, the use of streptomycin in such cases, even when care is taken to maintain an alkaline urine, is all too frequently associated with the appearance and persistence of resistant strains which then render that antibiotic entirely useless.

The introduction of a new antibiotic, particularly one which is effective against most of the types of bacteria found in urinary tract infections, is excreted in the urine in effective concentrations, is relatively nontoxic and can be given by mouth, warrants a careful study of its possible usefulness in this field.

Aureomycin is such an agent and this paper presents a clinical and bacteriologic study of its effectiveness in the types of infections

which are generally refractory to treatment with other agents or which consistently recur after temporary improvement following the use of the antibacterial agents now available.

*Choice of patients* The patients selected for treatment with aureomycin were all adults and almost all of them had severe and long standing infections which had failed to respond to treatment. Only 1 patient with a previously untreated acute pyelonephritis complicating pregnancy is included. The others all had various underlying defects along the urinary tract and had been subjected to numerous instrumentations and to various operative procedures either for diagnosis, for relief of symptoms or in an attempt to produce a radical cure. Most of the patients were in the older age groups. Only 4 of the patients, however, were hospitalized during the aureomycin therapy, the others were considered to be especially suitable for ambulatory therapy because they were highly intelligent, completely co-operative, and anxious to be relieved of the infection. Most of the ambulatory patients were referred by Dr. Herbert H. Howard, formerly chief of the Urological Service, who kept these patients under close observation both before and after the aureomycin therapy.

*Laboratory studies* Urinalyses were done frequently before, during, and after the aureomycin therapy and included examination of the unstained and stained sediment for cellular elements and for bacteria. These urine specimens, collected by catheterization in females or after careful local preparation in males, were also cultured on various media and the various types of organisms that grew out were isolated in pure culture and tested for sensitivity to the antibiotic. The concentrations of aureomycin in the urines were determined at irregular intervals either in single voided specimens or, in some instances, in

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TABLE I—SUMMARY OF RELEVANT CLINICAL AND LABORATORY FINDINGS

Patient Sex Age	Known duration of urinary infection	Complications, operations etc.	Organisms previously cultured	Previous chemotherapy	Symptoms before aureomycin therapy	Aureomycin therapy		
						Gm*	Days	Toxic effects
J W C. M 62	3 months	Frequent bleeding bladder cauterizations prostatectomy		Sulfadiazine mandelamine	Bleeding burning poor control, dysuria	4.5	4½	None
M C M 67	5 months	Retention 2 years prostatectomy, non functioning kidney, right hydronephrosis and hydro- ureter left.		Sulfadiazine	Nocturia cloudy urine back pain	7.0	7	Loose bowels 3 days
						2 week interval		
						14.0	7	Copious stools 3-7 days
J A M 52	12 years	Urethral strictures dilations prostatectomy, acute cystitis mild diabetes	K. pneumoniae Str faecalis Esch coli communis	Sulfadiazine	Dribbling nocturia cloudy urine	4.0	4	Frequent large stools
						10 day interval		
						13.0	6½	Same + urgency
J C M 60	2 years	Prostatectomy incontinence Cunningham clamp	A. aerogenes Esch coli P. vulgaris Str faecalis Staphylococcus Ps aeruginosa	Sulfadiazine penicillin, mandelamine streptomycin	Incontinence burning and dysuria	4.0	4	None
E F M 76	> 5 months 7 many yrs	Prostatectomy, frequent instrumentation residual		'Irrigations'	Nocturia, burning	3.0	3	None
K H M 56	1 year	Nephrolithiasis, 17 yrs urethrotomy monthly dilations bladder residual	Str faecalis	Sulfonamides, penicillin	Cloudy urine frequency burning	8	8	Loose bowels 3rd day
						16 day interval		
						11	5½	Nausea 7 dysuria
T J M M 70	> 1 year	Numerous instrumentations prostatectomy bladder residual	Ps aeruginosa Esch coli	Mandelamine streptomycin	Frequency dribbling nocturia	4	4	None
M N M 72	15 years	Urolithiasis nephrectomy 1935 prostatectomy 1944 cystitis, pyelonephritis residual		Sulfadiazine	Recurrent fever and colic dribbling cloudy urine	7	-	None
						12 day interval		
						13	6½	Nausea
P D M 60	3 years	Resection of tumor of left kidney bladder polyps cauterized	Esch coli	Sulfadiazine mandelamine penicillin, streptomycin	Frequency burning nocturia (worse after sulfonamides) poor control	15.5	9	Large frequent stools
W F M 32	Since birth	Spina bifida incontinence penile clamp many operations	P. vulgaris Str faecalis Staphylococcus Str mitior	Sulfadiazine mandelamine streptomycin	Incontinence burning thick cloudy urine	9.5	10	Loose bowels 7 days
						15 day interval		
						-	3½	Nausea ab- dominal discomfort
A M M 47	8 years	Nephrolithiasis 28 yrs nephrectomy nephrostomy	A. aerogenes Esch coli K. pneumoniae	Sulfadiazine, mandelic acid penicillin	Acute pyelonephritis sub- sided pyuria and bacilluria persisted	8	8	None
R M F 24	> 1 month	Chronic glomerulonephritis pyuria after catheterization			Afebrile and symptomless	6	6	None
H M F 52	2 years	Urethral suspension wound infection retention	A. aerogenes Ps aeruginosa P. vulgaris	Penicillin, sulfadiazine	Frequency, dribbling, dysuria fever nocturia C.V.A. pain	19	9	None

## IN SEVERE URINARY TRACT INFECTIONS TREATED WITH AUREOMYCIN

Bacteriology of urine†					Clinical effects of therapy			Evaluation of effects from aureomycin
Organism	M I C.	Relation to therapy			Pyuria		Symptoms and urinary findings	
		Before	During	After	Before	After		
Str mitior P vulgaris	63 125	+	o	o +3&14	++++	+	Bleeding stopped less dysuria cloudy urine 2 weeks later	Slight, temporary
A aerogenes, Ps aeruginosa	125 200	+	o	o +7	++++	+	Less nocturia, partial rapid clearing of urine recurred 7 days later Retreated after 2 weeks again symptomless during and for 1 week after treatment	Moderate temporary (both times)
Ps. aeruginosa	200	+	+3 o,7	+7	++++	±		
A aerogenes P vulgaris	63 250	+	+2 o 4	o +5	++++	±	Felt generally better less nocturia, cloudy urine and symptoms returned after 7 days felt better during second course	Slight, temporary
P vulgaris	250	+	+3&7	+	++++	+++		None
P vulgaris	125	+	+1 o 2&4	o 4 then +	++++	o	Burning stopped bladder control better less dribbling	Moderate, temporary
A aerogenes	63	+	o	o 5&12	+++	o	Much improved no symptoms	Good
Esch coli P vulgaris	125 125	+	+1 o,3-7 o	o +2&6	+++	±	Urine cleared but again got cloudy some frequency and burning after second course which then cleared (along with proteins) on sulfadiazine.	Slight, temporary (both times)
A. aerogenes, P vulgaris	25 125	+	o	o +2	++	o		
Esch coli	125	+	o	o	++	o	No nocturia less dribbling	Good
Esch coli A aerogenes	125 100	+	+3&5 o	+	++++	+	Urine cleared for 6 days after treatment then got cloudy again, improved after second course	Slight, temporary more from second course
Esch. coli, A aerogenes	25 50	+	o	o +2	++++	±		
Esch coli Ps aeruginosa A aerogenes	125 200 125	+	+3 then o o	o +1 +14	++++	+	Less nocturia and frequency burning almost gone better control	Slight, temporary
P vulgaris	200	+	+	+	++++	+	Improved, less burning and urine clear after first course relapsed and again improved after second course	Slight, temporary (both times)
P vulgaris Esch coli	250 25	+	+	+	++	+		
A aerogenes	25	+	+4 then o	o	++	o	Pyuria cleared rapidly	Good
Esch coli	100	+	o	o	++	o	Pyuria cleared	Good
Esch coli Ps aeruginosa, P vulgaris	63 >200 250	+	+2 +5 +5		++++	±	Almost complete symptomatic relief bladder emptied well no follow up	Moderate, incomplete

TABLE I—SUMMARY OF RELEVANT CLINICAL AND LABORATORY FINDINGS IN

Patient Sex Age	Known duration of urinary infection	Complications operations etc.	Organisms previously cultured	Previous chemotherapy	Symptoms before aureomycin therapy	Aureomycin therapy		
						C m *	Days	Toxic effects
S F 22	6 days	Pregnancy, acute pyelonephritis			Frequency burning flank pain	6	4	None
R M 28	3 years	Bilateral ureterolithotomy nephrectomy right nephros- tomy, left appendicitis with perforation and peri- tonitis Readmissions for abdominal abscess in dwelling catheter after operation	A aerogenes Esch coli Ps aeruginosa	Sulfadiazine, penicillin streptomycin	C V A pain cloudy urine malaise  Cloudy urine	7	7	Loose stools nausea once
						11 week interval		
						23	17	Nausea, vomiting stopped when dose reduced
D C F 27	2 months	Diabetes cesarean section intractable cystitis	Esch coli	Sulfadiazine mandelamine penicillin streptomycin	Back pain frequency cloudy urine chills fever malaise	4	4	Loose stools nausea
						25 day interval		
						28	28	None

\*Total amount listed mostly given in 0.5 gm doses morning and night or before each meal and at bedtime.

†M.L.C.—inhibiting concentration (complete) of aureomycin in  $\mu\text{g/ml}$ . + = positive, o = negative for organism indicated. All strains of the same begun and after treatment ended in columns 'during' and 'after' respectively.

urine collected over periods of several hours. The methods are described elsewhere (1, 3).

**Aureomycin treatment** The antibiotic was provided as a powder in capsules, each containing 50 milligrams, and was given by mouth. Most of the patients received 10 capsules (0.5 gm) morning and night for about a week, but 0.5 gram 4 times a day (before each meal and at bed time) was given for varying periods in some of the patients and in almost all of those who were given a second course.

### RESULTS

The relevant clinical and laboratory findings, the therapy used, and an evaluation of its effect in each of 16 patients is shown in Table I. In 7 of these patients a second course of aureomycin was given, usually after an interval of 2 weeks, either because the infection was not completely eliminated or because it recurred.

All but 1 of these patients had a chronic and recurrent infection of the urinary tract which, in most instances, was of several years' duration. Almost all of them had a long history of severe complicating factors, such as urinary retention, frequent instrumentations, prostatectomy, urolithiasis, and chronic and recurrent acute cystitis and pyelonephritis. In

almost all instances, one or more chemotherapeutic or antibiotic agents had been used previously without producing prolonged remissions. Thus, the least favorable types of cases were chosen for evaluation of the effects of aureomycin.

The predominant clinical symptoms prior to the aureomycin therapy were dysuria, poor sphincter control, frequency, nocturia, and cloudy urine. Some had had recurrent attacks of severe costovertebral angle pain and tenderness. The urine was loaded with pus cells in every case.

In general, the pyuria diminished markedly during therapy and disappeared entirely in about half of the patients while treatment was still being given. Symptomatic relief occurred at the same time in most instances, the burning on urination, frequency, and nocturia all diminished or subsided.

The urine became highly acid and remained so throughout the treatment. Cultures obtained immediately before treatment usually revealed only a single strain of organism but in those who received a second course of aureomycin, organisms other than those initially present had appeared during or after the first course. The cultures usually became sterile during the aureomycin treatment. In some of

## SEVERE URINARY TRACT INFECTIONS TREATED WITH AUREOMYCIN—Continued

Bacteriology of urine					Clinical effects of therapy			Evaluation of effects from aureomycin
Organism	M.I.C	Relation to therapy			Pyuria		Symptoms and urinary findings	
		Before	During	After	Before	After		
Esch. coli, A. aerogenes	25 125	+	0 + 1 then 0	0 0	+++	0	Fever subsided and urine cleared promptly afebrile in 2 days	Good
A. aerogenes K. pneumoniae P. vulgaris	25 50 125	+	+ 3 then 0 + 1, then 0 + 5-7	0 0 + 12 then 0	++++	0	Improved and remained well with clear urine until readmission for abdominal abscess urine cleared rapidly	Good, first course moderate second course
Ps. aeruginosa, P. vulgaris	250 125	+	+	+	++++	±		
Esch. coli	63	+	+	+	++	0	Asymptomatic until 10 days after first course when all symptoms returned again symptomfree after retreatment until 10 days after second course	Moderate and temporary (both times)
Esch. coli	63	+	+ 8 then 0	+ 14	++	±		

organism isolated in the same patient had the same sensitivity to aureomycin The numbers after "+" and "o" indicate the day after treatment

the patients, however, *Proteus vulgaris* or *Pseudomonas aeruginosa* and in 2 instances *Escherichia coli* either first appeared or persisted during aureomycin treatment. Infection recurred within a few days in most instances, with either the same or with different organisms. The proteus organisms were the most persistent but pseudomonas also could not be eradicated.

Good results of a permanent nature were, therefore, infrequent in these cases of chronic urinary tract infections. Temporary relief, either slight or moderate, resulted in about two-thirds of the patients. The patient with the acute pyelonephritis complicating pregnancy responded promptly with both symptomatic relief and a bacteriologic cure.

**Sensitivity of organisms.** As seen in Tables I and II, most of the organisms were quite sensitive to aureomycin. Most of them were completely inhibited by concentrations ranging from 6.3 to 50 micrograms per milliliter, but the strains of proteus and pseudomonas required 125 to 250 micrograms per milliliter for complete inhibition. Partial inhibition usually occurred in one-half or one-fourth of the concentrations which were needed for complete inhibition. It is seen from Table II that the more resistant organisms are the ones

which persisted or appeared in the cultures during and after the aureomycin treatment. All of the strains of the same organism that were isolated from the same patient, however, were equally sensitive to aureomycin. There was no evidence of any tendency for resistant variants to develop during therapy.

**Aureomycin levels.** The methods available were rather crude (1, 3). The aureomycin activity in the urine that was demonstrated by these methods was equivalent to concentrations of 32 to 256 micrograms per milliliter in specimens of urine obtained during treatment and between 2 and 12 hours after a dose of 0.5 gram. Of interest is the fact that concentrations of 16 micrograms per milliliter, and sometimes more were obtained as long as 48 hours after the last dose and smaller concentrations were demonstrable for more than 72 hours. The errors involved in the methods were such as to suggest that the actual concentrations were considerably higher, since the antibiotic tends to deteriorate rapidly on standing and even during the course of the tests. Blood levels were usually 2 micrograms per milliliter or less but concentrations of 8 micrograms per milliliter were obtained in 1 patient while he was receiving 1 gram every 12 hours.

TABLE II — SUMMARY OF BACTERIOLOGIC FINDINGS IN THE URINE IN RELATION TO AUREOMYCIN THERAPY

Organism	Sensitivity μg.-mi	No of patients*	Relation to aureomycin therapy †		
			Before	During	After
<i>Streptococcus mitior</i>	63	1	1	0	0
<i>Klebsiella pneumoniae</i>	5	1	1	1	—
<i>Aerobacter aerogenes</i>	63-100	9 <sup>1</sup>	7	4	3 <sup>‡</sup>
<i>Escherichia coli</i>	63-100	9 <sup>2</sup>	11	6	3
<i>Pseudomonas aeruginosa</i>	200-250	4 <sup>1</sup>	3	3	4
<i>Proteus vulgaris</i>	125-250	7 <sup>1</sup>	4	8	9

\*Superscripts indicate the number of patients included from whom the same organism was isolated in relation to 2 separate courses of aureomycin

†The figures denote numbers of patients those receiving 2 courses are listed separately in relation to each course

‡Two of these yielded the only strains that required 50 or 100 μg per ml to inhibit.

**Toxic effects** These were minimal. The most common complaint was looseness of the bowels with frequent (2 to 4 daily), bulky, and soft stools but not true diarrhea. This was more frequent and was accompanied by some nausea and occasional vomiting when doses of 2 grams a day were given. In some of the patients with cystitis, a disagreeable sensation as of something "drawing" or "squirming" in the pelvis was sometimes noted. This may have been related to the high acidity of the urine during ingestion of large doses of aureomycin. There were no other symptoms in these or in other patients, nor was there any laboratory evidence of renal or liver damage or of any toxic effects on the blood. There were no fevers or rashes attributable to the antibiotic.

#### COMMENT

These cases were chosen deliberately because, with the exception of the patient with acute pyelonephritis, they represent the types of urinary tract infection which are usually refractory to the chemotherapeutic and antibiotic agents that are now available. When all

of the clinical and bacteriologic findings are taken into account, the results in these cases may be considered to be quite satisfactory, although they still leave much to be desired. The results are probably as good as, if not better than, those usually obtained in similar cases with sulfonamides or with streptomycin. Since most of these patients had previously proved refractory to these agents and some were relieved of symptoms and pyuria for the first time in many months while they were taking aureomycin, this agent may prove to be a useful addition to the therapy of urinary tract infections. Aureomycin has several advantages over other agents used in this field in that it can be given by mouth, it is effective against infections with both gram-positive and gram-negative organisms (2) and from present indications it can be given for long periods without significant toxic effects and without giving rise to resistant variants (2, 3). It is relatively ineffective, however, against infections with *Proteus vulgaris* and with *pyocyaneus*.

#### CONCLUSIONS

Aureomycin may prove to be a useful addition to the list of agents that are effective in the treatment of urinary tract infections and should have further clinical trials in such infections.

**ADDENDUM**—Since this paper was submitted for publication, more than 50 additional patients with urinary tract infections have been treated with oral aureomycin. One-third of these patients had acute pyelonephritis, cystitis, or both, and all but 1 of these patients were completely cleared of bacteriuria and pyuria. The results in the chronic cases were similar to those noted in the cases presented here.

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# STUDY ON THE RELIEF OF OBSTRUCTION IN THE COMMON BILE DUCT AND IN THE PAPILLA OF VATER

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THE problem of obstruction at the terminal end of the common bile duct has been prominent for many years. The surgeon meets this condition all too frequently, and on occasion he is hard put as to know what to do. Those patients who have had cholecystectomy, with or without choledochotomy, and who subsequently develop evidence of obstruction to the flow of bile from the common bile duct into the duodenum have been responsible for much aggravation for the surgeon. The obstructions to be considered at the present time are those resulting from spasm at the papilla of Vater, and from stones or mucous plugs in the common bile duct.

The presence of a sphincter mechanism at the termination of the common bile duct was noted by Oddi in 1887. Careful anatomical studies by Kirk and by Schwegler and Boyden leave little to be added along this line of investigation. Much has been written regarding the physiology of the sphincter of Oddi, reporting the effect of certain drugs upon the state of the sphincter and the duodenum, but with varying and at times controversial results (1, 2, 4, 6, 7, 8, 10-12, 14, 15, 20-22, 25, 26, 32). Various methods have been described and advocated, in an effort to dislodge or dissolve the obstructing factor, be it stone or mucous plug (3, 5, 13, 17, 18, 23, 24, 29, 30). Such obstructions at the terminal end of the common bile duct may be relieved by either surgical or nonsurgical methods. The surgical approach to the problem is obvious, but in many instances reoperation may not be advisable. One may consider several different approaches, namely, an attempt to enlarge the tube through which the obstructing agent

must pass, an attempt to increase the hydrostatic pressure within the common bile duct proximal to the obstructing agent, thereby forcing it into the duodenum, or a combination of the two. The hydrostatic pressure in the common bile duct may be increased by perfusing solutions through a drainage tube or by the administration of hydrocholeretics which usually result in the outpouring by the liver of a large amount of thin watery bile. The terminal end of the common bile duct may be enlarged by the use of certain drugs, in an effort to produce relaxation of the sphincter of Oddi and duodenum, or possibly an actual paralysis of the sphincter and duodenum as will be seen later. Our problem was, therefore, divided into several parts: (a) a study of the effect of certain drugs upon the state of the sphincter of Oddi and duodenum, (b) a study of the site of action of these drugs and, (c) an attempt to duplicate the problem in the laboratory animal as it appears in the human.

Our preparation was similar to that of Kozoll and Necheles (17), Necheles (25) and Crohn and associates (9). Figure 1 illustrates diagrammatically the animal preparation. Dogs with an average weight of 10 kilograms were anesthetized with sodium pentobarbital. Carotid blood pressure was recorded. The pylorus was ligated and gastric secretion was evacuated through a drain. The common bile duct was cannulated *in situ*. One cannula in its proximal end served to evacuate bile. A second cannula, inserted approximately 2 centimeters from the papilla of Vater and pointing toward the duodenum, was connected by a T tube to a constant infusion pump (27) and to a recording mercury manometer. The solutions which were perfused through the common bile duct at a rate of 2 cubic centimeters per minute were evacuated through a tube in the duodenum, 2 to 3 centimeters distal to the papilla of Vater. Following a control

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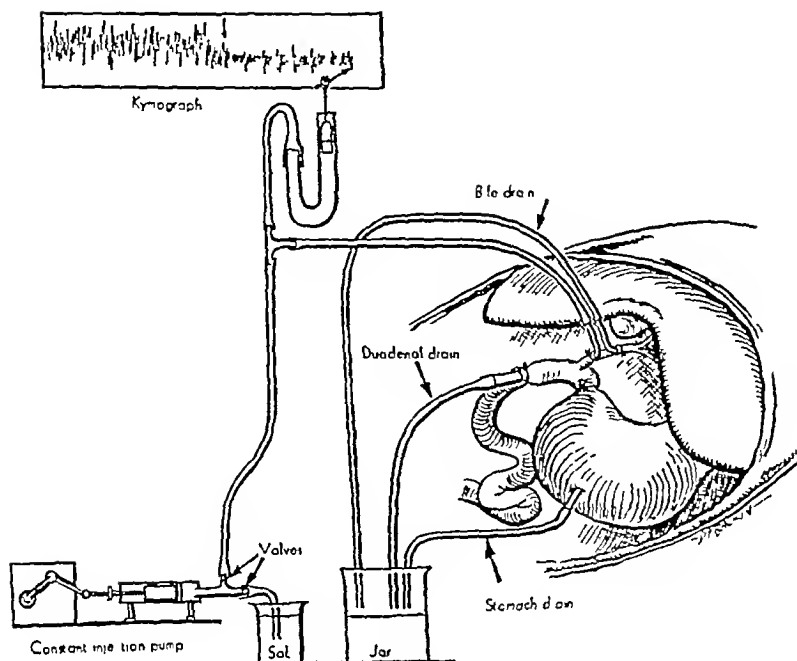


Fig 1 Experimental preparation See text

period, the saline perfusate through the distal common bile duct was replaced by the test drug dissolved in 100 cubic centimeters of saline. The time of perfusion with each drug was approximately 10 minutes, after which time saline perfusion was resumed. In an effort to duplicate what may often occur in the human with biliary tract disease, it was decided to maintain the sphincter of Oddi in a state of spasm. This was accomplished by constant slow intravenous injection of a saline solution of prostigmine, at the rate of 0.1 milligram of the drug per hour.

Changes in rhythmic motility and tone of the sphincter of Oddi are graded as + to +++++. + Denotes a diminution of rate of rhythmic contractions but not of their height. ++ Denotes diminution of rate and slight diminution of height of the contractions. +++ Denotes distinct diminution of both and drop of tone. ++++ Denotes drop of tone and abolition of motility, i.e., complete patency of the sphincter. Nontoxic doses of all drugs were employed. The percentage of effectiveness denotes the per cent incidence of relaxation of the sphincter in all experiments with a given drug.

The drugs which may have an effect on the sphincter of Oddi can be grouped into two categories. The group of topic or local anesthetic drugs were considered as being of possible benefit because of their interference with sensory receptors and afferent branches of reflex arcs, with subsequent release of spasm and subsidence of edema (LeRiche and Crohn and associates). The second large group of drugs includes those responsible for smooth muscle relaxation, either by direct effect on the smooth muscle or by abolishing cholinergic nerve action. Many drugs were tested in an effort to find the one which afforded consistently good results. The drugs were administered intraductally in saline solution or they were given intravenously. The following local or topic anesthetic drugs were tested: procaine, nupercaine, butyn, cocaine, mety-caine. The following antispasmodic or spasmolytic drugs were tested: papaverine, trasentin, atropine, homatropine methyl bromide, dibutylene, amyl nitrite, aminophylline, some spasmolytic drugs have also local anesthetic effects, e.g. trasentin.

In the first group of experiments, drugs were tested by means of perfusion through the

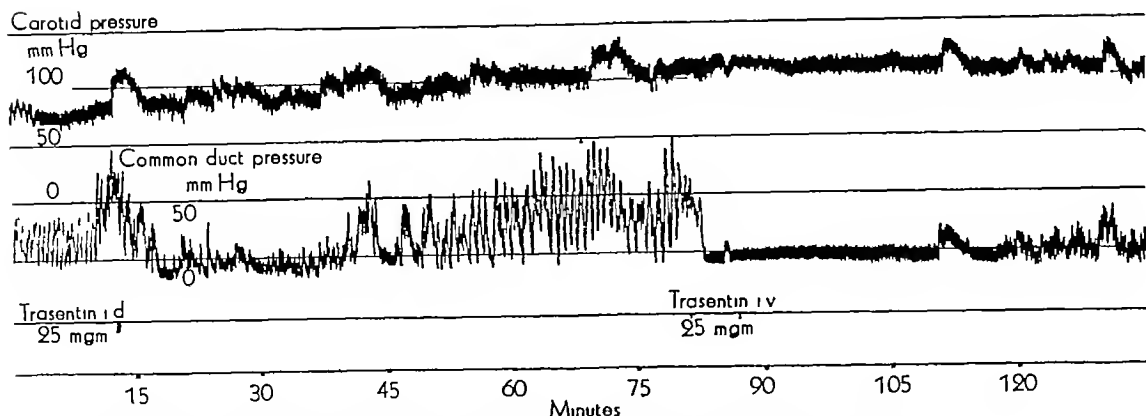


Fig 2 Experiment 10, male dog weighing 12 kilograms  
Effect of trasentin ++ Response after perfusing 25 milligrams of trasentin through the common bile duct.

+++ Response following intravenous injection of 25 milligrams of trasentin

common bile duct and part of the duodenum. The results were graded as described before. There was a latent period following perfusion of the drugs which varied from a few seconds to 11 minutes from the time of completion of the perfusion. The latent periods, for the same dose of the same drug, varied in the same animal in a number of experiments. However, in most tests the latent periods were rather short. The duration of drug effect also varied in the same animal with the same dose of the same drug. A +++ response may persist for 25 minutes on one occasion whereas another +++ response may persist for 74 minutes. It was also noted that at times a ++ response would last longer than a +++ response, again using the same dose of the same drug in the same animal. Because of the constancy of the dosage and infusion, it must be assumed that these are variations peculiar to the animal being used at the time. The blood pressures, as recorded, did not vary as a result of perfusion of the test solution through the duct. Of all the drugs used intraductally, the only one which gave results consistently was papaverine, which was graded 100 per cent. Atropine and homatropine methyl bromide were graded 50 per cent, procaine 47 per cent, trasentin 44 per cent, and aminophylline 33 per cent, effective. The other drugs tested, nupercaine, metycaine, butyn, dibutylene, sodium nitrite, and cocaine, were found ineffective. The effect of amyl ni-

trite was rather interesting in that a ++ response was obtained by the perfusion of a saline solution of the drug, the perle having been crushed under saline. However, the result could not be duplicated, even when a crushed perle was held to the animal's nose or tracheal cannula.

In the second group of experiments, drugs were used intravenously. The dog preparation was the same as used before. The drug was injected over a period of 10 minutes and its effect, when present, was seen as soon as the injection was completed and frequently even before completion. The latent periods were shorter with intravenous administration. The length of effect varied in this series as it did when the drugs were perfused through the common bile duct. Also, identical doses of the same drug produced effective changes in the intraductal pressure which were either longer or shorter than the changes produced when the same drug was given intraductally. The duration of effect, using the same dose of the same drug in the same animal, varied, for instance, a +++ response persisted for 62 minutes whereas a +++ response persisted for 38 minutes. However, there seemed to be a more constant relation in this series of tests between the degree and the duration of effective response, i.e., the greater the degree of response, the longer the effect. It was also noted that there was a tendency for the blood pressure to drop during the injection of the



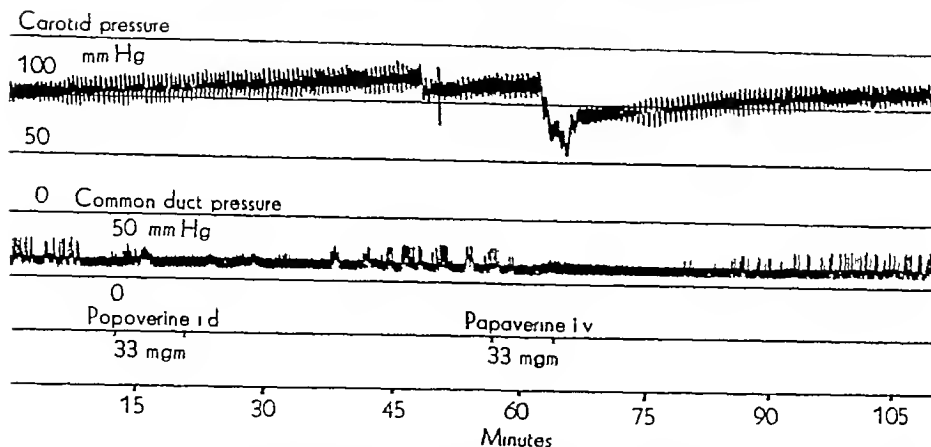


Fig 3 Experiment 11, male dog weighing 12.2 kilograms Effect of papaverine +++ Response after perfusing 33 milligrams of papaverine through the common bile duct +++ Response following intravenous injection of 33 milligrams of papaverine

test drug or during its period of effectiveness. This could be kept at a minimum by administering the drug slowly and in a dilute solution. In this series papaverine was again rated as being 100 per cent effective. Atropine, homatropine methyl bromide and dibutylene were also rated as 100 per cent, the latter having been used only once. Aminophylline was graded 75 per cent, trasentin 66 per cent, and procaine 41 per cent. The remainder of the drugs tested intravenously, nupercaine, metycaïne, butyn, and cocaine, were graded 0 per cent.

Several drugs were tested which have been known to increase intraductal pressure and several others whose specific effect had not yet been determined. These drugs also tested the responsiveness of the sphincter of Oddi and duodenum in a number of experiments. Codeine phosphate, given subcutaneously or intravenously, produced an elevation of intraductal pressure, probably as a result of contracting the sphincter of Oddi and duodenum. Demerol was also tested and found to react in a similar manner, although the effect was not as marked. Adanon, which is said to have a morphine like action, produced an increase in the intraductal pressure.

Figure 2 illustrates the effect obtained after the administration of trasentin intraductally and intravenously. Twenty-five milligrams of the drug were perfused through the common bile duct and a ++ response was obtained

which persisted for about 30 minutes. A +++ response was obtained after the intravenous administration of the same dose of drug, persisting for about 25 minutes. It will be noted that there was no lowering of the blood pressure after either test.

Figure 3 illustrates the effect obtained after the administration of papaverine intraductally and intravenously. Thirty-three milligrams of the drug were perfused through the common bile duct and a +++ response was obtained which persisted for about 30 minutes. A similar dose administered intravenously resulted in a ++++ response persisting for 30 minutes. It will be noted here that the blood pressure was not lowered during the intraductal administration of the drug, but that a temporary lowering did occur following the intravenous injection.

Figure 4, in a similar experiment, demonstrates the effect of 1 milligram of homatropine methyl bromide (Maltbie) when perfused through the common duct, and a much more profound and long lasting effect of half of the dose of the drug given intravenously, there was hardly an effect on the blood pressure.

The question of site of action of these drugs soon arose. Because of the fact that the latent periods proved to be shorter following the intravenous injection than following intraductal perfusion of the drug, it was surmised that perhaps the drugs when perfused through the common bile duct, produced their effects after

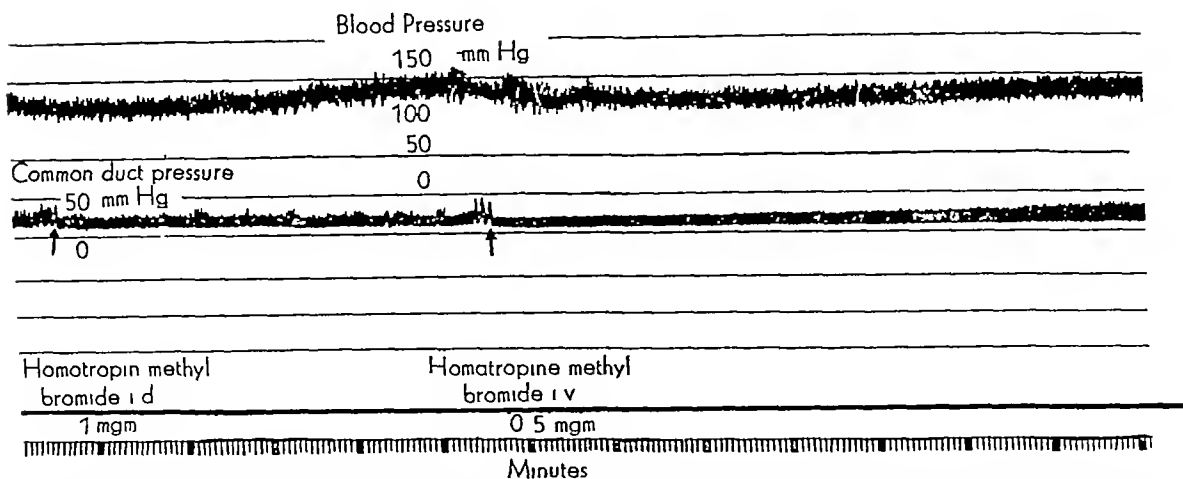


Fig 4. Dog M, weighing 14 kilograms July 26, 1947  
Nembutal anesthesia. Effect of homatropine methyl bromide. Positive effect following perfusion of 1 milligram of homatropine methyl bromide (Maltbie) through common

duct. Very prolonged +++++ effect following intravenous injection of  $\frac{1}{2}$  milligram of same drug. Homatropine methyl bromide was a very effective intravenous drug for relaxation of sphincter of Oddi and duodenum.

absorption from the duodenum. A modification of the dog preparation was instituted. In addition to the preparation described, the duodenum was incised on its antimesenteric border, in the region of the papilla of Vater. The papilla was visualized and covered with one end of a soft rubber tube with a lumen of 0.5 centimeter. An inverted U stitch was placed in the rubber tube, brought out through the duodenal wall away from the papilla, and tied gently over a button, thereby anchoring the tube over the papilla. The other end of the rubber tube came out through the incision in the duodenum and drained into a glass jar. Tests with dyes showed that the duodenum had been excluded from the flow of the perfusion fluid and absorption by the duodenal mucosa of solutions perfused through the common bile duct was therefore minimal. Solutions of papaverine, butyn, procaine, traseratin, aminophylline, atropine, and ether, were perfused through the common bile duct and their effects on intraductal pressure recorded. All drugs were ineffective. At the end of each experiment in this series a drug which was known to decrease intraductal pressure was given intravenously as control. It was reasoned that, if several drugs known to be effective when given intravenously had been perfused through the common bile duct and found to be ineffective, and if an effective

result was obtained by a known effective drug given intravenously, we had proved the site of action of these drugs. Figure 5 illustrates an experiment in this series. Solutions of aminophylline, papaverine, procaine and traseratin were perfused through the common bile duct and produced no effective response, whereas the intravenous injection of 50 milligrams papaverine produced a +++++ response. Papaverine, because of its 100 per cent effectiveness was used at the end of three experiments, aminophylline was used once. Both drugs, when given intravenously, proved to be very effective, after no results had been obtained when the drugs were perfused through the common bile duct. This group of experiments led us to believe that whatever good results we had previously obtained by means of perfusion of drugs through the common bile duct occurred as a result of absorption via the duodenal mucosa, rather than by direct action upon the papilla of Vater. These findings corroborated the fact that the duodenum has great absorptive power in spite of the fact that the perfused solutions spent so little time in that organ.

The next phase of our problem was an attempt to duplicate human pathology in the laboratory animal, the production of an obstruction of the common bile duct. The dog preparation was essentially the same as used

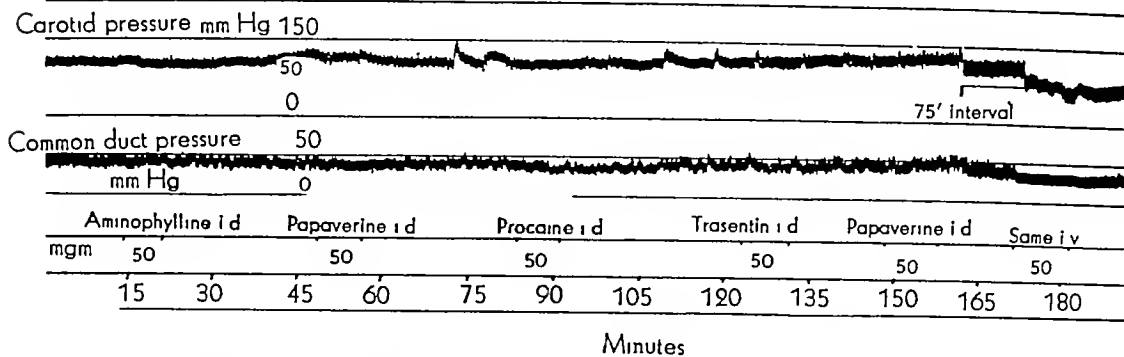


Fig 5 Experiment 26, female dog weighing 13 kilograms. Papilla of Vater covered and duodenum excluded. No effective response of intraductal pressure following perfu-

sion of drug solutions through the common bile duct. +++ Response following intravenous administration of papaverine.

in the first series of experiments except for the fact that small gall stones or small pieces of gravel were placed into the distal segment of the common bile duct before the cannula was inserted. Gravel was used in the smaller common ducts whereas gall stones were used in the larger ones. The dog preparation allowed us to use one or both of the methods mentioned earlier in an effort to produce passage of the obstructing agent into the duodenum. We were able to increase the hydrostatic pressure within the common bile duct proximal to the obstructing agent by means of perfusion pressure or by the intravenous administration of decholin, and we were able to produce relaxation of the sphincter by the intravenous administration of the most effective drug tested earlier. Seven dogs were used for this group of experiments. In dog 27, whose kymograph tracing is presented in Figure 6, two gall stones were inserted into the common bile duct and passed rather quickly into the duodenum under influence of the perfusion pressure. The same occurred after another stone had been inserted. However, a third and larger pair was inserted and passage of these did not occur until we had increased the perfusion pressure and had administered 50 milligrams of papaverine intravenously. In dog 4 a stone was placed into the common bile duct, but the hydrostatic pressure was increased by the intravenous administration of decholin. Decholin was given at intervals of 15 minutes and papaverine was given every 30 minutes. The duodenum was opened at the end of about

2½ hours. Examination revealed the stone to be nearly through the papilla of Vater, with about 75 per cent of its mass protruding into the duodenum. If we had waited a bit longer there was every reason to have expected to find the stone entirely within the duodenum. A rather large piece of gravel was placed in the common bile duct of dog 6 and it did not move in spite of decholin and papaverine administered intravenously and procaine perfused through the common bile duct and the duodenum. Obviously the foreign body was too large for the common bile duct to pass. Several insertions of stones were performed in dog 33. These stones passed into the duodenum under influences of the perfusion pressure. A fifth stone did not pass with perfusion pressure alone. Following the use of papaverine, the intraductal pressure suddenly rose and soon dropped, followed by passage of the stone into the duodenum. This phenomenon may be explained by the stone passing along the common bile duct, meeting the sphincter and causing a rise in the intraductal pressure. The pressure dropped and the stone was passed into the duodenum.

#### DISCUSSION AND CONCLUSIONS

The problem of obstruction at the terminal end of the common bile duct is interesting, but often is difficult to manage. Our efforts have been directed toward the search for a safe, comparatively easy method for removal of these obstructions, and one which will afford a good chance of success. The investigation

# EISENSTEIN RELIEF OF OBSTRUCTION IN COMMON BILE DUCT

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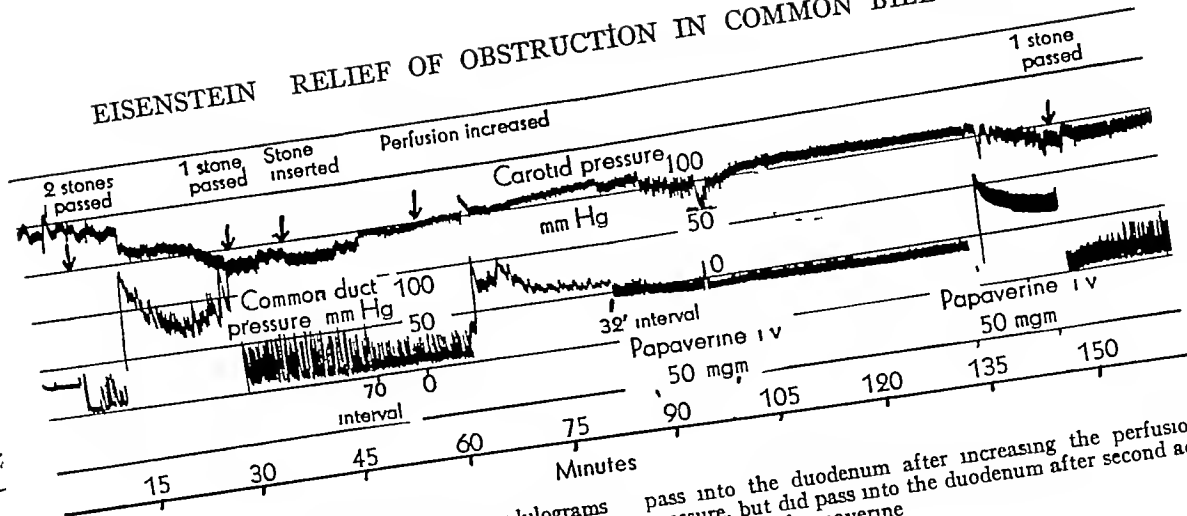


Fig 6 Experiment 27, male dog weighing 14 kilograms Stone experiment. Stones passed into the duodenum twice under influence of the infusion pump Third stone did not

pass into the duodenum after increasing the perfusion pressure, but did pass into the duodenum after second administration of papaverine

divided itself into three parts, namely (a) a study of the effects of certain drugs on the terminal end of the common bile duct, (b) a study of the site of action of these drugs, and (c) an effort to duplicate in the laboratory animal what may appear in the case of stones in the common bile duct. When given into the common bile duct or when injected intravenously, would have a relaxing effect upon the sphincter of Oddi. Two large groups of drugs presented themselves for consideration, the local or topic anesthetic group and the antispasmodic or spasmolytic group. Many members of each group were tested and we found that papaverine gave us the most constant relaxing effect upon the sphincter of Oddi. Papaverine worked equally as well given intravenously or when perfused through the common bile duct. Papaverine has been previously tested by other authors and found to give inconstant results, but in our hands it seemed to be the most reliable of all drugs used. This discrepancy lies probably in the fact that the dose used had been too small. Recent laboratory and clinical studies have emphasized the fact that papaverine must be given in sufficiently large doses to produce the desired effect. The local or topic anesthetic group of drugs seemed to be promising early in our study, but as repeated experiments were carried out they seemed to be less reliable than the antispasmodic group. Other drugs gave

verine, but it seemed to us that papaverine proved to be the drug of choice, because of its reliability in producing a prolonged relaxation of the sphincter of Oddi and duodenum.

The problem of the site of action of the drugs used was then investigated. We set out to prove whether a drug acted upon the sphincter of Oddi after absorption through the duodenal mucosa, when it was perfused through the common bile duct, or whether it had a direct action upon the terminal end of the common bile duct. By a method of completely blocking the papilla and thereby blocking out the duodenum, we were able to answer this question. It was found that drug solutions perfused through the common bile duct and excluded from the duodenal mucosa had no effect upon the sphincter of Oddi, while the same drug had a good relaxing effect on the sphincter of Oddi when given intravenously. This series of experiments leads us to believe that the effect upon the sphincter of Oddi by the drug solutions perfused through the common bile duct was produced by absorption had taken place from the duodenal mucosa and not because of a direct action of the drug upon the terminal end of the common bile duct. We were also impressed by the marked absorptive power by the duodenum of a drug solution which was perfused in a small section of that organ.

The final part of our problem remained in an effort to duplicate human

the laboratory animal. Stones of varying sizes and shapes were inserted into the distal common bile duct and various methods were studied by which they could be made to pass into the duodenum. It seemed reasonable to assume that stones would pass if one of three methods were utilized, building up the hydrostatic pressure within the common bile duct, relaxing the terminal end of the common bile duct, and a combination of the two. The hydrostatic pressure was increased by either perfusing solutions through the common bile duct or by the administration of decholin, which resulted in an increased flow of thin watery bile. The terminal end of the common bile duct was relaxed by the intravenous administration of adequate doses of papaverine. We found the common bile duct to vary considerably with individual animals and on several occasions many insertions of increasingly larger sized stones were necessary in order to test our methods. Some of the stones were forced into the duodenum by the infusion pump running at normal speed, whereas other stones did not pass until the perfusion stroke volume had been increased. The experiments wherein the stones did not pass under the effect of the infusion pump but finally passed when papaverine was given, proved quite satisfying to the observer. Careful experiments on patients will have to determine which of the above procedures are applicable to the human and particularly, what perfusion pressure through a drained common duct can be employed.

#### SUMMARY

1. Certain drugs, when perfused through the common bile duct, can lower the intraductal pressure by their relaxing effects upon the sphincter of Oddi and duodenum.

2. Papaverine seemed to be the drug of choice. It produced the most constant results when given in large enough doses.

3. The drugs used do not act directly upon the terminal end of the common bile duct. When perfused into the common bile duct they exert their effect after absorption through the duodenal mucosa.

4. Obstructions at the terminal end of the common bile duct, produced experimentally by insertion of stones, were relieved by either increasing the hydrostatic pressure within the common bile duct, by relaxing the sphincter of Oddi and duodenum or by a combination of the two. Pressure in the common ducts was increased either by administration of a hydrochologogue, or by perfusion through the cannulated distal common duct.

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# INTRATHORACIC GOITER LOCATED IN THE POSTERIOR MEDIASTINUM

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**I**N spite of the existence of an extensive literature on the subject of thyroid disease, there remains considerable misunderstanding regarding the development and characteristics of intrathoracic goiter. The terms substernal and intrathoracic goiter are often confused and are sometimes considered to be synonymous. An understanding of the anatomical relations of the several types of intrathoracic goiter is of great importance to the surgeon in the differentiation of these terms.

In the majority of cases when a goiter extends into the thorax, the enlarging gland pushes downward and forward so that its lowermost portion lies ultimately in the superior mediastinum just beneath the sternum. It is rare in such a condition for the tumor to lie almost completely within the chest. There is usually a large component of the gland in the neck as well. The term substernal goiter used to designate such an arrangement is only partially correct and to speak of such goiters as being intrathoracic is somewhat misleading. In true intrathoracic goiter, on the other hand, the largest diameter of the tumor lies in the mediastinum below the thoracic inlet. The majority of these lie anteriorly, but in a few cases the mass descends into the posterior portion of the mediastinum, a situation which has rarely been referred to in the literature. Its importance lies in the fact that such posteriorly placed goiters are often erroneously thought to be primary mediastinal tumors, and in the fact that if they become very large they can be removed only through a thoracotomy incision.

*Anatomical considerations* Posteriorly placed intrathoracic goiters always have a pedicle-like connection with the thyroid gland in the neck, but this attachment is frequently small. They lie at the farthest posterior aspect of the mediastinum against the vertebral column. They tend to press the esophagus to

the right or left but as a rule they do not disturb the relations of the trachea to as great an extent. A slight forward displacement of the trachea, however, is often observed. As they increase in size they enlarge downward and laterally. When they are very large, they encroach considerably upon the space occupied by the upper lobe of the lung on the side where they happen to lie (Cases 5 and 6).

It has been said that an intrathoracic goiter always retains a position anterior to the recurrent laryngeal nerve and to the inferior thyroid artery. This is correct only in the case of those which descend into the anterior mediastinum and are therefore merely substernal. The goiters which enter the posterior mediastinum lie behind these structures. Furthermore, there is an important difference between the two types of goiter, depending upon their relations to the carotid sheath, the innominate and subclavian arteries, the innominate veins, and, on the right, the superior vena cava. Anteriorly placed substernal goiters always descend in front of these vessels. Posteriorly placed intrathoracic goiters, on the other hand, always descend behind them.

The reason for the differences between the anatomical relations of the two types of intrathoracic goiter is a simple one. Substernal and anteriorly placed intrathoracic goiters arise either from the lower poles of the lateral thyroid lobes or from the isthmus. As they enlarge and extend downward, they push the trachea and esophagus posteriorly and laterally and always lie in front of the recurrent laryngeal nerve, the inferior thyroid artery, the innominate veins, the innominate and subclavian arteries, and to some extent the carotid sheath. The fact that posteriorly placed goiters descend behind these structures is explained by the fact that such goiters arise not from the inferior pole of the lateral lobe of the gland but from its posterior and lateral aspect.



Fig 1, left Case 1 Anterior roentgenogram showing marked deviation of the esophagus produced by small intrathoracic goiter with relatively little tracheal displacement

Fig 2 Case 1 Lateral roentgenogram showing slight anterior deviation of the trachea at the base of the neck

The validity of this explanation based upon the site of origin of the goiter in the gland itself is strongly suggested by the findings at operation in 3 of the 6 cases reported. In Case 1 the preoperative roentgenogram showed marked displacement of the esophagus to the left side and only slight displacement of the trachea forward and to the left. At operation, performed through the usual cervical thyroidectomy incision, the lower pole of the right lobe was uninvolved but the goiter, which was relatively small, had arisen from the posterolateral surface of the lobe and had enlarged downward a short way into the mediastinum but definitely behind the carotid sheath and the recurrent laryngeal nerve and inferior thyroid vessels. The situation in this case represented an early phase in the development of a posterior mediastinal intrathoracic goiter. Removal was accomplished easily through the cervical incision (Figs 1 and 2).

Case 2 represents a further stage in the process. In this case the goiter arose from the left lateral lobe and descended posteriorly and to

the left, pushing the esophagus and trachea to the right. At operation it was demonstrated that the enlargement had arisen from the lateral aspect of the left lobe well above the lower pole. It had descended behind the recurrent laryngeal nerve and inferior thyroid vessels as well as the carotid sheath and left subclavian vessels, lodging finally in the posterior mediastinum against the anterior surfaces of the upper thoracic vertebral bodies. It bulged into the left pleural cavity but was relatively easily removed through the cervical incision. In this case the mass was larger and had extended much further downward and posteriorly than in Case 1 (Figs 3 and 4).

Case 3 is of particular importance in demonstrating the origin and anatomical relations of a posteriorly descended intrathoracic goiter. The intrathoracic extension in this instance was unusually large. Upon exploration through the usual cervical incision it was possible to demonstrate that there was no appreciable enlargement of the right lobe excepting for the goiter itself which was almost entirely intra-



Fig 3, left Case 2 Anterior roentgenogram showing moderately large intrathoracic goiter with rather marked lateral displacement of trachea

Fig 4 Case 2 Lateral roentgenogram showing posterior location of the goiter lying upon the upper thoracic vertebrae

thoracic The attachment to the gland consisted only in a relatively thin and narrow strip of thyroid tissue which extended downward behind the great vessels of the neck into the posterior mediastinum where it expanded into a large goiter lying upon the anterior surface of the spine, pushing the esophagus to the left and bulging against the right pleural sac. These relations were more readily demonstrated because of the use in this case of the combined cervical and thoracic incisions (Figs 5, 6, 7, 8)

*Technical considerations* Almost without exception substernal or anterior intrathoracic goiters can be removed through the usual cervical thyroidectomy incision. This is because by pushing the great vessels and trachea posteriorly during their development they create a space from which they can be enucleated with relative ease by exerting upward traction on the gland while the dissection around and beneath the goiter is being accomplished.

Posteriorly descended goiters, on the other hand, may present a considerable obstacle to

removal through the neck. This is because the space through which they must be extracted is relatively small and because when very large they are almost invariably attached only by a narrow pedicle which occupies a small space at the thoracic inlet. This space is bounded laterally by the first rib, posteriorly by the vertebral column, medially by the trachea and esophagus, and anteriorly by the carotid sheath and the subclavian and innominate vessels. Through this small, rigid-walled aperture it is impossible to extract a very large posterior goiter attached to the gland by only a narrow segment of thyroid tissue (Fig 8). It is necessary in such cases to remove the goiter through a thoracotomy incision. The necessity for using the thoracic approach can be decided on the basis of the size of the tumor mass as visualized in roentgenograms of the chest. In Cases 5 and 6 the necessity for using the thoracic approach was obvious. As in Case 3, the decision to open the chest may have to be made after an attempted removal through





Fig 5, left Case 3 Anterior roentgenogram showing intrathoracic goiter bulging to the right with downward descent to approximately the level of the arch of the azygos vein

Fig 6 Case 3 Lateral roentgenogram showing posterior location of the goiter

a cervical incision has failed. There is no objection in such a situation to turning the patient on his side and removing the mass through a standard thoracotomy incision provided that the anesthetist has taken the precaution to use an intratracheal tube so that positive pressure may be exerted upon the lung. Of the 6 cases reported, the thoracic approach was mandatory in 2 and preferable in 1 case. In the 3 other cases the goiter was small enough to be removed easily through the neck.

**Symptoms** Five patients complained of cough, in 2 of these the cough was very troublesome. Expectoration was not a factor in any case. Two patients experienced moderate dysphagia as a result of pressure on the esophagus. In 1 there was pain referred to the shoulder on the side where the goiter was. A moderate degree of dysphonia was noticed by 1 patient. One patient experienced no symptoms whatever. The symptoms in all 5 cases in which they were present were mild, but

complete relief resulted from the operation in all cases.

**Indications for operation** The decision to operate in cases of posterior intrathoracic goiter should be based partly on the presence of symptoms but partly also upon the prediction that progressive difficulty is to be anticipated. An equally important factor is the knowledge that as the tumor enlarges, the technical difficulties encountered in its removal inevitably increase. If operation is performed early, an excision of the mass can be accomplished through the usual thyroidectomy incision. If the goiter exceeds a certain size, however, a thoracotomy becomes necessary for its extirpation. The desirability of early discovery and prompt removal of these tumors is therefore obvious.

#### CASE REPORTS

**CASE 1** A R, MGH No 587155, female, aged 33 years, was admitted to the hospital on November 17, 1947 because of trouble with swallowing. About 18 months previously she had had an attack of acute choking after swallowing a peanut. Since that time

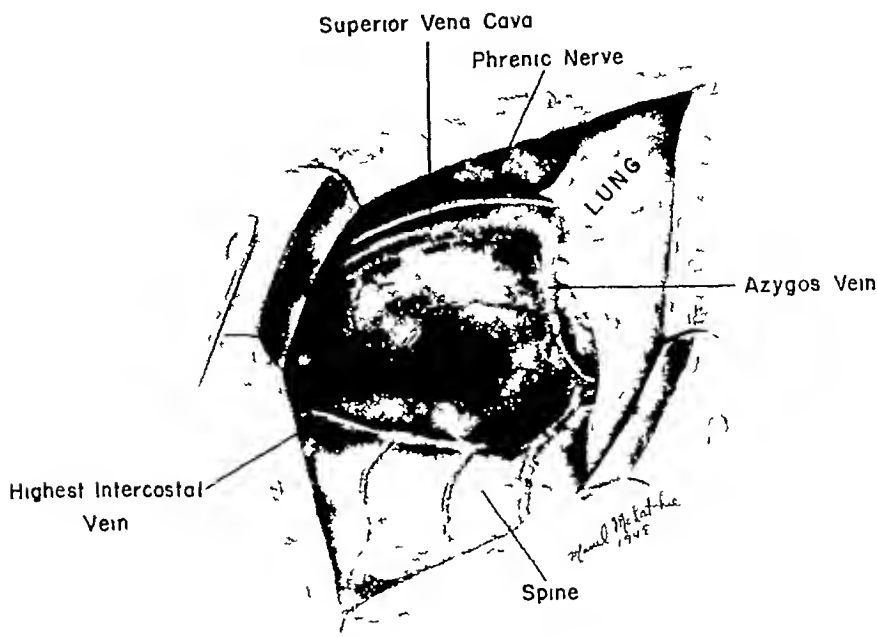


Fig 7 Case 3 Drawing based on sketches made at operation showing the goiter through the thoracotomy incision. Note the relations of the mass to the spine, the azygos vein, and the superior vena cava.

she had had the feeling that there was a lump present behind the upper sternum inhibiting the swallowing of large particles. She had had no vomiting or bleeding. She had a dry cough which she thought was due to pressure. She had lost about 3 pounds in weight during the previous few weeks but was otherwise well. She denied nervousness, increase of appetite, insomnia, intolerance to heat, diarrhea, or any other signs of thyrotoxicosis.

On physical examination no mass could be felt in the neck. The heart was regular, the sounds of good quality, and no murmurs were heard. Blood pressure was 130/85.

Roentgenographic studies showed a mass in the right side of the neck displacing the esophagus to the left (Figs 1 and 2). Her basal metabolic rate was  $+21$  per cent.

An operation was performed on November 19, 1947. The usual curved thyroid incision was made. The pretracheal muscles were separated in the midline and retracted so as to expose the right lobe of the thyroid. The lobe itself appeared to be essentially normal, but arising from the posterior aspect above the lower pole there was a rounded, soft tumor mass about 4 centimeters in diameter, possibly larger, extending downward into the superior mediastinum behind the innominate artery. By getting into the proper plane of cleavage it was easy

to liberate this tumor and deliver it through the wound. In doing this, however, it burst and a considerable amount of fluid was evacuated. From that point on the removal of the abnormal mass was carried out in the usual fashion. At the completion of the operation the layers were approximated with interrupted fine silk sutures. No drainage was used.

After microscopic diagnosis the pathologist reported the tumor to be nodular goiter with hyperplasia and involution. She made an uneventful recovery and was discharged from the hospital in excellent condition 5 days postoperatively with the wound well healed, swallowing well, and without evidence of hoarseness.

CASE 2 H. B., MGH No 610270, male, aged 57 years, was admitted to the hospital on March 8, 1948, because of hoarseness, cough, hemoptysis, asthmatic breathing, and fatigue. He had a prolonged history of asthma. There was some evidence of bronchiectasis on the roentgenogram of the chest, but bronchoscopic examination was completely negative. Roentgen examination, however, showed the presence of a soft tissue mass in the left upper mediastinum deviating the trachea to the right (Figs 3 and 4). Because this mass appeared to be pressing on the trachea and was believed to be contributing to his symptoms, an operation was advised. His basal metabolic rate was  $-4$  per cent.

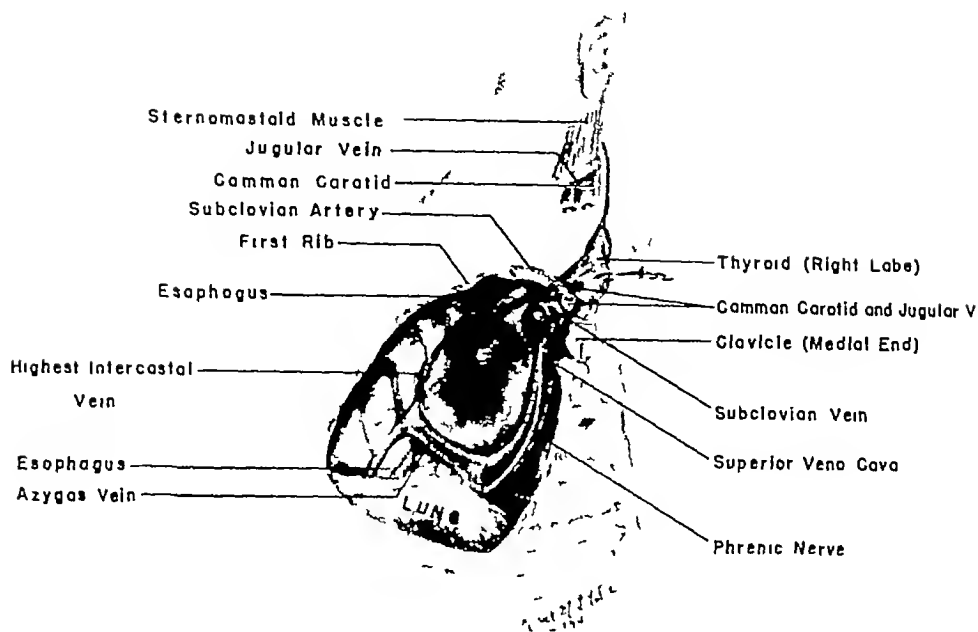


Fig 8 Case 3 Composite drawing based upon observations of the anatomical relations of the goiter as seen through both cervical and thoracic incisions. Note (1) The tumor arises by a narrow pedunculated attachment from the posterolateral aspect of the right lobe of the thyroid (2) It had descended behind the vessels in the carotid sheath, the subclavian vein and artery, the innominate vein, and the superior vena cava (3) The recurrent laryngeal nerve (not shown) approaches the larynx beneath the uninvolved lower pole of the lobe and anterior to the pedicle of the goiter

The operation was performed on March 19, 1948. The usual thyroid incision was made. The pretracheal muscles were parted in the midline and retracted. By entering the proper plane of cleavage it was possible to palpate downward along the left lobe of the thyroid and the intrathoracic goiter was felt. The tumor arose from the posterior aspect of the thyroid lobe instead of from the inferior pole. It extended behind the carotid sheath posteriorly and lay against the anterior surface of the vertebral column. There were no adhesions so that it was relatively easy to pull it up by grasping it with tenaculum forceps. It was then delivered through the wound and removed, except for a small portion of the lobe which was left behind. The cut edges of the lobe were approximated by means of several fine silk sutures after the vessels were tied. The muscles were then drawn together, the divided platysma edges were sutured, and the skin was closed with silk. No drainage was used.

On pathological examination a microscopic diagnosis of struma nodosa micro et macro folliculare was made.

The patient's postoperative recovery was uneventful and he was discharged from the hospital in good condition.

CASE 3 W K, MGH No 602786, male, aged 43 years, was admitted to the hospital originally for diagnosis and treatment of a very troublesome diarrhea. Roentgen-ray examination of the chest revealed the presence of a rounded mass in the upper mediastinum on the right side, displacing the trachea to the left (Figs 5 and 6). The esophagus was not much deviated. There was slight motion of the mass on swallowing. There were no symptoms attributable to this tumor, but excision was advised on the basis that it should be removed before it became large enough to cause serious trouble. His basal metabolic rate just prior to operation was +4 per cent.

An operation was performed on March 24, 1948. The usual thyroid incision was made in the neck. The pretracheal muscles were parted in the midline and retracted. It was soon discovered that there was a mass extending downward from the posterior surface of the right lobe of the thyroid behind the jugular vein and carotid artery and descending into the thorax posteriorly so as to lie upon the vertebral column. A tenaculum was applied and considerable force was exerted in an effort to pull the tumor up. Blunt dissection with the finger down into the chest as far as could be reached failed to free the mass and it seemed obvious that it could not be delivered

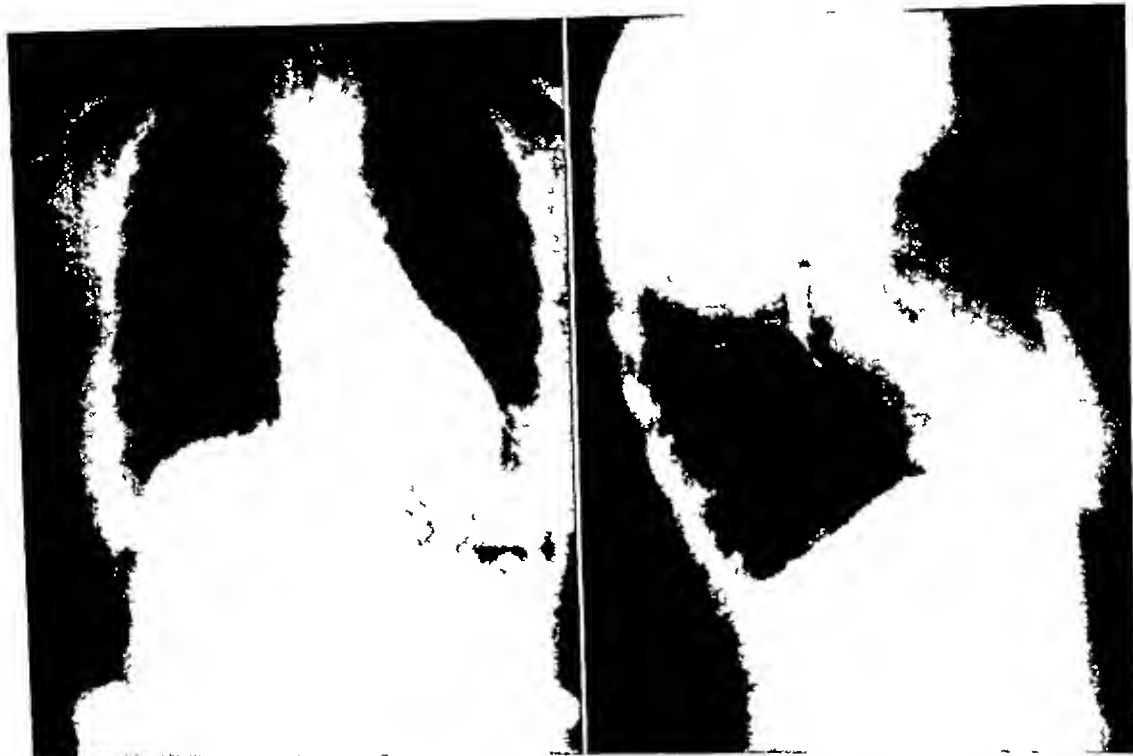


Fig 9, left Case 4 Anterior roentgenogram showing posterior intrathoracic goiter of fairly large size removed through a cervical incision

Fig 10, Case 4 Lateral roentgenogram showing posterior location of the goiter with marked anterior deviation of the trachea

readily through the neck. The cervical incision was therefore closed and the patient was turned on his left side

A standard thoracotomy incision was made on the right side and the chest was opened through the fourth intercostal space. The large bulging goiter could be seen protruding beneath the mediastinal pleura (Fig 7). It extended downward as far as the azygos vein. It pushed the superior vena cava forward and was resting upon the vertebral column. An incision was made in the mediastinal pleura and the goiter was freed of its local fixation, which was quite considerable. In the process of dissection it broke with the discharge of 1 or 2 ounces of watery fluid. An effort was made to get around the proximal attachment of the goiter in order to remove it from below, but it was discovered that there was a medial extension in the region of the trachea and esophagus which could not be reached because it was so high in the neck. On the other hand, the reduction in the size of the tumor and the freeing of its adhesions made it possible to withdraw it from the chest through the neck. It was therefore decided to close the chest wound and to remove the goiter through the cervical incision.

After closure of the thoracotomy incision the patient was put on his back once more. The cervical

incision was reopened and the goiter was delivered with relative ease. It had arisen from the posterior aspect of the gland and not from the inferior pole. It was necessary, however, to remove the major portion of the right lobe in order to get the base of this goiter out. This was done without much difficulty and the wound was once more closed in layers, by means of interrupted silk sutures without drainage.

On microscopic examination the pathologist made a diagnosis of nontoxic nodular goiter, involution, hyperinvolution with cyst formation, and adenoma.

Following operation the patient had periods of slight difficulty with breathing, but his recovery was essentially uneventful and he was discharged from the hospital in excellent condition.

CASE 4 I L, MGH No 600308, female, aged 56 years, was admitted to the hospital on December 4, 1947. Nine months previously she had had the rapid onset of paroxysms of coughing. There was no loss of weight. Her local doctor had discovered the presence of a superior mediastinal tumor which was treated by roentgen therapy with very slight shrinking in size. There was no dysphagia, feeling of pressure, pain, or hemoptysis.

Roentgenographic studies of the chest showed a smooth, rounded tumor mass in the superior mediastinum bulging slightly more to the right than to the



Fig. 11, left (Case 5). Anterior roentgenogram showing unusually large posteriorly located mass in right upper lung field, removed through a thoracotomy incision. Deviation of trachea shown.

Fig. 11, right (Case 5). Lateral roentgenogram showing posterior location of the tumor actually overlying the middle of the vertebral column.

but displacing the esophagus and trachea inferiorly and to the right (Fig. 9 and 10). The mass showed slight pulsation which appeared to be transmitted. It moved upward on swallowing. No calcification was seen within the mass and there was no evidence of bone erosion. Both lung fields were clear.

On December 8, 1937, an operation was performed

CASE 5. A. A. MGH No. 45,419 and 45,423. A 34-year-old male admitted to the hospital on April 1, 1933 complaining of paroxysmal cough of the paroxysmal form of 12-month duration. Four months previously a roentgen examination had revealed the presence of a mass in the right upper chest. The mass was not palpable by roentgen waves either horizontally or laterally.



Fig 13, left Case 6 Anterior roentgenogram showing very large posterior intrathoracic goiter arising from right lobe of thyroid, removed through thoracotomy incision

Fig 14. Case 6 Lateral roentgenogram showing posterior location of goiter overlying the side of the vertebral column

An operation was performed on May 3, 1943. A long oblique incision was made across the right chest. The chest was opened by the rib resection technique through the bed of the sixth rib. The tumor appeared to be mediastinal in origin, but it protruded a long distance into the right side of the chest, extending posteriorly as it went. There were no adhesions of the lung. The mediastinal pleura was incised, and the tumor was found to be covered by a network of very large, thin-walled veins. It had a pedicle coming from the base of the neck. After the periphery of the tumor was freed the pedicle was reduced to about 2 by 3 centimeters in size and this tissue felt exactly like thyroid tissue. The tumor was obviously solid. It was immediately apparent that the growth had arisen from the right lobe of the thyroid gland, extending down lateral to the trachea in the chest and behind the subclavian artery.

Clamps were placed on the pedicle and the tumor was removed. The vessels of the pedicle were secured with suture ligatures. The incision in the mediastinal pleura was closed with interrupted silk sutures and the lung was re expanded. The chest wall was closed in the usual manner by means of silk sutures. No drainage was used.

The pathologic diagnosis after microscopic examination was mediastinal thyroid, hyperinvolution.

On the first postoperative day 700 cubic centimeters of air was aspirated from the right pleural space. On the next day he had a period of auricular fibrillation, but this was readily controlled by means of cedi-

land. On the fourth day aspiration of the chest yielded 500 cubic centimeters of deeply blood-stained fluid. His subsequent convalescence was slow but satisfactory and he was discharged from the hospital in good condition and relieved of his symptoms on the nineteenth day following operation.

CASE 6 K C, PMH No 47 374, female, aged 51 years, was admitted to the hospital on March 3, 1947. Roentgen-ray examination during a routine chest survey of all the employees of the company with which she was associated had revealed the presence of an upper thoracic mass. Up to that time she had thought she had no symptoms, but on careful questioning it was quite apparent that she had had in the previous year or two an increasing amount of dry irritative cough and more recently a certain amount of dysphagia.

Physical examination was negative except for possibly a little more dullness in the superior mediastinum than one might expect. Roentgen-ray examination, however, revealed the presence of a smoothly rounded mass in the right upper thorax medially and anteriorly (Figs 13 and 14). The mass measured about 6 by 8 centimeters and was of homogeneous density. By fluoroscopy it showed no evidence of pulsation, but there was a definite tracheal tug with swallowing. The heart and great vessels appeared normal, and examination of the esophagus showed no abnormality. The mass was in contact with the trachea and produced very slight narrowing and displacement of it.

An operation was performed on March 6, 1947. A long oblique incision was made across the right chest and the fourth rib was resected. This incision gave good exposure to the superior portion of the chest and the superior mediastinum. The tumor was very large, extending from the base of the neck down to the right main bronchus. Its lower end depressed the arch of the azygos vein. It lay in the posterior aspect of the chest behind the level of the superior vena cava and did not come at all close to the anterior chest wall. It was obviously a posteriorly placed intrathoracic goiter. It was very vascular, but when the proper plane of cleavage was entered it was readily dissected free. It was necessary in order to start the dissection in the proper plane to divide the azygos vein. The tumor was freed and the large vascular pedicle coming down from the right lobe of the thyroid beneath the clavicle and first rib was secured by means of hemostats and stitch ligatures of heavy silk. In doing this the subclavian artery and vein had to be carefully avoided. No evidence of the recurrent laryngeal nerve could be made out.

After the tumor had been removed and the vascular bleeding points had been secured, the edges of the mediastinal pleura were approximated with interrupted silk, the lung was fully expanded and the chest wall was closed in layers, the silk technique being used.

On microscopic examination the pathologist reported this tumor to be multiple colloid adenomatous goiter.

The post-operative convalescence was uneventful. The wound healed well and she was discharged from the hospital in excellent condition on the seventeenth postoperative day.

#### CONCLUSIONS

1. In general intrathoracic goiters should be removed not only because of the symptoms they may be causing when the patient is first seen but also because as they increase in size the technical difficulty of the operation becomes greater.

2. In order to plan the operation to the best advantage it is important for the surgeon to distinguish between the anterior substernal goiters and those which lie posteriorly. The former can almost invariably be removed through a cervical incision. The latter, on the other hand, may require a thoracotomy if they are unusually large.

3. The suggestion that the descent of a goiter into the posterior mediastinum is caused by the fact that it happens to arise from the posterior or lateral aspects of the thyroid lobe above the lower pole appears to be a reasonable explanation of this relatively infrequent occurrence.

## OUTLET PELVIMETRY

### Results in Measuring the Symphysis-Biparietal and Sacral-Biparietal Diameters in 145 Primiparous Women

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THE use of manual methods to determine the size and contours of the bony pelvic outlet is an important obstetrical procedure. The simple palpation of the arch, the tubera ischia, and the coccyx and lower sacrum, even without mensuration, will give to the experienced examiner valuable information. Unfortunately, because of the lack of definite end-points, such as are found in the pelvic inlet and the pelvic midplane, the dimensions of the outlet in terms of diameters are subject to variation due to subjective interpretation. This is true in both the manual and the roentgenologic methods used for this purpose. Having these considerations in mind, the senior author described in 1946(3) a pelvimeter for estimating the symphysis and sacral biparietal distances. From the mechanics of head and outlet relationship it is recognized that the width of the subpubic angle and the shape of the pubic arch are of considerable importance, but, as Allen logically states, "The important point is clearly how close the occiput is allowed to approach the lower edge of the symphysis." Therefore, as an alternative to attempting to determine the subpubic angle and a transverse outlet diameter, the measurement of the symphysis-biparietal distance is recommended. This is the distance within which a normal biparietal diameter cannot approach the lower edge of the symphysis. This distance, as well as the sacral-biparietal distance, can be determined externally by the pelvimeter described previously (3, Fig 7). The crossbar of this instrument is 9 centimeters and, allowing about 0.5 centimeter for the thickness of the soft parts covering the pubic ramus in their

medial aspect, represents an average biparietal diameter of 9.5 centimeters, a figure close to the average of 93 millimeters given by Scammon and Calkins. When this instrument is used the patient is brought well down over edge of the examining table - the lithotomy position, the arch is then palpated, by using both hands alternately, as in the manner usually described in textbooks. The course of the ramus downward is noted, whether straight or moderately or widely arcuate. The crossbar of the pelvimeter is then passed between the ramus and by upward pressure it is brought as near the symphysis as possible. As the crossbar is held in this position, the end of the arm of the pelvimeter is brought to the lower edge of the symphysis and the symphysis-biparietal distance read on the scale. With the crossbar in position the tip of the arm of the pelvimeter is swung posteriorly to rest externally over the tip of the sacrum. The sacral-biparietal distance is then determined from the scale after subtracting 1 centimeter, which represents the thickness of the sacrum.

The 145 women included in this discussion, all primiparas who had been followed in labor, had a roentgen pelvimetric survey of the pelvis according to the Thoms and Wilson (4) technique, which consists of an inlet and lateral film from which the important diameters of the inlet and pelvic midplane may be measured.

The values for the symphysis-biparietal and sacral-biparietal diameters in these women have been determined and the relationship of these measurements to the type of pelvis, to the transverse diameter of the midplane, and to the type of delivery has been noted. For purposes of classification the pelvic classification which we have found of practical value is reviewed, namely

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- I Dolichopellic type—The transverse diameter of the inlet is less than the anteroposterior diameter
- II Mesatipellic type—The transverse diameter of the inlet is greater than the anteroposterior diameter by no more than 1 centimeter
- III Brachypellic type—The transverse diameter of the inlet is from 1.0 to 2.9 centimeters greater than the anteroposterior diameter
- IV Platypellic type<sup>1</sup>—The transverse diameter of the inlet is 3 centimeters or more greater than the anteroposterior diameter

In considering the pelvic arch in relation to the type of pelvis, it would be expected that the dolichopellic type, with its relatively narrowed sidewalls, also would present a relative narrowing of the arch and, therefore, relatively longer symphysis-biparietal and sacral-biparietal diameters. Conversely the brachypellic type would show relatively shorter symphysis-biparietal and sacral-biparietal distances. These diameters in the mesatipellic type should occupy a midposition. These expectations were borne out.

	Average diameter centimeters
Dolichopellic group—45 pelves	
Symphysis biparietal diameter	5.0
Sacral biparietal diameter	8.0
Transverse midplane diameter	9.9
Mesatipellic group—55 pelves	
Symphysis biparietal diameter	4.5
Sacral biparietal diameter	7.7
Transverse midplane diameter	10.3
Brachypellic group—45 pelves	
Symphysis biparietal diameter	4.9
Sacral biparietal diameter	7.6
Transverse midplane diameter	11.0

A further correlation of the narrowing of the pelvic sidewalls, to the pelvic arch is shown by the relationship of the transverse midplane diameter to the symphysis-biparietal diameter in Table I.

#### OPERATIVE INTERFERENCE

With transverse narrowing of the lower pelvis both in midplane and outlet as evidenced by a relatively increased symphysis-biparietal distance an increased incidence of operative intervention might be expected. This is shown in the type of delivery of these 145 women. We recognize, however, that

<sup>1</sup>The platypellic type is relatively infrequent and almost always shows chances characteristic of pelvic outlets. In the present group there were no pelvis of this type.

TABLE I—AVERAGE TRANSVERSE MIDPLANE DIAMETER FOR DIFFERENT SYMPHYSIS BIPARIETAL DIAMETERS

Number of cases	Symphysis biparietal	Average transverse midplane
3	2.5	11.1
10	3.0	11.0
2	3.5	10.8
18	4.0	10.4
12	4.5	10.6
58	5.0	10.6
15	5.5	10.1
13	6.0	10.5
1	6.5	9.9
4	7.0	9.5

the indications for operative delivery in primiparas, which includes low forceps, are manifold. Our results show that of these 14 primiparas, in 113 with a symphysis biparietal distance of 5.0 centimeters or less, 44, or 38.1 per cent, were delivered by operation. In 31 women with symphysis-biparietal diameter greater than 5.0 centimeters, 17, or 53.1 per cent, were delivered by operation.

From this study of outlet pelvimetry in relation to the fetal biparietal diameter certain conclusions previously held have become reinforced. The chief of these is that in order to evaluate pelvic capacity, the pelvis must be studied as a whole, that is, inlet, midplane, and outlet measurements must be included. It is probable that outlet constriction rarely exists alone but is accompanied by relative constriction somewhat higher in the pelvis, especially in the midplane. A proper pelvic survey should include roentgen pelvimetry with inlet and lateral views showing pelvic contours and from which dimensions can be measured. Manual palpation of the pubic arch with measurement of the symphysis-biparietal and sacral-biparietal diameters, as outlined here, are useful adjuncts to roentgen pelvimetric procedures.

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# THE BIOLOGICAL CHEMISTRY OF WOUND HEALING

## II The Effect of dl-Methionine on the Healing of Surface Wounds

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**I**N a previous publication (5) two of the authors showed that the parenteral administration of dl-methionine to protein-depleted rats shifts the curve of wound healing of abdominal wounds toward normal. In that study the healing of the skin was excluded from the experiments.

Healing of peritoneum, muscle, and fascia is primarily a process of fibroplasia. The healing of a surface defect is primarily a process of contraction and epithelization (2, 3). It seemed to us to be of interest to record the effect of dl-methionine on the healing of surface wounds in protein-depleted rats, and to record briefly observations on 2 patients.

### MATERIAL

Young white adult male rats of pure Wistar strain, purchased from a commercial breeder, were used in the experiments. The first group consisted of 45 normal control animals. The second group of 23 animals were depleted and rendered hypoproteinemic by means of diet. The third group of 16 animals were depleted and then received dl-methionine. The fourth group of 16 animals were normal controls which received dl-methionine.

### METHODS

Under ether anesthesia and using a template, a standard sized area of skin ( $r=1$  cm  $a=3.14$  sq cm) was excised from the freshly shaven back of the animals. The wounds were traced on cellophane at 4 day intervals. The cellophane image of the wounds was transferred to bond paper and the bond paper weighed on an analytic balance. The weight of the bond paper per square millimeter was previously determined and by a simple factor

weight was translated to size. This gravimetric method of Douglas (4) is far more simple and rapid than the planimeter, and it was found to be satisfactory.

Group 1, normal control animals, were maintained on a basal ration of purina chow pellets, preoperatively and postoperatively.

The animals in Groups 2 and 3 were placed on a diet containing 0.23 per cent nitrogen and consisting of 10 per cent carrot powder, 5 per cent crisco, 3 per cent agar, 1 per cent salt, and 81 per cent moisture. This diet, used in previous studies (5), was found uniformly to render an animal hypoproteinemic within 5 weeks. At the expiration of 5 weeks the animals were operated upon and their wounds measured as those in Group 1. Postoperatively, the animals of Groups 2 and 3 were maintained upon the nitrogen-poor depleting diet. However, the animals in Group 3 received 150 milligrams of dl-methionine subcutaneously daily during the entire postoperative period of observation.

The fourth group of animals were normal animals which received 150 milligrams of dl-methionine parenterally, starting on the first postoperative day and continuing throughout the period of observation. The animals were maintained on a diet of purina chow pellets.

At the completion of the experiments in Groups 1, 2, and 3, heart blood was obtained for total protein determinations.

### RESULTS

The results are tabulated in Table I, and shown graphically in Figures 1, 2, 3.

The normal control rats gained an average of 56 grams during the experiment, had a normal blood protein of 6.5 grams per cent and healed in 27.1 days.

The depleted rats lost 106 grams, had 3.9 grams per cent of protein in the blood and

From the Surgical Research Laboratory, The New York Post-Graduate Medical School and Hospital. The research was supported by a grant from the National Institute of Health.

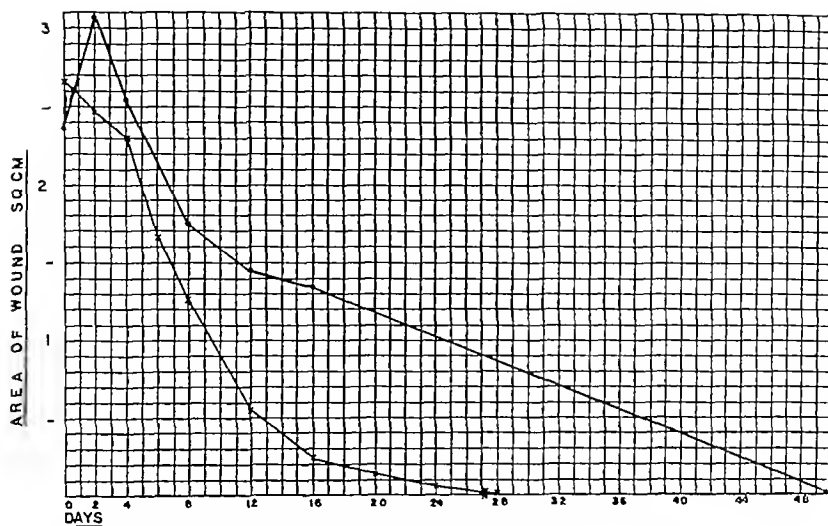


Fig 1 Comparison of healing of surface wounds in normal control (x—x—x) and in hypoproteinemic (•—•—•) animals

healed in a calculated average time of 49.8 days. Actually only 6 of the 23 animals in this group went to the stage of final healing. The others died unhealed. In order to obtain data for mathematical comparison, the healing time of the 17 unhealed animals was calculated by estimating the day of healing according to the normal healing curve and not the healing curve of a protein-depleted animal. Had we used the latter calculation, the average healing time would have exceeded by far the 49.8 days

TABLE I—SUMMARY OF HEALING OF SURFACE WOUNDS IN RATS

Group No		No animals	Wt start grams	Wt end grams	Change grams	Bl prot gm percent	No healing days	Skin diameter sq cm
1	Normal controls	45	222	278	+56	6.5	27.1	7.6
2	Hypoproteinemic	23	206	100	-106	3.9	49.8	20.5
3	Hypoproteinemic plus 150 mgm methionine	16	219	136	-83	4.0	32.6	6.3
4	Normal plus 150 mgm methionine	16					31.6	5.1
5	Calculated by Du Nouy's equation						31.75	

days recorded. Clinically, the wounds appeared pallid, or, as Thompson, Ravdin, and Frank expressed it, "they appeared as if a local anesthetic had been injected in the tissues."

The protein-depleted rats that received dl-methionine lost an average of 83 grams, the blood proteins averaged 4.0 grams per cent and the wounds healed in 32.6 days. In all of these animals wound healing occurred. In the normal animals that received dl-methionine healing took place in 31.6 days. The healing time of a rat wound the size of our average wounds as calculated by Du Nouy's equation for the healing of surface wounds, is 31.75 days.

Except for the untreated protein-depleted hypoproteinemic group, statistically each series was well grouped as regards healing time, as indicated by the standard deviation from the mean.

#### DISCUSSION

As expected from clinical observation and from previously published work, the healing time of a surface wound in a protein-depleted animal is prolonged. The healing of surface wounds in protein-depleted animals that received dl-methionine approaches the normal, notwithstanding the fact that the animals were maintained upon a depleting diet and remained depleted according to the level of the

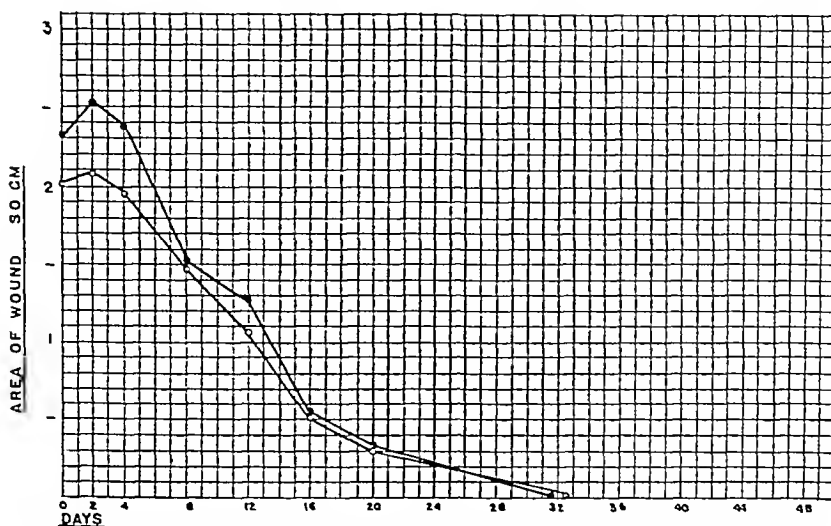


Fig 2 Comparison of healing of surface wounds in hypoproteinemic animals receiving dl methionine (○—○—○) and normal animals receiving dl methionine (●—●—●)

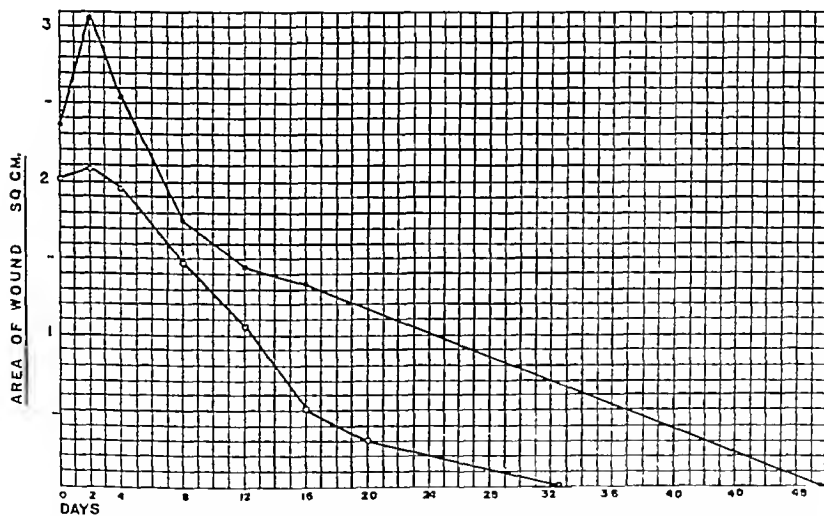


Fig 3 Comparison of healing of surface wound of hypoproteinemic animals (●—●—●) and of hypoproteinemic animals receiving dl methionine (○—○—○)

blood proteins. These results also follow those previously recorded for abdominal wounds.

Localio, Morgan, and Hinton outlined an hypothesis indicating that these results may be due to the fact that dl-methionine supplies necessary sulfhydryl (SH) radicals to the enzymatic activity of the chemical reactions that lead to healing. The present study does not prove that hypothesis. However, it does indicate that abnormal healing in a structure con-

taining concentrations of sulfur (hair and skin) can be corrected in large part by an essential sulfur-containing amino acid.

It is of some importance to emphasize that dl-methionine did not speed the healing of a normal wound. These surface wound experiments are more easily put to test in the human than the experiments on the abdominal wall. We have observed 2 patients whose histories we wish to record briefly.

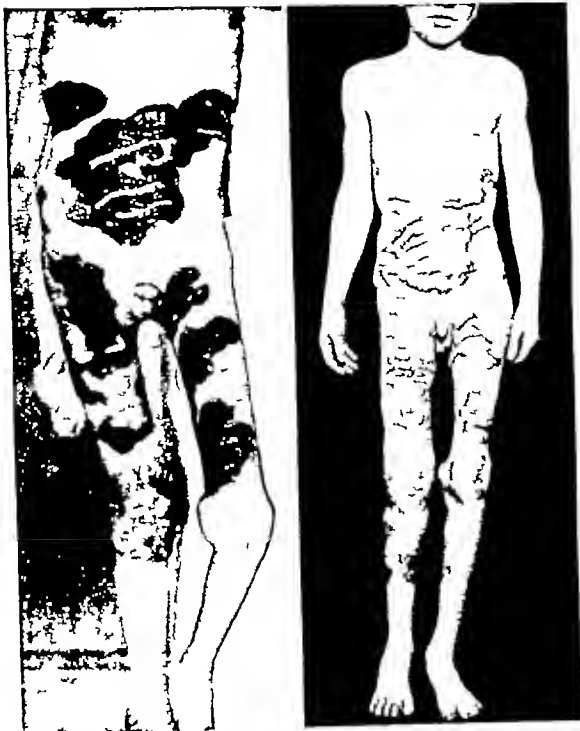


Fig 4, left Case 1 Patient prior to treatment with dl-methionine

Fig 5 Case 1 Patient 6 months after treatment with dl-methionine

**CASE 1** F A, Age 10 years, sustained extensive third degree burns  $2\frac{1}{2}$  years prior to our observation. For 1 year at another hospital, several attempts to cover the granulations with skin grafts not only failed but the donor sites failed to heal. During the next year at the New York Post-Graduate Medical School and Hospital, 16 attempted skin grafts failed despite antibiotics, transfusions, plasma, oral and intravenous hydrolysates, and numerous forms of local preparation of recipient area. The blood proteins ranged from 5.6 to 5.8 with a normal albumin globulin ratio. The hemoglobin and red blood cell count were maintained within normal limits, and the hematocrit ranged between 41 and 43. When we were asked to see the patient his weight was 43 pounds.

The patient was placed on 1 gram of dl-methionine 3 times daily for 2 weeks with little observable result. At the same time, furacin was used as a local dressing. The dose of dl-methionine was then raised to 2 grams 3 times daily, and on the ninth day, epithelization for the first time was observed in the wound edges. Therapy was continued for 14 weeks, during which time many of the areas epithelized spontaneously. Three skin grafts were attempted and all remained viable.

Six months later the patient weighed 83 pounds. Wounds were healed. Blood protein was 6.7 grams (Figs 4 and 5).

**CASE 2** Male, aged 77 years, entered the Fourth Surgical Division of Bellevue Hospital complaining of chronic ulcers of both ankles of 7 years' duration. This patient had generalized atherosclerosis and moderately severe varicosities of the lower extremities. For 16 weeks he was treated by rest, elevation, and numerous varieties of local dressings. Two separate attempts at pinch grafting of the ulcers failed. When we were asked to see the patient, the ulcer on the right covered an area of 108 square centimeters. The anterior surface of the tibia was exposed and necrotic. The ulcer on the left measured 57 square centimeters. The Achilles tendon was exposed and sloughing. Both ulcers had areas of necrotic muscle and slough at their base. The red blood count was 4.0 million, hemoglobin 12.5 grams. Blood proteins were 5.9 total, albumin 3.8, globulin 2.1. The patient was given 500 cubic centimeters of whole blood and 2,500 cubic centimeters of blood plasma. He was maintained on the general ward diet. Ten days later he was placed on 4 grams of dl-methionine 3 times daily. One week following inception of this therapy, epithelization began at the edge of the ulcers. Because of the huge size of the ulcer on the right it was decided to pinch graft this area. In an isolated area below the ankle, roughly 15 per cent of the grafted area, all grafts failed, elsewhere all grafts remained viable and spread. Ten weeks after inception of therapy the unhealed areas measured 12 square centimeters. This included only an area of exposed necrotic bone and the area below the ankle mentioned. In this latter area, epithelization was proceeding from the borders.

The ulcer on the left was not grafted. It was decided to see if this ulcer could be made to heal by epithelization. Ten weeks after inception of dl-methionine therapy, this ulcer measured 15 square centimeters. Of this, 5 square centimeters was over necrotic Achilles tendon. The patient is still under observation.

We do not offer dl-methionine as a panacea for the healing of stubborn surface wounds. Wound healing is much too complex a process to hope that any one factor will solve its problems. On the basis of our animal experiments and 2 cases, we believe that this easily tolerated, apparently nontoxic amino acid, is worthy of further controlled clinical study.

#### CONCLUSIONS

- 1 Protein depletion markedly prolongs the healing of surface wounds in rats
- 2 The administration of dl-methionine in spite of continued protein depletion, restores the healing time toward normal
- 3 Dl-methionine does not speed the healing of surface wounds of normal rats
- 4 Two clinical cases are presented which

indicate that dl-methionine may be worthy of trial in stubborn unhealed surface wounds in protein-depleted humans

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## THE PHYSIOLOGICAL EFFECTS OF CURARE

## Its Failure to Pass the Placental Membrane or Inhibit Uterine Contractions

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THE present study was undertaken in an effort to add to our knowledge of the pharmacology of curare and to establish an experimental basis for its use for operative deliveries should the need arise

Several authors have reported the use of curare for cesarean section Whitacre and Fisher (8, 9) reported a series of 285 cases of cesarean sections in which curare was used The drug was given "until there was evidence of respiratory depression" One hundred units of intocostin was the average dose They reported that there was no depression of respiration in the baby Cullen said, "The effect of intocostin on the uterus has not been thoroughly studied A number of patients have been given curare for the purpose of producing abdominal muscle relaxation during cesarean section without any apparent adverse effect on uterus or infant" In 1947, G F V Anson advised the use of curare for poor risk patients "including toxemias of pregnancy, ectopic pregnancy, puerperal hemorrhage, inversion of the uterus" He made no mention of the condition of the babies Later in 1947, T Cecil Gray reported the use of d-tubocurarine in 30 cases of cesarean section Premedication consisted of 1/100 grain of atropine Fifteen

units of d-tubocurarine (a subapneic dose) were injected intravenously, followed by 0.3 gram of a thiobarbiturate, "kemithal" Anesthesia was maintained with cyclopropane in a closed system Respirations were "aided" to prevent hypoxia He reported that the babies were awake and showed no signs of curarization, the uteri contracted normally and vigorously, retching and vomiting were rare, and the patients were awake at the end of the operation

At the University of California Hospital we have had no reason as yet to use curare in deliveries of any type No muscular relaxation should be needed for a classical cesarean section, instrumental deliveries from below are more easily handled by simpler anesthetic techniques However, we believe that the use of curare might be advantageous in certain situations, such as emergency intra-abdominal or intrathoracic surgery in which the delivery of the baby is to be performed at the same time, extraperitoneal cesarean section, and perhaps mid and low forceps deliveries in which relaxation of the perineum with preservation of normal uterine tone would be of help At this institution curare is used in doses which are calculated to produce apnea (4, 5, 6, 7) There is no evidence as to what effect such large doses would have on the fetus or the uterine muscle Therefore, we have investigated the effect of apneic doses of curare on pregnant dogs Although our series is small, the results in all cases are identical For this

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TABLE I.—SUMMARY OF RESULTS

Dog No	Total dose of curare (intocostrin) units	Duration of apnea hrs min	Condition of pups	Condition of uterine muscle	Condition of dog during surgery	Postoperative condition	Remarks
1	60	3 35	Breathing and squirming	Contracted normally	Good	Good	One pup given 0.5 c.c. intocostin i.v. became limp and apneic; c after 1 hour
2	90	2 10	Breathing and squirming	Contracted normally	Good	Good	
3	40	2 10	Breathing and squirming	Contracted normally	Good	Good	
4	40	1 45	Breathing and squirming	Contracted normally	Good	Good	
5	80	1 25	Breathing and squirming	Contracted normally	Good	Good	
6	60	2	Breathing and squirming	Contracted normally	Good	Good	
7	60	3 25	Breathing and squirming	Contracted normally	Went into shock	Good	Shock successfully treated by dextrose.
8	100	3 30	Breathing and squirming	Contracted normally	Good	Good	
9	120	4 50	Breathing and squirming	Contracted normally	Good	Good	
10	80	2 50	Breathing and squirming	Contracted normally	Good	Good	

reason we feel justified in reporting them at this time

Ten pregnant bitches near term were used. Nine of them were premedicated with atropine 0.0006 (gr 1/100), the tenth, due to oversight, was unmedicated. Thirty to 80 units of intocostrin (a dose calculated to produce apnea depending on the size of the dog) were injected intravenously. As soon as relaxation and apnea occurred an orotracheal tube was inserted and attached to a breathing bag and a cylinder of oxygen. "Controlled respiration" with oxygen was instituted and continued throughout the procedure. If the dog began to make respiratory efforts before the puppies were delivered, a subsequent dose of 10 to 40 units of intocostrin was given. An abdominal wall block with 1 per cent procaine with epinephrine was done as soon as the endotracheal tube was inserted, and cesarean section performed. Care was taken that the dogs were completely curarized, limp, and apneic until all the puppies were delivered. Controlled respiration was continued until the curare had worn off and the dog was breathing well with both intercostal muscles and diaphragm.

In all 10 cases the results were identical. As soon as the mother's abdominal wall relaxed it became apparent that the pups were not

curarized, their intrauterine squirming became so evident that it seemed as if they would break out of the abdomen by their own effort. On delivery every one of them (69 in all) breathed, squirmed, and in every way behaved like normal pups, this in spite of the fact that in more than half the cases they were considerably premature. None of them was kept alive for more than 2 months, due to lack of facilities in the animal house, but in no case was there any evidence that their death was caused by the curare the mother had received. In every case the uterus contracted normally with or without the use of ergotrate. In all cases the mothers made uncomplicated recoveries.

The possibility that lack of curarization of the pups might be due to resistance to curare rather than to absence of placental transmission of curare was considered. Four units of intocostrin were injected into the umbilical vein of a lively, breathing pup while it was still attached to the placenta, causing complete apnea in 15 seconds. The pup could not be intubated because of the minute size of the larynx and artificial respiration by squeezing the chest was carried on for about an hour. After 45 minutes a few diaphragmatic contractions were felt, but a little later the heart

stopped. It is probable that our attempts at resuscitation were too rough.

Table I gives a summary of our results.

Although we hesitate to report an isolated case, the results in this instance parallel so exactly the findings in dogs that we believe they should be included.

A hysterotomy and sterilization with curare-nitrous oxide anesthesia were performed on a 19 year old epileptic girl, 4½ months pregnant. A single dose of 200 units of curare was administered 5 minutes after the nitrous oxide anesthesia was begun. The baby was delivered 40 minutes after the administration of curare, and when the patient had been in apnea for 35 minutes. The baby was too small to make any respiratory efforts, but all its normal reflexes (withdrawal, knee jerks, etc.) were present and as active as could be expected in a normal fetus of that size. The mother's uterine muscle contracted perfectly normally. The duration of the operation was 1 hour 40 minutes, the duration of apnea, 1 hour 5 minutes. The baby, of course, was not viable, but the mother made a normal recovery.

## CONCLUSIONS

1. Curare in apneic doses in dogs does not pass the placental membrane nor inhibit normal postpartum uterine contractions.

2. The reports of previous workers and our own limited observations lead us to believe that these findings can be applied to human patients.

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# OBSERVATIONS ON THE MACROCYTIC ANEMIA ASSOCIATED WITH PREGNANCY

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FOR many years we have been studying nutritive failure in families living in areas in which undernutrition is endemic. We have observed in this large group that many persons develop an anemia secondary to infection or hemorrhage, but it is not with this type of anemia that we are concerned in this paper. This report is concerned strictly with the anemia of nutritional origin. The longer we study nutritional anemia, the more it appears to us that it is always a symptom and that in every instance it is indicated that the cause must be found and eliminated as well as the anemia treated specifically.

The relationship of anemia in the mother and the young infant is close, closer perhaps than has been realized. For a number of years we have been studying the anemia complicating pregnancy, which some call the pernicious anemia of pregnancy. It is a macrocytic anemia with a high color index and it responds to liver, folic acid, or yeast. If the mother is not treated while pregnant, the infant also may have anemia later, especially if the infant's diet is poor in substances which contain folic acid or substances which act similarly. We have been making assays of the folic acid content of the various ingredients commonly used in infants' diets but we are not reporting them or the anemias of infancy at this time. The important thing is to realize that there is an association between anemia in the mother and the early development of anemia in the child and to understand the necessity of administering in many instances, yeast, folic acid, meats and meat products, or various mixtures of these materials. For years it has been recognized that certain infants have megaloblastic anemia and some of these infants have been treated successfully with

liver extract. More recently Zuelzer and others described a syndrome of this type which responds to folic acid therapy. We also have observed that folic acid is effective in this type of anemia in infants and children. The point we wish to stress here is that if treatment is administered to the mother and if the baby is fed a diet containing adequate folic acid or substances acting similarly, anemia of this type does not develop.

## MATERIALS AND METHODS

Six patients were selected for study using the following criteria:

1. The patient must have been pregnant within a few weeks prior to the initiation of the study.
2. She must have a macrocytic anemia with red blood cell counts of 2.5 million or less and a color index greater than 1.
3. She must have megaloblastic arrest of the bone marrow.
4. She must have free hydrochloric acid in the gastric juice.
5. She must be untreated or must not have been treated recently enough to interfere with folic acid as a therapeutic agent.

The patients were admitted to the hospital and throughout the course of the study were maintained on a diet which was devoid of meat, meat products, fish, poultry, milk, and eggs.

Daily hematologic examinations included white and erythrocyte counts, hemoglobin determinations, and reticulocyte counts. Certified Trenner pipettes were used for both the white and the erythrocyte counts. A Jentz colorimeter was used for determining in grams the hemoglobin content of the blood. The reticulocytes were counted in wet preparations by the use of a modified brilliant cresyl blue solution of Dameshek. Cell volumes were determined frequently on oxalated venous blood by Wintrobe hematocrit tubes. Bone marrow was obtained by sternal aspiration prior to therapy and at the peak of reticulo-

From the Department of Nutrition and Metabolism, North Carolina University. No three-term University Studies in Nutrition at the Holman Hospital, Birmingham, Alabama. This study was supported by grants from the Federal Laboratories for the Control of Birth Defects, Citizens Committee.

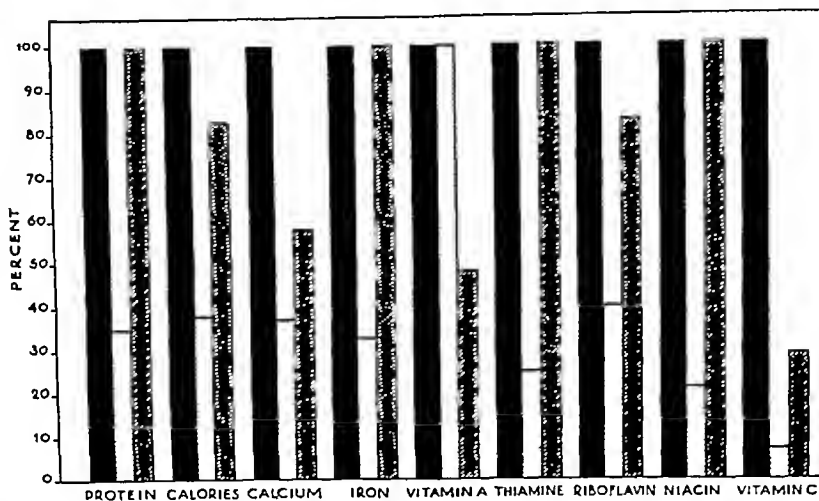


Fig 1 Nutrients supplied by the diet of a patient with the macrocytic anemia of pregnancy before and after folic acid therapy, contrasted to the recommended allowances of nutrients. Black areas, allowance of nutrients recommended by Council on Foods and Nutrition, National Research Council. Dotted areas, nutrients supplied by diet of patient before therapy. Crosshatched area, nutrients supplied by diet of patient after therapy.

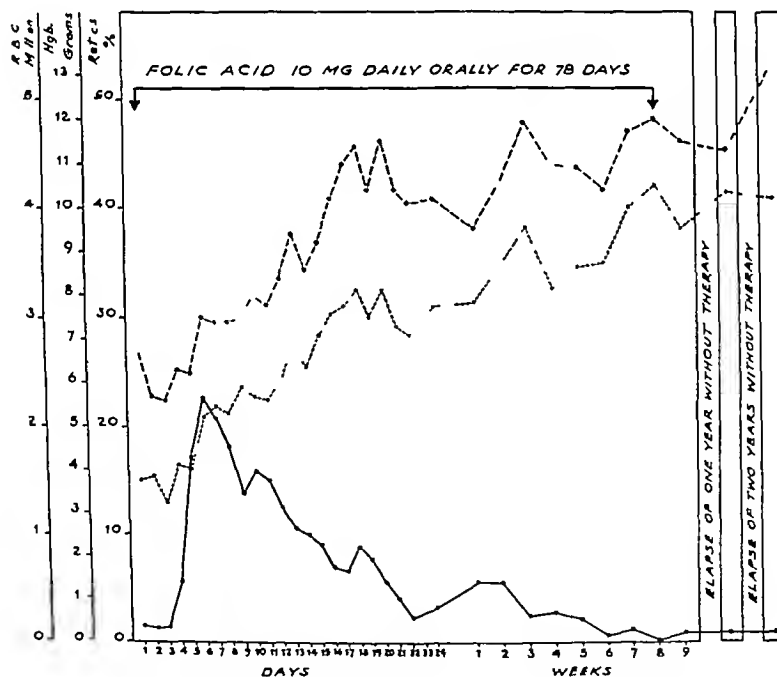


Fig 2 Hemopoietic response of a patient with macrocytic anemia of pregnancy to folic acid.

cytosis. Differential counts were made on preparations stained while both supravital and Wright's stains.

After the baseline determinations were completed, the patients were given folic acid by mouth. The course in each of the cases is

illustrated in the following representative case history

C C, a white woman aged 29 years, was admitted to the hospital 9 days after the birth of her sixth child. At this time she complained of loss of appetite, weakness, and diarrhea.

Her illness began 7 years previously, after the birth of her second child, with gradual loss of appetite, intermittent diarrhea, and loss of strength. At intervals throughout her third, fourth, and fifth pregnancies, she lost her appetite, lost strength, and had diarrhea and burning of the tongue. Two months prior to her admission to the hospital and during the seventh month of her sixth pregnancy, she lost her appetite, developed diarrhea, and her mouth and tongue became so sore she could eat very little food of any kind. The nutrients supplied by her diet during this time are shown in Figure 1. Her diet, which consisted chiefly of foods assayed for folic acid by Angulo and Spies, was also low in folic acid. She became so weak she stayed in bed all the time and for 6 days following the birth of the child she was too weak even to feed herself. She was then brought to the hospital in an ambulance.

As can be seen in Figure 2, her blood values on admission were: red blood cells, 1.50 million, hemoglobin, 6.6 grams (43 per cent), reticulocytes, 2.6 per cent. She was given 10 milligrams of folic acid daily by mouth. The third day after therapy was initiated, she said she felt much stronger than she had for many months, her tongue ceased burning, her desire for food returned, and she ate most of the food offered. On the fifth day of therapy, the reticulocytes rose to 22.7 per cent. Her diarrhea subsided at this time. Her appetite and strength continued to improve and 10 days after therapy was initiated she began walking around the ward and asked to go home. She was kept on folic acid therapy for 78 days during which time she gained 17 pounds in weight. At the end of this time she was instructed as to the foods she should eat and discharged from the hospital. At this time her blood levels were: red blood cells, 4.20 million, hemoglobin, 11.5 grams (75 per cent), reticulocytes, 0.8 per cent.

In the 2 years since she was treated, her diet has been much more adequate than it had been previously (Fig. 1). She has had no recurrence of symptoms and her blood values are: red blood cells, 4.07 million, hemoglobin, 13.2 grams (86 per cent) (Fig. 2).

#### DISCUSSION

In this clinic we have made many studies on the specificity of the folic acid molecule

(2, 4). Various fragments of the molecule are ineffective when given alone or in any combination. The change of the glutamic acid to aspartic acid also makes it ineffective. Folic acid either in its conjugated form or in its free form is effective in producing reticulocytosis, an increase in white blood cells, hemoglobin, red blood cells and platelets in persons who have pernicious anemia, nutritional macrocytic anemia, and the macrocytic anemia of pellegra, pregnancy, and sprue (3, 5). Folic acid should be considered a member of the vitamin B complex, as are thiamine, niacin, and riboflavin. The author believes that the pregnant woman should have 2 milligrams of folic acid daily during the latter months of pregnancy.

#### SUMMARY AND CONCLUSIONS

1. The megaloblastic anemia of pregnancy, infancy, and early childhood often can be prevented by treating the mother in the late stages of pregnancy with substances having an anti-anemic effect. (If this is not done and if the infant develops megaloblastic anemia, it eventually can be relieved by the administration of folic acid.)

2. It is recommended that this anemia associated with pregnancy be prevented by the administration of 2 milligrams of folic acid daily during the latter months of pregnancy. In a few instances 5 milligrams are required.

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# PRIMARY SPLENIC PANHEMATOPENIA

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IN 1944, Doan first used the term splenic panhematopenia to designate a syndrome characterized principally by splenomegaly, panhyperplasia of the bone marrow, and varying degrees of anemia, neutropenia, and thrombocytopenia. His investigations, which ultimately led to the separation of splenic panhematopenia from other splenic syndromes, were first reported in 1939. In the original report, Wiseman and Doan (9) described 4 patients with a chronic neutropenia which was believed to be caused by sequestration and destruction of neutrophilic granulocytes within the splenic sinusoids. The 4 patients underwent splenectomies with restoration of the blood picture to normal and a subsequent report in 1942 (10) stated that the patients had remained in good health. The 4 original patients displayed some anemia and thrombocytopenia as well as neutropenia and in the 1944 report (2) which included additional patients, the term primary splenic panhematopenia was applied to the syndrome. In 1946, Doan and Wright further divided the syndrome into primary splenic panhematopenia on a congenital or familial basis and splenic panhematopenia secondary to some constitutional pathologic process which disturbed splenic physiology. The primary type of splenic panhematopenia may occur as a chronic relapsing disease with intermittent episodes of hemoclastic activity or as a relatively acute disease characterized by prostration and a rapid depression of the cellular elements of the blood. The secondary acquired form of panhematopenia has been observed in Hodgkin's and Gaucher's diseases (3).

Based principally on the results of epinephrine tests, supravital stained preparations of freshly excised splenic tissue, and the histologic appearance of the bone marrow, Doan and his associates have concluded that the hematologic alterations observed in splenic panhematopenia are due to sequestration of

erythrocytes, leucocytes, and thrombocytes within the splenic sinusoids and the destruction of these elements by reticuloendothelial macrophages. In the majority of Doan's patients the subcutaneous administration of 0.5 to 1.0 cubic centimeter of epinephrine produced a significant elevation of the number of circulating erythrocytes, leucocytes, and thrombocytes. Supravital stained preparations of splenic tissue demonstrated increased phagocytic activity by the clasmatoocytes. Bone marrow studies consistently displayed a myeloid hyperplasia and, in many instances, erythroid and megakaryocytic hyperplasia. The authors concluded that congenital hemolytic anemia and idiopathic thrombocytopenic purpura could be included in the same syndrome.

Moore and Bierbaum reported a patient with splenic neutropenia treated successfully by splenectomy. They concluded from supravital staining of fresh splenic tissue that excessive phagocytosis of leucocytes by splenic clasmatoocytes was the cause of the neutropenia.

Muether, Moore, Stewart, and Broun did not observe excessive phagocytosis of leucocytes in the spleen in 1 patient. It was not stated, however, whether the microscopic observations were made on supravital stained tissue or fixed sections.

Rogers and Hall reported a patient with splenic neutropenia which could not be explained on a basis of splenic phagocytic activity. Fixed sections of the spleen were studied. In this patient a chronic hepatitis diagnosed by means of a liver biopsy was present. No other patient thus far reported has had any associated or coincidental hepatic disease.

During the past few years, the diagnosis of primary splenic panhematopenia has been made in 7 instances at the University Hospitals of Cleveland. All of the patients have been subjected to splenectomy. One patient died after operation and a postmortem examination was performed. Some of the observations made upon these patients are at variance with those of Doan and his associates. Our

TABLE I—PATIENT E D HEMATOLOGIC DATA BEFORE AND AFTER SPLENECTOMY

Date	RBC $\times 10^4$ per c.mm	Hgb gm per 100 ml	WBC per c.mm	Differential per c.mm		Plat. $\times 10^4$ per c.mm	Hemt. %	Ret %	Icterus Index units
				Neut	Lymp				
1 29-42	4 20	10 9	7 500	5 700	1,425				
5 26-43	4 52	12 8	8 350						
8- 8-44	3 89	11.4	4 600	2 480	1 610	120 59			
12 27-44	2 20	6 6	2 500	1 050	950				
12 29-44	2 25					13 2	18		16
12 30-44			2 250						
1 4 45	2 07	6 3	1 450	203	789	20 0		27	13
1 5 45	Splenectomy Blood transfusion—500 ml whole blood								
1 6-45	4 17	11 0	6 050	4 850	454	12 5			

studies offer no support to the hypothesis that the hematologic changes observed in this disease are due to excessive sequestration and phagocytosis of the cellular elements of the blood in the spleen

The clinical manifestations of primary splenic panhematopenia are variable and depend to a large extent upon the degree of anemia, neutropenia, and thrombocytopenia present. The patients may complain of lassitude, palpitation, and fever. Oral ulceration and indolent ulcers of the lower extremities may be present. Purpura or icterus may or may not be present. Splenomegaly has been present in all but 1 of the patients herein reported.

The peripheral blood shows varying degrees of anemia, neutropenia, or thrombocytopenia or any combination of the three, although neutropenia has been the outstanding feature of our cases. Reticulocytosis and an increase in hemogenous bilirubin as measured by the indirect van den Bergh reaction have been observed in some patients. None of the patients thus far reported here or elsewhere has demonstrated spherocytosis.

Although the exact mechanism producing a reduction of erythrocytes, granulocytes, and thrombocytes in the circulating blood cannot be definitely stated, there is little doubt that this syndrome is separate and distinct from malignant neutropenia, hypoplastic anemia, aleucemic leucemia, Banti's syndrome, and Still's disease.

CASE I E D, 42 years old, white, single female was first admitted to University Hospitals on Janu-

ary 28, 1942, when a diagnosis of diabetes insipidus was made and the symptoms were well controlled by administration of pitressin. Congenital absence of the right radius and partial absence of the left radius were demonstrated by roentgenologic examination. Blood findings at that time (Table I) were not striking. She was readmitted on May 25, 1943, complaining of unsteadiness, vertigo, and paralysis of the left hand. She recovered rapidly from these symptoms and a diagnosis of thrombosis of a small vessel of the right cerebrum was made. Again, blood findings were not remarkable. On this admission, roentgenologic examination of the chest revealed streaky, nodular shadows scattered throughout both lungs and the roentgen diagnosis was fibrosis which might have resulted from atypical pneumonia or sarcoidosis. Her next admission was on August 27, 1944, at which time the spleen was palpably enlarged. At this time the blood showed definite anemia and leucopenia as shown in Table I. Roentgenologic examination revealed the urinary tract and skull to be normal. A diagnosis of splenomegaly and possible sarcoidosis was made. The radiographic appearance of the lungs had not changed in 16 months. Her last admission was on December 26, 1944, when she entered complaining of drenching night sweats for 2 months, worse during the preceding 10 days. She claimed to have sustained a loss of weight of 14 pounds in the preceding 20 days. She had experienced dyspnea and orthopnea. Examination revealed a harsh systolic murmur over the left side of the sternum. The spleen extended 6 centimeters below the costal margin. The liver was palpable 1 to 2 centimeters below the costal margin. On January 2, 1945, a petechial type of purpura appeared over the entire body and the temperature rose to 38.5 degrees C.

The blood findings are shown in Table I. A sternal marrow aspiration was performed and revealed the nucleated cell count to be 139,750 per cubic millimeter, the erythrocyte count 1,840,000 per cubic millimeter, and the hemoglobin 6.5 grams per 100 milliliters. The differential count on the marrow

content was neutrophiles 10 per cent, eosinophiles 30 per cent, basophiles 0, unsegmented neutrophiles 76 per cent, metamyelocytes 76 per cent, myelocytes 138 per cent, myeloblasts 16 per cent, lymphocytes 02 per cent, monocytes 0, normoblasts 316 per cent, erythroblasts 326 per cent, and megakaryoblasts 10 per cent. Fifteen cells in mitosis were seen while counting 500 nucleated cells. These were about evenly divided between red and white cells. The granulocyte-nucleated red cell ratio was 053 - 100. There were many megakaryocytes present. The marrow was interpreted as showing increased activity, with all elements participating, and with an especial increase in the nucleated red cells. Other laboratory findings included an icterus index of 16 units, normal bleeding and clotting times, and a normal fragility test (044 per cent to 036 per cent saline with an identical control). A second icterus index on January 4, 1945, was 13 units. The serum bilirubin was 16 milligrams per 100 milliliters. The van den Bergh reaction was weakly positive, direct delayed. There was no increase of urobilinogen or urobilin in the urine as determined by qualitative tests. The reticulocyte count as shown in Table I was 27 per cent.

Splenectomy was performed on January 6, 1945. The spleen was greatly enlarged and was adherent laterally to the parietal peritoneum. It weighed 888 grams and measured 23.5 by 10.0 by 6.5 centimeters. Examination of imprint preparations with the supravital stain (Janus green and neutral red) and Wright stain failed to reveal the presence of any phagocytic clasmatoocytes. Examination of fixed tissue sections stained with hematoxylin and eosin revealed fibrous bands adherent to the outer capsule. The connective tissue in the substance of the spleen was not increased in amount. Follicles were numerous and relatively large, many having distinct secondary centers, some of which showed hyalinization and degeneration. The pulp contained lymphocytes, large mononuclear cells and erythrocytes in usual numbers with a distinct increase in the number of eosinophiles. The oxidase stain revealed the presence of a large number of cells containing oxidase positive granules. Throughout, there were many plasma cells, and large mononuclear cells with acicular, relatively large nuclei. Mitoses were observed and there were some nucleated red cells. Sections treated with potassium ferrocyanide and hydrochloric acid showed throughout the pulp masses of blue material indicating the presence of iron. The diagnosis was splenomegaly with myeloid metaplasia and follicular hyperplasia.

Following operation, there was a steady rise in temperature. The blood pressure fell to very low levels and the patient died on the second postoperative day. Only one postoperative blood examination was done as shown in Table I. Autopsy was performed and the following diagnoses made: chronic interstitial

pneumonitis, bilateral, marked, chronic encephalitis, marked in hypothalamus, congenital defect in the membranous portion of the interventricular septum, covered by septal leaflet of the tricuspid valve. The disease in the lung was definitely considered not to be the result of tuberculosis or sarcoidosis. It was of an inflammatory nature which might have been the result of an atypical pneumonia, although there was no proof for this. There was marked generalized hyperplasia of the bone marrow throughout. It appeared that the cause of death was right heart failure associated with the pulmonary fibrosis.

CASE 2 H. H., 31 years old, white female was admitted to University Hospitals on July 28, 1942, with a chief complaint of "canker sores" in the mouth, which had occurred intermittently every 3 to 4 months during the preceding 15 years. She also noted increased sensitivity to minor infection, stating that small cuts and injuries healed slowly and remained inflamed for long periods of time. Physical examination revealed a well developed, obese, white woman not acutely ill. There was a deforming scar on the lower lip where one of the ulcers had been removed for biopsy at another hospital. Throughout the buccal mucosa were several small ulcers varying in size from 1 to 5 millimeters in diameter. Her gums bled slightly after she brushed her teeth. Small, nontender submental lymph nodes were present. The spleen was palpable 2 centimeters below the costal margin in the left midclavicular line.

Blood findings on several occasions prior to the subsequent splenectomy are shown in Figure 1. Sternal marrow aspiration was performed with the following results: total nucleated elements, 37,150 per cubic millimeter, erythrocytes 4,780,000 per cubic millimeter, hemoglobin, 12.5 grams per 100 milliliters, neutrophils, 21.8 per cent, eosinophiles, 40 per cent, basophiles 0, immature neutrophils, 40.8 per cent, myelocytes, 70 per cent (all ages and varieties), myeloblasts, 12 per cent, lymphocytes, 80 per cent, monocytes, 18 per cent, normoblasts, 13.2 per cent, erythroblasts, 20 per cent, megakaryocytes, 0, plasma cells, 0.2 per cent, and megakaryocytes, 0. The granulocyte-nucleated red cells ratio was 55:100. This was interpreted as representing an active marrow with an increase in the cells of the granulocyte series. An epinephrine test was performed, the results of which are shown in Figure 2. Following the injection of epinephrine the spleen was no longer palpable and the pulse rate increased. Other laboratory data included a blood platelet count of 75,000, reticulocytes, 0.1 per cent, bleeding, coagulation and clot retraction times, normal. Splenectomy was recommended but the patient wished to consider the matter and was discharged on August 3, 1942.

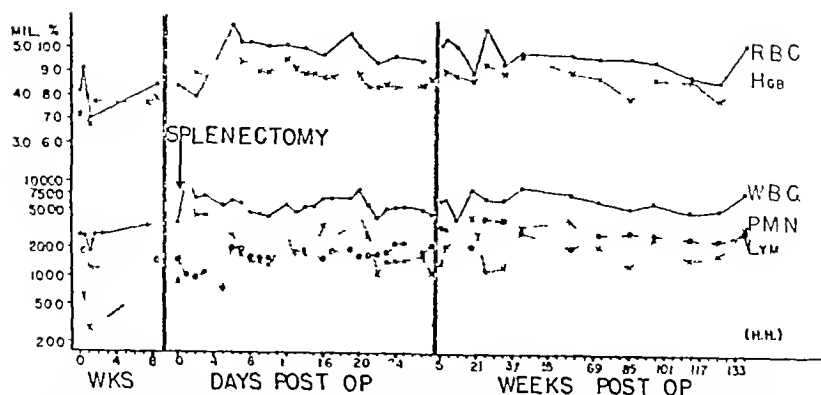


Fig 1 Patient H H Hematologic data before and after splenectomy and follow up  
One hundred per cent hemoglobin equals 15.6 grams per 100 milliliters

She was readmitted on September 15, 1942. The mild anemia, marked neutropenia, and thrombocytopenia persisted. She had continued to have crops of small ulcers on the oral mucous membranes. On this admission a fragility test showed beginning hemolysis at 0.48 per cent saline with complete hemolysis at 0.32 per cent saline. Control showed values of 0.46 per cent and 0.32 per cent. The icterus index was 5 units. Urobilinogen and urobilin in the urine were not increased as determined by qualitative tests. A diagnosis of primary splenic neutropenia was made and splenectomy was performed on September 17, 1942. Five hundred milliliters of whole blood were administered at the time of operation. The spleen weighed 280 grams and measured 16 by 9 by 4 centimeters. Supravital preparations (Janus green and neutral red) and Wright stained imprints were examined with care and an unusual number of phagocytes could not be demonstrated. Occasional phagocytic cells were present, always containing erythrocytes. Sections stained with hematoxylin and eosin likewise did not demonstrate any unusual phagocytosis. The follicles were large and numerous, and many showed prominent secondary centers. The diagnosis was follicular hyperplasia of the spleen.

Immediately following splenectomy, there was a marked increase in the number of granulocytes, erythrocytes, hemoglobin, and platelets (Fig 1). It is of interest that the ulcers in the mouth healed within 4 to 5 days after splenectomy. A urinary

tract infection, present from the 15th to the 24th day after splenectomy, was treated successfully with sulfathiazole.

During a follow-up period of 140 weeks there was considerable fluctuation in the number of neutrophils and lymphocytes in the peripheral blood, although the neutrophils remained above preoperative levels. It was noted that when mild infections were present, the neutrophils increased in number. Whether this was true before splenectomy cannot be stated. Occasionally a small ulcer appeared in the mouth, but it never required more than a single treatment with silver nitrate. She gained a considerable amount of weight and felt well. The red blood cell count and hemoglobin levels were a little higher after operation than before and the platelets were present in considerably increased numbers. A small number of target cells were present on the blood films. From Figure 1, it can be seen that there tended to be an inverse relationship between granulocytes and lymphocytes during the entire period of observation following splenectomy.

**CASE 3** Patient M B, 36 years old, unmarried, white female, was admitted to University Hospitals on August 13, 1942. Her complaint was "tiredness in the legs, especially on climbing stairs, and a feeling of fullness in the abdomen, especially after eating a full meal." These symptoms had been present for about a year. She stated that at about the time of onset of symptoms, while running in the dark, she struck a wire which was strung about waist high. She was entangled over the wire and experienced severe pain in the left upper quadrant during the following day, and milder pain for a week. She

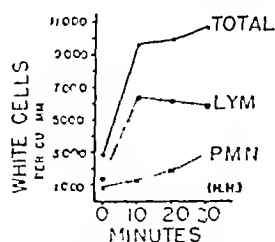


Fig 2 Patient H H Epinephrine test

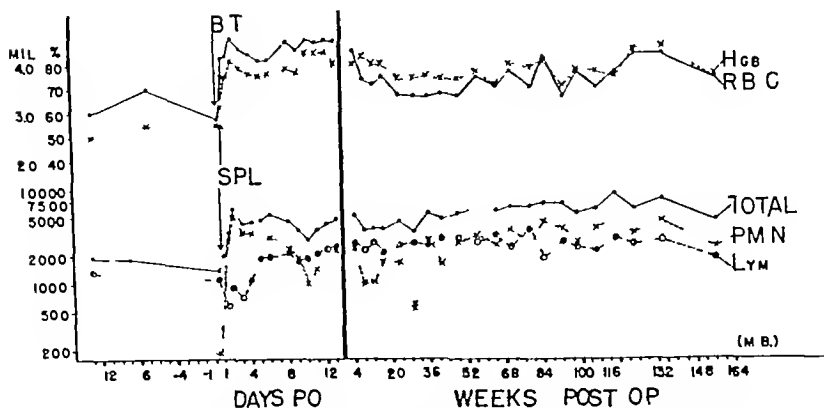


Fig 3 Patient M B Hematologic data before and after splenectomy and follow up, 100 per cent hemoglobin equals 15.6 grams per 100 milliliters

gained about 5 pounds in weight "immediately" and remarked that her dresses felt tight. She added, further, that the gain in weight was limited to the abdomen. She did not consult a physician. Physical examination revealed a well developed and nourished patient who did not appear acutely ill. There was no enlargement of the lymph nodes. A harsh systolic murmur was heard over the cardiac apex. The spleen was greatly enlarged, extending to the umbilicus inferiorly and to the mid-line medially. The remainder of the physical examination was within normal limits. Laboratory examination revealed urine to be normal. Blood findings prior to operation are shown in Figure 3. The icterus index was 7.0 units, and the erythrocyte fragility test showed beginning hemolysis at 0.46 per cent saline and complete hemolysis at 0.34 per cent saline with a control having values of 0.42 per cent and 0.30 per cent. A repeat test showed beginning hemolysis at 0.46 per cent with complete hemolysis at 0.36 per cent with a control having values of 0.40 per cent and 0.32 per cent. Bleeding, coagulation, and clot retraction times were within normal limits.

On August 20, 1942, the urine contained a slightly increased amount of urobilinogen and urobilin. Roentgenologic examinations of the abdomen and gastrointestinal tract were normal except for the presence of the enlarged spleen. The basal metabolic rate was plus 19. On August 14, 1942, a sternal marrow biopsy was performed. Examination of imprint smears stained with Wright's stain and fixed sections stained with hematoxylin and eosin revealed generalized hyperplasia with marked red cell activity. There was a marked reduction in fat and the ratio of nucleated red cells to granulocytes was increased. The differential cell count on the marrow imprints showed percentages of neutrophils 62, eosinophiles 0.4, basophiles 0.4, unsegmented neutrophils 13.2, myelocytes 9.2, myeloblasts 1.6, lymphocytes 3.0, monocytes 0, normoblasts 54.0, erythroblasts 10.6, and megaloblasts 1.4. The granulocyte nucleated red cell ratio was 0.47:1.00.

A diagnosis of primary splenic neutropenia was made and splenectomy was performed on August 24, 1942. At operation the spleen appeared to be "five times" its normal size. The patient received 900 milliliters of citrated blood on the day of operation. The spleen weighed 1800 grams and measured 29 by 19 by 5 centimeters. A supravital preparation (Janus green and neutral red) was made and an extensive search made for phagocytic cells. Few such cells could be found and those present contained erythrocytes. Phagocytes containing granulocytic cells could not be demonstrated. Imprint smears stained with Wright's stain and fixed sections stained with hematoxylin and eosin likewise failed to reveal any unusual phagocytosis. The final diagnosis was hyperplasia of the spleen without other histologic abnormality.

Rapid recovery followed the splenectomy. Symptomatic improvement was marked and has continued to the present time. The hematologic findings are shown in Figure 3. It will be noted that immediately following operation, the granulocytes rose to a high level, then over a period of time fell to a lower level, although never as low as preoperative levels. Over a period of 3 years, the granulocytes remained at a considerably higher level than before the operation. The initial increase in red cell count and hemoglobin was contributed to, at least in part, by the blood transfusions given at the time of operation. It will be noted that a mild anemia persisted for most of the 3 year observation period, although there was some increase in red cell count and hemoglobin, especially during the last year. The patient received ferrous sulfate and liver extract for several months at a time without any



TABLE II—PATIENT N J P HEMATOLOGIC DATA BEFORE AND AFTER SPLENECTOMY AND FOLLOW-UP

Date	RBC $\times 10^6$ per c.mm	Hgb gm per 100 ml	WBC per c.mm	Differential per c.mm				Plat. $\times 10^3$ per c.mm	Hemt %	Ret %	Icterus index units
				Neut.	Lymp	Mono	Eos				
9-15-44	1 20	5 5	2 000	560	1,180	200	80	50		1-2	
9-21-44	3 06	11 5	3 000	840	2 040	60	60	100	35 7		6
9-28-44	2 91	10 8	3 400	476	2 800	68	34	80			
10-2-44	2 70	9 8	4 300	602	3,480	172	43			1	
10-9-44	2 88	8 0	4 000	Discharged from hospital							
11-21-44	1 27	5 5	4 750	1 425	2 850	475	0	103		0 8	7
11-24-44	2 00	8 3	2 900	522	2 030	319	0	100		1 8	
12-1-44	3 90	14 0	4 500	2 250	1 575	540	135		55 0		
12-7-44	Discharged from hospital										
5-2-45	1 47	4 7	4 000	1 900	1 800	200	80				
5-4-45	1 81	7 0	4 100	982	2 950	41	41				
5-7-45	4 50	10 9	6 500	1 170	5 000	260	65	135			
5-8-45								110		0 4	
5-23-45	3 98	11.4	3 000								
5-25-45	Splenectomy										
5-26-45	4 23	11 5	7 250	4 560	2 660	0	0				
5-28-45	4 00	11 5	6 500	5 840	520	130	0				
5-30-45	4.68	14.4	6 300	3 470	2 645	126	63				
6-8-45	5 79	13 3	5 250	2 640	2 420	0	63				
6-9-45	Discharged from hospital										
6-25-45	4 38	13 0	4 650	2 020	1 955	395	186	N*			
7-16-45	3 51	10 9	6 300	2 047	3 270	32	536	Red*			
8-14-45	4 70	10 0	8 600	3 880	4 550	172	0	N*	33 3	0.8	
11-26-45	3 11	10 7	6 500	2 145	4,160	130	65	130		2 1	
3-14-46	3 96	12 3	7 450	4,395	2 384	149	521				
4-6-46	5 40	15 3	11 200	2 688	4 816	1 797	112	260			
9-3-46	4 60	11 5	15 000	10 500	3 750	300	450				

\*N is normal number of platelets Red \* is reduced number

effect on the anemia. Fragility tests done on a few occasions since splenectomy showed a gradual increase in resistance of the erythrocytes to hypotonic saline. Seventy-eight weeks after operation, hemolysis began at 0.36 per cent saline and was complete at 0.18 per cent saline. Some target cells could be observed in the blood at this time. The blood platelets, which were reduced in number to as low as 49,000 before operation, rose to 602,000 a month later and have continued to be present in increased numbers since. Of interest in the hematologic course shown in Figure 3 is the fact that there was a gradual increase in

total white cell count and granulocyte count over a period of 3 years. Also of interest is the observation, again, of the inverse relationship of granulocytes and lymphocytes. From Figure 3 it will be noted that generally when granulocytes are increased, lymphocytes are decreased, and vice versa.

CASE 4 N J P, 2 year old, white female, was admitted to the pediatric service for the first time on September 15, 1944. At this time a history of tonic convulsions of 6 weeks' duration was elicited from the parents. Her past history revealed a normal full term birth. Nutrition had been consistently poor. At the age of 1½ years, she was treated for an anemia of undetermined type at another hospital.

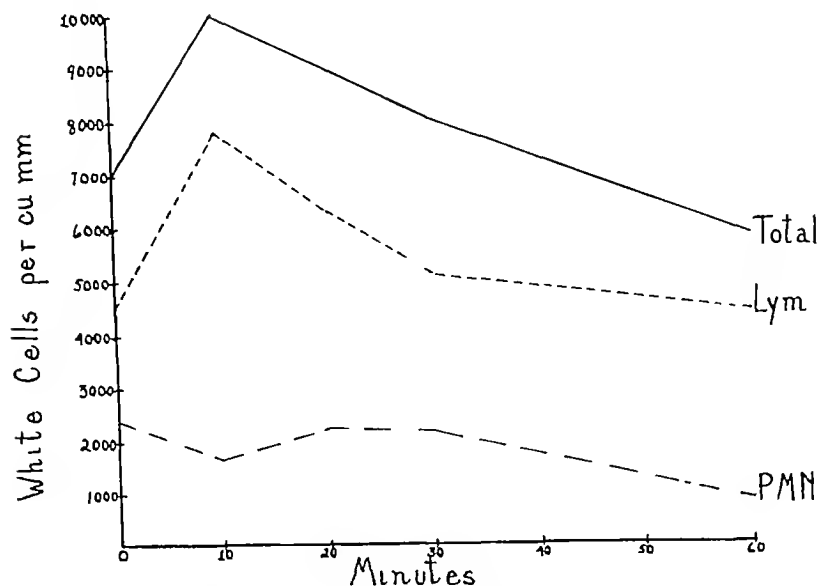


Fig 4 Patient N J P Adrenalin test.

Physical examination revealed a pale, chronically ill child. Her weight was 7.5 kilograms. Her skin was pale and the subcutaneous tissue scant. The heart was questionably enlarged to the left and a systolic murmur at the apex was transmitted to the axillae. The spleen was palpable just beneath the costal margin, and the liver was palpable 3 centimeters below the costal margin.

Initial blood findings showed a hemoglobin of 5.5 grams per 100 milliliters, erythrocytes 1,200,000 per cubic millimeter, and leucocytes 2,000 per cubic millimeter. A differential count showed segmented neutrophils 28.0 per cent, lymphocytes 58.0 per cent, large mononuclears 10.0 per cent, and eosinophiles 4.0 per cent. A platelet count showed 50,000 thrombocytes per cubic millimeter, and reticulocyte counts were less than 2.0 per cent. Several blood transfusions were given during the hospital course. Sternal marrow aspiration showed a nucleated cell count of 38,300 per cubic millimeter, erythrocyte count 3,240,000 per cubic millimeter, and hemoglobin 10.4 grams per 100 milliliters. A differential marrow count showed neutrophils 18.6 per cent, eosinophiles 4.6 per cent, basophiles 0.6 per cent, unsegmented neutrophils 14.6 per cent, metamyelocytes 15.2 per cent, myelocytes 10.8 per cent, myeloblasts 4.4 per cent, lymphocytes 16.4 per cent, monocytes 0.8 per cent, normoblasts 10.6 per cent, erythroblasts 2.0 per cent, megaloblasts 0.8 per cent, plasma cells 0.6 per cent, and megakaryocytes 0. The granulocyte nucleated red cell ratio was 5.13:1.00. The marrow was considered essentially normal. Radiographic examination of the chest showed slight enlargement of the cardiac silhouette toward the left. An electrocardiogram was normal. At the time of discharge September 9, 1944, the hemoglo-

bin was 8.0 grams per 100 milliliters, erythrocytes 2,880,000 per cubic millimeter, and leucocytes 4,000 per cubic millimeter. A tentative diagnosis of primary splenic neutropenia was made.

The patient was readmitted on November 21, 1944, and again on May 2, 1945. The blood findings before and after operation are found in Table II. An epinephrine test is shown in Figure 4. On May 25, 1945, a splenectomy was performed. The spleen weighed 32 grams and measured 7.0 by 4.5 by 2.0 centimeters. Two accessory spleens were also removed. Microscopic examination of fixed sections showed no demonstrable phagocytosis, moderate follicular hyperplasia, and hemosiderin pigmentation. A final diagnosis of splenic panhematopenia was made.

The patient was readmitted on several occasions for follow-up studies and acute respiratory infections, as shown in Table II. On her last admission on September 3, 1946, the hemoglobin was 10.5 grams per 100 milliliters, erythrocytes 4,600,000 per cubic millimeter, and leucocytes 15,000 per cubic millimeter. A differential count showed segmented neutrophils 70 per cent, lymphocytes 25 per cent, monocytes 2 per cent, and eosinophiles 3 per cent. This patient subsequently died at another hospital on July 3, 1947. The cause of death is unknown.

**CASE 5** L. B., 50 years old, white, married female, was admitted to University Hospitals on July 12, 1945, with a complaint of pain in the joints of several

TABLE III—PATIENT L B HEMATOLOGIC DATA BEFORE AND AFTER SPLENECTOMY AND FOLLOW-UP

Date	RBC $\times 10^3$ per c.mm	Hgb gm per 100 ml	WBC per c.mm	Differential per c.mm				Plat. $\times 10^3$ per c.mm	Hemi %	Ret %
				Neut.	Lymp	Mono	Eos			
7 13 45	4 53	12 5	1,380	97	952	317	13			
7 14 45			1 575							
7 16 45	4 33	11 5	850	68	630	153	0	134 8	42	0 2
7 17 45	4 70	12 5	740	89	443	177	30			
7 19-45		11 5	650	58	409	169	13			
7 19-45	Splenectomy 1000 ml citrated whole blood transfusion									
7 19-45	3 96	11 5	2 950	1 770	912	236	29			
7 20-45		12.4	7,400	5 820	664	888	0	296 0	38	
7 21 45	3 49	10.4	9 750	7 410	878	1 360	48			
7 23 45		11.3	8 900	7 520	580	712	89		36 5	
7 23 45	3 83	10 6	7 850	5 320	1 020	1,255	157			
5 1 45		10.4	5 150	3 040	1,030	929	154			
8 2 45	Discharged from hospital									
10- 1 45	3 73	11 2	9 600	1 055	7 630	672	192			
11 5 45	4 03	12 2	5 550	389	1 609	888	166			
1 7 46		13 6	5 200	676	3,796	624	104			
4 13 46	4 48	14 2	6 000	1 340	2 940	1,440	120			
7 5 46		15 0	9 600	3 744	4 800	768	288			
12 7 46	4 61	16 1	11 250	2 812	7 200	562	1 012			
12 23 46		13 4	6 500							
3 18 47	4 80	14 3	6 050							
9-30-47	4 42	14 2	5 350	1 391	3 263	535	160			

years' duration, which had become more acute during the past 3 months. The symptoms were thought to be the result of hypertrophic arthritis and she was admitted for study. Physical examination revealed a well nourished woman who did not appear acutely ill. There was slight sclerosis of the retinal arteries. The liver was palpable about 1 centimeter below the costal margin and the spleen was enlarged to 3 centimeters below the costal margin and was firm and nontender.

Blood findings are shown in Table III and Figure 5. It can be observed that there was a marked progressive drop in the total white blood cell count, especially of the neutrophils but also of the lymphocytes. Sternal marrow biopsy was done and imprint smears showed an active marrow. The differential count on Wright stained imprint smears was neutrophils 22 per cent, eosinophiles 42 per cent, basophiles 02 per cent, unsegmented neutrophils 124 per cent, metamyelocytes 110 per cent, myelocytes 216 per cent, myeloblasts 14 per cent, lymphocytes 106 per cent, monocytes 02 per cent, normoblasts 268 per cent, erythroblasts 70 per cent, megaloblasts 0, and plasma cells 24 per cent. The granulocyte nucleated red cell ratio was 157

100. Fixed tissue sections of sternal marrow showed increased cellularity, with both erythrocytic and granulocytic cells participating. There appeared to be an increased number of eosinophiles present. The blood platelet count was 134,800, the bleeding time 2 minutes, and the clotting time 4 minutes with normal clot retraction. The prothrombin content (Quick's method) was 78 per cent of normal, the icterus index 3 units, the reticulocyte count 02 per cent, and the hematocrit 42 per cent. A diagnosis of primary splenic panhematopenia was made in which it was noted that the granulocytic series of white cells was particularly involved. Splenectomy was recommended. Preceding operation the temperature slowly rose until the day before operation it reached 40.2 degrees C.

Splenectomy was performed on July 19, 1945. At operation the spleen was found to be adherent to the diaphragm and was removed with some difficulty. During the operation considerable hemorrhage took place. The patient received 1000 milliliters of citrated whole blood during and immediately following the operation. The spleen weighed 575 grams and measured 20 by 12 by 5 centimeters. Supravital preparations (Janus green and neutral

cytes or neutrophils. These were not numerous and only a few could be found on prolonged search. There was an increased number of eosinophils present. Wright stained imprint of splenic tissue revealed an occasional very large phagocytic cell containing one or more neutrophils, erythrocytes, or nucleated red cell. These were not numerous and only 3 or 4 were found on prolonged search. Fixed tissue sections were not striking. No phagocytic cells could be seen. The germinal centers of the follicles appeared to have been "washed out" and contained fewer cells than normally seen. The final diagnosis was moderate hyperplasia of the spleen. The patient's postoperative convalescence was uncomplicated, and she was discharged on her 12th postoperative day. Hematologic findings, before and after operation, are recorded in Table V.

These patients presented the findings described by Doan (2) as occurring in primary splenic panhematopenia. Neutropenia, anemia, and thrombocytopenia occurred in all patients and varied from mild to severe. Splenomegaly was constantly present, but variable in degree. Purpura was observed, depending upon the degree of thrombocytopenia. Oral ulcerations were present in 1 patient and chronic ulcers on the legs of another patient, both of whom had severe, and presumably chronic, neutropenia. Mild jaundice occurred in only 1 of the 7 patients. The bone marrow was hyperplastic in all instances.

Examination of the spleen, in all instances, and an autopsy performed on 1 patient, did not reveal the presence of any other disease that might have accounted for the hematologic disturbance. There was no suggestion that leukemia or other diseases of the lymphoblastoma group were present. Findings characteristic of Banti's disease, Gaucher's disease, or Still's disease were not present. The histologic picture was not characteristic or specific, and generally no more than mild follicular hyperplasia could be demonstrated.

These patients also demonstrated certain characteristics which were somewhat unexpected. In spite of moderate or severe anemia, reticulocytosis was absent, except in 1 patient, E. D. Occurrence of reticulocytosis after splenectomy would tend to have been obscured, if present, by blood transfusions given at the time of operation.

The absence of visible jaundice, little or no elevation of the icterus index, and no increase of urinary urobilinogen were also notable

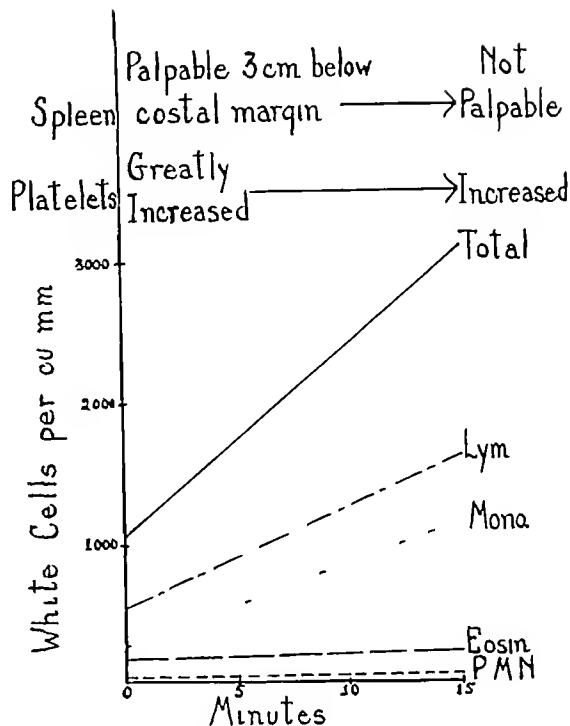


Fig 6 Patient A F Adrenalin test

With the exception of 1 patient, E. D., who also demonstrated reticulocytosis, the usual evidence of hemolysis was absent even in patients with severe anemia. Since fecal urobilinogen studies were not made on these patients, it cannot be said that conclusive proof against increased production of bile pigments has been offered. It is conceivable that even with excessive production of bile pigment due to rapid breakdown of erythrocytes, the liver was able always to clear the blood stream and prevent jaundice. In such a case, it must be presumed that the increased amount of urobilinogen was excreted entirely in the feces and not at all in the urine. That such a condition existed in all these patients seems unlikely, even though possible.

Because of these findings, it seems obvious that the anemia in these patients was not clearly hemolytic in origin and is not comparable to congenital hemolytic anemia. The most outstanding difference between the anemia of congenital hemolytic anemia and that of primary splenic panhematopenia, however, is the constant presence of spherocytosis in

TABLE V—PATIENT A F HEMATOLOGIC DATA BEFORE AND AFTER SPLENECTOMY AND FOLLOW-UP

Date	RBC $\times 10^6$ per c.mm	Hgb gm per 100 ml	WBC per per c.mm	Differential per c.mm				Plat $\times 10^3$ per c.mm	Hemt %	Ret %	Icter index unit
				Neut	Lymp	Mono	Eos				
3 3 47	4 75	13.4	1 900	57	988	494	228	269 6	41	1 -	0
3 8-47	Splenectomy 500 ml citrated blood transfusion										
3 9-47			9 650	6 948	337	1 968	48				
3 10-47	4 37	12.4	10 900	4 850	1 199	2 343	436	399 9			
3 11 47			8 800	4 532	748	704	836				
3 12 47			7 100	4 544	994	639	639				
3 13 47			7 100	4 402	1 278	407	639				
3 14 47			6 000	3 300	1 560	420	480				
3 15 47			7 900	3 318	2 765	637	711				
3 18-47			4 200	2 268	1 092	546	210				
3 19 47			7 650	3 748	2 065	1 147	459				
3 20-47	Discharged from hospital										
4 1 47	4 38	13.4	6,400	2 848	2 112	1 056	256	Inc *			
5 1 47	4 72	14.0	5 700	2 679	1 795	1 083	57	Inc *			
8- 8-47			5 600	2 194	2 800	504	112	Adeq *			

\*Inc is increased numbers of platelets Adeq \* is adequate number

the former and its constant absence in the latter disease. The usual patient with congenital hemolytic anemia exhibits leucocytosis and thrombocytosis at the time of crisis, unlike the patients in this series. Reticulocytosis, jaundice, and an increase in urinary urobilinogen are likewise common, if not constant, findings in congenital hemolytic anemia.

Idiopathic thrombocytopenic purpura also differs in certain characteristics from primary splenic panhematopenia. Splenomegaly is notably absent. There is no alteration in the erythrocytes unless hemorrhage has occurred. A leucopenia, but not specifically neutropenia, exists in some cases, although leucocytosis may be present if hemorrhage has occurred. Even so, it might be conceivable that idiopathic thrombocytopenic purpura could represent an instance of primary splenic panhematopenia in which the destructive action of the spleen was selective for platelets alone and in which enlargement of the spleen does not occur. In idiopathic thrombocytopenic purpura, however, specific changes are seen in the megakaryocytes which were not seen in any of these patients and have not been reported by others.

Failure to demonstrate excessive phagocytosis in the spleens of these patients after careful study of supravital, Wright stained and fixed tissue preparations makes it doubtful that phagocytosis is the mechanism responsible for the production of primary splenic panhematopenia. Other authors (6) have likewise commented on their inability to demonstrate phagocytosis. Moore and Bierbaum were able to demonstrate it in 1 of 3 cases.

A tendency for a delayed leucocyte response in certain of these patients, especially M. and H. H., with a slow return toward normal over a period of many months was also noted. If excessive phagocytosis occurring solely in the spleen, was responsible for the occurrence of the hematologic disorder, it would be reasonable to expect that splenectomy would produce an immediate, persistent, and complete return of the hematologic picture to normal. Indeed, if the spleen is the sole organ concerned in the production of the disease whatever the mechanism, such an immediate complete response might be expected. The abrupt return to normal in patients with congenital hemolytic anemia and in some cases of idiopathic thrombocytopenic purpura for

lowing splenectomy is well known, although it is not uncommon to observe a gradual, rather than abrupt, increase in platelets following splenectomy in cases of thrombocytopenic purpura

In our experience, the epinephrine test has not been of aid in the diagnosis or interpretation of the mechanism of this syndrome. The rise in leucocyte count following the administration of epinephrine is the result of the appearance of increased numbers of lymphocytes in the peripheral blood, with little change in the number of polymorphonuclear neutrophils. The change in erythrocyte, hemoglobin, and platelet levels (not recorded in the charts) has been too small to be subject to interpretation, and similar changes have been observed in normal individuals and even in individuals who have undergone splenectomy. These findings, coupled with failure to find increased numbers of myeloid cells in the spleen, either free or phagocytized, make it more doubtful that sequestration and phagocytosis of cells in the spleen can be considered the primary mechanism of the syndrome.

The role of the spleen in this disease is, therefore, not clearly defined at this time, especially if patients with this syndrome continue to show absence of excessive phagocytosis. An alternative explanation, which seems to us to be better correlated with the findings, is that the spleen has a regulatory effect on bone marrow as proposed by Dameshek in idiopathic thrombocytopenic purpura. The anemia, not clearly hemolytic, may be the result of failure of proper discharge of erythrocytes from the marrow. The presence of neutropenia and thrombocytopenia could be explained, likewise, on the basis of suppression of discharge of these elements from the marrow. Direct proof, however, of such a mechanism is lacking at this time. Ungar (8) has demonstrated an endocrine-like relationship between the pituitary and the spleen in protein metabolism and claims to have isolated from the spleen a pure crystalline material which is responsible for this effect. Singer, Miller, and Dameshek likewise have claimed to demonstrate that lysolecithin, produced by the spleen, has a regulatory effect on erythro-

cytes. Further study is necessary to determine whether the hematologic findings in primary splenic panhematopenia might be the result of a similar regulatory mechanism.

#### SUMMARY

1 Seven patients are described with the clinical and laboratory findings characteristic of primary splenic panhematopenia. After splenectomy 1 patient died, the 6 others were markedly improved.

2 Jaundice, urobilinogenuria and reticulocytosis were not as evident as would have been expected if the anemia was of a simple hemolytic nature.

3 Following splenectomy, hematologic improvement tended to be gradual and prolonged rather than immediate and complete.

4 Excessive phagocytosis of myeloid elements could not be demonstrated in the spleens of these 7 patients.

5 Examination of the spleens in all instances, and one autopsy, did not reveal the presence of any known disease. The spleens were enlarged and generally showed varying degrees of follicular hyperplasia. In only 1 patient was there an increase of myeloid elements in the splenic pulp.

6 It is questionable that congenital hemolytic anemia and idiopathic thrombocytopenic purpura are members of this syndrome.

7 Since excessive phagocytosis could not be demonstrated in these patients, it is suggested that some regulatory action of the spleen on bone marrow may be the mechanism responsible for the hematologic disorder.

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# EDITORIALS

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## SURGERY Gynecology and Obstetrics

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JULY, 1949

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### THE INDICATIONS FOR HYSTERECTOMY

THE word hysterectomy is derived from the Greek,—*Hyster*a, uterus and *Ectome*, excision. Therefore, it means excision of the uterus. This term is applied to the uterus alone and does not include the tubes and ovaries. If the oviducts and ovaries are also removed, the term hysterectomy must be followed by unilateral—right or left, bilateral salpingo-oophorectomy, or hysterosalpingo-oophorectomy. Hysterectomy may be total or subtotal, and may be performed for either malignant or benign disease of the uterus and adnexa. Synonyms for total hysterectomy are complete hysterectomy and panhysterectomy, while those for subtotal hysterectomy are partial, supravaginal, supracervical and fundic hysterectomy. The extirpation of the uterus may be performed through the abdomen—abdominal hysterectomy, or through the vagina—vaginal hysterectomy.

Carcinoma of the uterus, cervix or corpus, sarcoma of the uterus and chorionepithelioma are the malignant diseases for which hysterectomy is generally indicated. In the presence of malignant disease the total operation is always performed and should be accompanied by the ablation of the adnexa, because of the frequent metastases to these structures. While the majority of carcinomas of the cervix uteri are treated by radium and high voltage x-ray, the radical abdominal panhysterectomy, commonly referred to as the Wertheim operation, is reserved, by some surgeons, for malignant disease of the cervix uteri in certain group I and group II cases, League of Nations classification. This intervention consists of the suppression of the entire uterus, the tubes, the ovaries, the pelvic connective tissue after dissection of the ureters, the vagina almost entirely, and the obturator and iliac glands. The radical vaginal hysterectomy, proposed by Schauta for the same indication, namely malignant disease of the cervix, does not afford as satisfactory exposure as does the abdominal intervention and has, therefore, never acquired the popularity of the latter among the majority of pelvic surgeons.

In the treatment of malignant disease of the corpus uteri, such as carcinoma, adenocanthoma and chorionepithelioma, radium or high voltage x-ray should be applied, and, in the course of five to six weeks this should be followed by a panhysterectomy and bilateral salpingo-oophorectomy. Exposure to radium or x-ray so modifies or eliminates the carcinomatous cells that their implantation elsewhere at the time of operation is greatly reduced or totally prevented. In sarcoma of the uterus radium or x-ray are not employed because

these agents have very little effect on this type of tumor, but the total hysterectomy with the excision of the adnexa should be performed as soon as the diagnosis is established. Malignant neoplastic disease of the oviducts and ovaries demands the total removal of the uterus with the pathological adnexa.

The indications for hysterectomy for benign disease are fibromyoma, the most common indication, uterine prolapse when it is accompanied by uterine bleeding or when the uterus is pathological,—vaginal hysterectomy, inversion of the uterus, when gangrene and infection have set in, myometrial hypertrophy associated with hyperplasia of the endometrium and hemorrhage, cesarean hysterectomy, in the presence of fibromyomas, infection, and hemorrhage, pelvic inflammatory disease, specific, tuberculous and puerperal, when the involvement of these structures is marked, and in endometriosis, interna and externa, when the pathology is extensive and cannot be treated by conservative measures. When hysterectomy is performed for benign uterine disease, the adnexa are removed if pathological, and conserved, as a rule, if normal.

In myometrial hypertrophy with endometrial hyperplasia and hemorrhage, and in certain intramural fibromyomas, which in size are not larger than a three month gestation, hysterectomy enters into competition with irradiation by means of radium or high voltage x-ray. Irradiation will control the bleeding, and the small fibromyomas will regress after this form of therapy, but the organs remaining *in situ* may be the seat of carcinoma of the uterus or ovaries a number of years later—fifteen years from my observation. Irradiation in the treatment of these conditions is a valuable procedure in the poor surgical risk, in one whose physical condition precludes the performance of an operation so extensive as a hysterectomy, but, when there is no con-

traindication, hysterectomy, with or without the ablation of the adnexa, as the case may be, shows a certain superiority over irradiation since it insures the patient against future disorders of these organs.

The question of total versus subtotal hysterectomy is still unsettled. The literature of the past two decades definitely shows that an increasing number of surgeons are performing the complete operation as routine, and reserving the subtotal operation for special conditions, this being a complete reversal of the opinions of a half a century ago. The advantages of the total over the subtotal hysterectomy are absolute prophylaxis against carcinoma of the cervical stump, protection against benign tumors of the cervix, such as cervical fibromyomas, the avoidance of the so called bleeding cervix from benign causes, and the prevention of an annoying leucorrhea which frequently originates in the cervix after the suppression of the uterine corpus. The disadvantages are said to be the operation is more difficult of execution, the operative mortality and morbidity are higher, the danger of injury to the bladder and ureters is greater, and finally the vagina is shortened. However, it has been proved by statistics, that in the hands of surgeons well trained in the performance of this operation, the mortality and morbidity of panhysterectomy need not be greater than that of subtotal hysterectomy, and that also, in the hands of surgeons so trained, injuries to the bladder and ureters are uncommon. The shortening of the vagina need be but very slight if the vagina is cut close to the cervix, and after its closure, it is well supported by the fascia endopelvina, aided by the round and uterosacral ligaments. An increasingly large number of operators are of the opinion that the advantages overbalance the disadvantages of the complete operation.

LOUIS E. PHANEUF



## VAGINAL HYSTERECTOMY

THE removal of the uterus by the vaginal route is an operation of considerable age, in spite of what one might judge from the discussions at gynecological assemblies. Probably no operation has had as many "ups and downs" as has vaginal hysterectomy. Preceding the introduction of aseptic technique, the mortality following the abdominal removal of pelvic tumors was so high that it was performed only under the greatest urgency. At a meeting of the American Gynecological Society in 1880 a series of 119 abdominal hysterectomies for fibroids was reported with a mortality of 64 per cent. At the 1886 meeting, it was stated that abdominal hysterectomy was so highly dangerous that it was rarely warranted.

In 1876 Czerny revived the vaginal hysterectomy technique of Souter of Constance, and it rapidly came into vogue both in Europe and in this country, and abdominal hysterectomy was performed but rarely. Large series of vaginal hysterectomies were reported from all medical centers. Great dexterity in technique was developed so that even large fibroids were removed by morcellation, and both ovarian and uterine tumors, even complicated by inflammation of the appendages, were removed vaginally with far greater safety than by the abdominal route. In 1884 Mundé stated that the day following a vaginal hysterectomy for cancer lasting two hours, the patient usually appeared no worse than if she had been delivered of child.

When at the end of the last century aseptic surgery became perfected, the abdomen was entered with relative safety. Gynecologists largely deserted the vaginal attack on pelvic disease and entered the abdomen, so that in addition to doing the indicated surgery, they might also remove the chronic appendix. They

learned about cecum mobile, Jackson's membrane, Lane's kink, and devised procedures for their attention, and they shortened the mesentery of the colon, if it appeared longer than pleased them. Meddling minds found much to do. Follicular cysts were punctured or cauterized, and if no cysts were present, the ovaries were resected if the patient menstruated too much or too little. In most clinics vaginal hysterectomy was abandoned entirely and a generation of gynecologists grew up totally unacquainted with the vaginal approach to pelvic disease. As well known a gynecologist as Floyd Keene of Philadelphia, the head of a large and important teaching unit, lived and died without ever performing a single vaginal hysterectomy nor did he ever see his former chief, John Clark, do one. In only a few centers in this country was the operation performed, though it still survived in the German clinics.

American gynecologists, spending their residencies in Germany, were impressed with the easy recoveries of the patients operated upon vaginally as compared to the convalescences of patients operated upon abdominally, and upon their return reintroduced vaginal surgery to American gynecology. The mortality after vaginal hysterectomy, under comparable conditions, is much lower than after abdominal hysterectomy. A shorter period of anesthesia is required. Shock is extremely rare. Vomiting and gas pains are much less severe. Bowel obstruction is very unusual. Paralytic ileus hardly ever occurs. Bleeding from the vaginal hysterectomy itself is usually less than from an abdominal incision alone. The patient is not so sick and the hospital stay much shorter. The period of convalescence is not so protracted and the patient may resume her usual duties in a much shorter time. Postoperative hernia and eventration are, of course, unknown.

Now that we know that chronic appendicitis is largely mythical and the procedures accessory to an abdominal hysterectomy are frequently harmful and meddlesome, it is high time that vaginal hysterectomy assumes its rightful place in gynecology. It is interesting to note how those who persist in perfecting themselves in the technique of vaginal hysterectomy gradually disregard more and more of the contraindications so insistently laid down by those with little or no familiarity with the operation. When the operator's technique is finally perfected, he finds it easier to remove the uterus through a nulliparous or virginal pelvis, if the vaginal vault is ordinarily capacious and is not constricted or infantile, than if relaxation is considerable.

Under certain conditions, a vaginal hysterectomy is strictly indicated and no other procedure is even a passable substitute. A young woman, for example, under thirty-five has an uncontrollable menorrhagia. She has had several curettements with only temporary or no relief. All styptics have failed and all the directions of the endocrine wizards have been conscientiously but unsuccessfully followed. The patient is extremely obese or is otherwise a poor operative risk, and an abdominal hysterectomy would be extremely hazardous. Under these conditions radium is ordinarily administered. The patient's menorrhagia will be relieved, but the annoyances of

the menopause will be added to her already long list of complaints. Estrogens cannot be safely given and the patient may later have the delayed effects of the radium. Under these circumstances a vaginal hysterectomy might very safely be performed, I have never yet substituted radium therapy in a patient in whom vaginal hysterectomy is indicated. However, if one is to confine the use of vaginal hysterectomy to only such patients as present absolute indications, he will not have the necessary dexterity to operate upon such patients when the necessity arises. The Kjelland forceps is frequently a fetal life saver. If the obstetrician does not familiarize himself with its use as mid and low forceps, where it is not necessary, he will not know one blade from the other when great familiarity is necessary for the occasional case in which it is strictly indicated.

Is a gynecologist competent when he gives radium to a patient who really needs a vaginal hysterectomy because he is not able to do the particular operation that is indicated? Is a man a specialist, in a field as restricted as is gynecology, unless he can do the special operations applicable to that province? Particularly, would one expect that, when a surgeon is certified by an examining board which limits the area of his activities, he would be able to perform every operation peculiar to his restricted sphere?

N SPROAT HEANEY



*ANDREAS VESALIUS*

Bruxellensis

*Invictissimi Caroli V Imperatoris Medicus*

Vesalius demonstrating the muscles of the upper extremity, title page, *Opera Omnia* of Boerhaave and Albinus, 1725

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## THE BOOK SHELF

### ANATOMICAL TABULAE AND INITIAL LETTERS IN VESALIUS' FABRICA AND IN IMITATIVE WORKS

BARRY J ANSON, Ph D (Med Sci), Chicago, Illinois

#### I VESALIUS' CENTURY

THE sixteenth century was marked by exuberant achievements in all fields of human endeavor. This was the century of William Shakespeare (Fig 1), Francois Rabelais (Fig 2), Sir Thomas More (Fig 3), Francis Bacon (Fig 4), Galileo Galilei (Fig 5), and of Girolamo Fracastoro, Leonardo da Vinci (Fig 6) and Ambroise Paré (Fig 7), of John Calvin (Fig 8) and Martin Luther (Fig 9), of Miguel de Cervantes (Fig 10), Sir Francis Drake (Fig 11) and Sir Walter Raleigh, of Henry VIII of England (Fig 12) and Henry II of France. It was the age of Giovanni Marinello, Carlo Ruini, Niccolo Machiavelli, Hans Holbein, Guilelmus Rondeletius, Richard Hakluyt, Nicolas Monardes, Tiziano Vecellio, Ulysses Aldrovandi, Benvenuto Cellini, and Albrecht Durer.

To Shakespeare we owe the robust humor of Falstaff and the ethereal plaint of Ophelia, the macabre intrigue of Macbeth and the whimsy and prank of Puck and Bottom, the reverie of Juliet and the stratagem of Caesar, the gemmy beauty of Cleopatra and the sinister hideousness of three witches. Comparably, Francois Rabelais excelled

as a story teller, as did Sir Thomas More and Francis Bacon in the fields of statecraft and philosophy. Galileo Galilei found a magnetic core for the Earth, and Leonardo da Vinci and Tiziano Vecellio painted masterpieces, to fasten wings of glorious hope on mankind's concepts of heavenly aspiration. Ambroise Paré, surgeon to four successive kings of France, not only spread new knowledge of surgery, but also wrote expansively of his journeys with the armies of the French kings. Girolamo Fracastoro, in his treatise of contagion, set forth a prevision of infection by micro-organisms. Martin Luther and John Calvin liberated religion from hierarchic domination. While the churchmen brought clerical balm to the soul, Giovanni Marinello, with mundane practicality, laid the groundwork for epidermal rehabilitation in his volume on cosmetics, perfume, and hair-dyes. Aware of the importance of cavalry in the game of war, Carlo Ruini prepared an illustrated treatise on the anatomy of the horse. Niccolo Machiavelli codified military and diplomatic methods and practices for the guidance of aggressive monarchs. Keeping pace with the expansion of ambitious nations, Johann Huttichius compiled his collection of voyages and discoveries in the New World, and Richard Hakluyt published his account of the principal navigations of the English nation. In the field of zoology Guilelmus Rondeletius wrote on the subject of fishes, and in that of botany Nicolas Monardes described therapeutically the "rare and singular virtues" of the herbs, trees, oils and stones brought from America. The biological sphere was further widened by the contents of folios, from the hand of Ulysses Aldrovandi, on various aspects of natural history, including the occurrence of human monsters. Benvenuto Cellini worked exquisitely with precious stones and metals, while Albrecht Dürer excelled in the handling of wood engravings.

The First Brödel Memorial Lecture read at the Chicago (September 1948) meeting of the Association of Medical Illustrators. More than a half century ago (1894) Max Brödel came to Baltimore, from Leipzig at the behest of Dr. Franklin P. Mall for an immediate association with Dr. Howard A. Kelly and later with Drs. Thomas S. Cullen and William S. Halsted and their eminent colleagues.

Mr. Brödel was an enemy of plagiarism—against which larcenous practice Vesalius had inveighed and the malignant abuses of which he had suffered deeply. Aware of the fact that sometimes larceny is a way of taking what one cannot create and recognizing that medical pictures were being done by artists untrained and therefore inescapably dependent upon predecessors, Mr. Brödel established the first department of art as applied to medicine.

For biographical material dealing with the life and achievements of Mr. Brödel the reader is referred to the following articles: *J Am M Ass* vol 110 no 11 March 12 1938 pp 817-818 p 823; *ibid* vol 117 vol 9 August 30 1941 pp 668-67; *Bull Med Libr Ass* vol 33 no 1 Jan 1945 pp 6-9.



William Shakespeare (1564-1616)



Francois Rabelais (1490-1553)



Sir Thomas More (1480-1535)



Francis Bacon (1561-1626)



Galileo Galilei (1564-1642)



Leonardo da Vinci (1452-1519)

Fig. 1 to 6. Illustration of some of the great men of the 16th century.



Ambroise Paré (1510-1590)



John Calvin (1509-1564)



Martin Luther (1483-1546)



Miguel de Cervantés (1547-1616)



Sir Francis Drake (1540-1596)



Henry VIII (1491-1547)

Figs 7 to 12 Personnages, sixteenth century, continued

of productive skill. The artists in particular found outlet for their fervor in preparation of magnificent illustrations for those of their contemporaries who labored in the biological sciences. Briefly, there were playwrights, play-actors and essayists, inquisitive ecclesiastics and searching scientists, conquerors and chroniclers, monarchs and monastics, artists and artisans, political planners and pietistic pieceworkers.

It would have been strange, indeed, had this surge of creative force failed to inspire some inquisitive and sagacious scholar to unriddle the mystery of human fabric. Men were now thinking with anthropocentric bias, and the ultimate product of Nature's perfect contriving could not be long neglected. Appropriately, the study of

man was lifted to a station of suitable loftiness in the folio treatise of Andreas Vesalius.

## 2 PRIMITIVE ANATOMIC FIGURES<sup>1</sup>

Only when the early books, antecedent to, or contemporaneous with, the appearance of the

<sup>1</sup>Almost all of the anatomic illustrations reproduced herein were photographed from the original works in the Archibald Church Library of Northwestern University Medical School. However, for material from manuscripts and incunabula the writer was dependent chiefly upon the following sources: *History and Bibliography of Anatomic Illustration* Ludwig Choulard (transl. and ed. Mortimer Frank) Chicago University of Chicago Press 1920. *Atlas of the History of Medicine Anatomy*, J. G. De Lint. New York. Paul B. Hoeber, 1926.

The pictures of personages (Figs. 1 to 12) were copied from the following source-books: *Portraits of Illustrious Personages of Great Britain* London Printing and Publishing Co. *Imperial Dictionary of Universal Biography* Glasgow William Mackenzie.

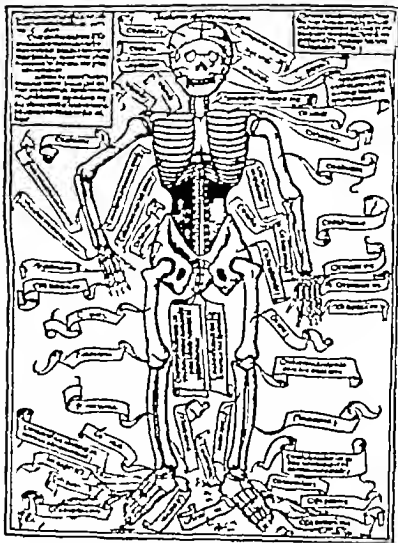


Fig. 13



Fig. 14

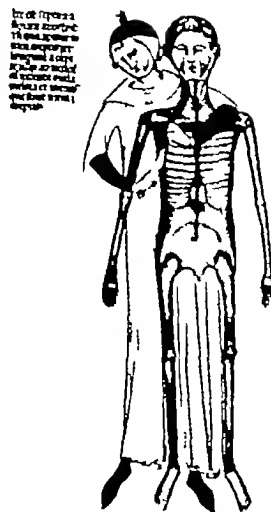


Fig. 15

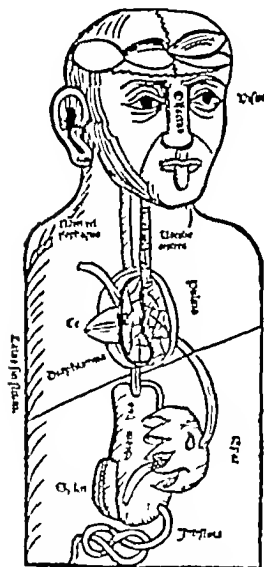


Fig. 16

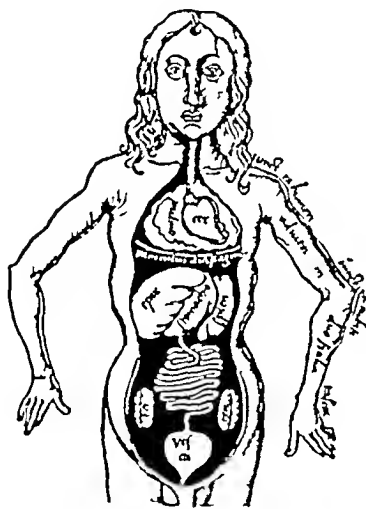


Fig. 17

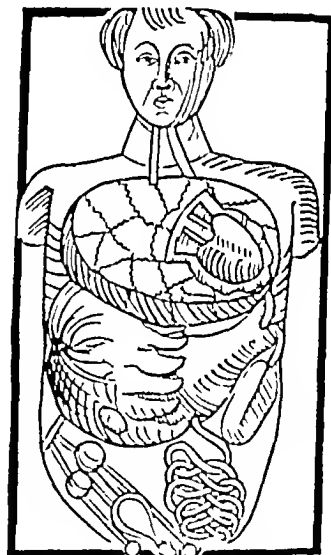


Fig. 18

Figs. 13 to 18 Primitive anatomic illustrations

Fig. 13 The Nuremberg skeleton (Richard Helwig published in 1493)

Fig. 14 Skull from Charles Estienne (*De Dissectione Peritum Corpus Humanum Libri Tres* 1545)

Fig. 15 Thoracic dissection from the *Anatomia* of Guido de Vigevano (1478)

Fig. 16 Thoracic and abdominal viscera and cerebral

ventricles, from Johann Peuvig's *Philosophia Naturalis Compendium* (1499)

Fig. 17 Viscera from Gregor Reisch's *Margarita Philosophica* (Johann Schott 1503)

Fig. 18 Visceral figure from Magnus Hundt's *Antropologia de Homine Dignitate Naturae et Proprietatibus* (1501)

*Fabrica* are examined does the excellence of the Vesalian figures become impressive. If morphology Vesalius torches us would be referred to the Nuremberg plate which played

the bones articulated and named in bannered labels (Fig. 13) or to some equally primitive representation of man's supportive framework. Details would later have been supplied by the

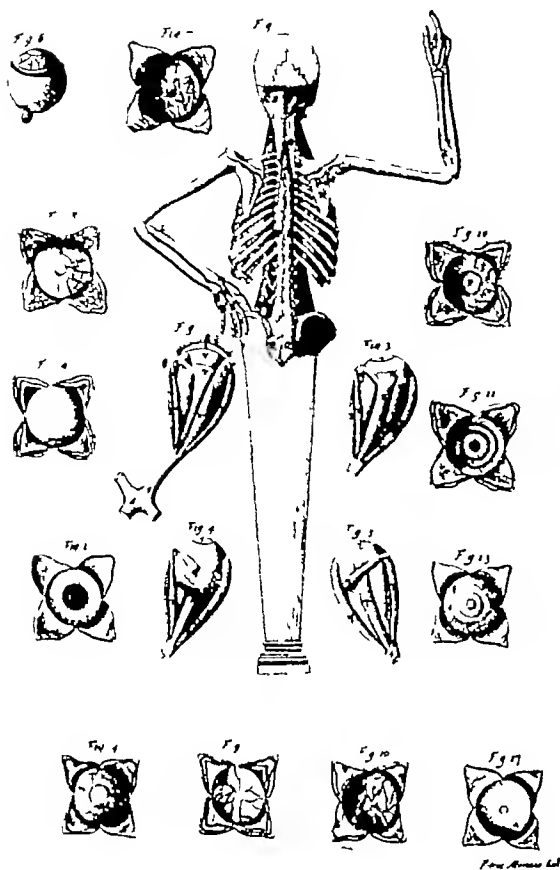


Fig 19

figures of Charles Estienne (Fig 14), whose lengthy folio, *De Dissectione Partium Corporis Humani, Libri Tres*, was published in 1545. For the dissector, recourse could have been made to the work of Guido de Vigevano, which recorded successive anatomic levels in serial lamination, pictured a method of anatomizing the cadaver (Fig 15), and made such fabulous additions to human anatomy as the seven-celled uterus. Other writers stressed the configuration and topography of the thoracic and abdominal organs, and the disposition of the ventricular spaces within the brain. For example, in the visceral figure from Peylgh's *Philosophia Naturalis* (1499), the morphology of the brain and of the thoracic and abdominal organs, is handled in stylized fashion (Fig 16). The cerebral ventricles are superimposed upon a calvarium. Pulmonary and coronary anatomy is diagrammatized, the lungs and heart lie cranial to an oblique line which repre-

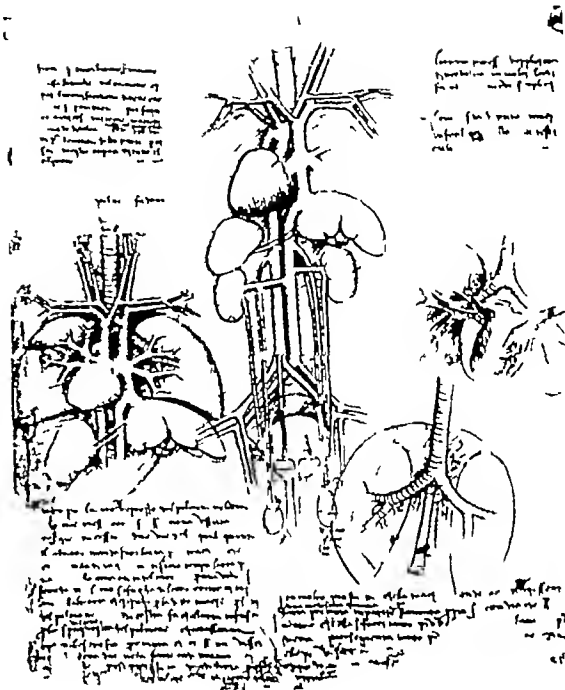


Fig 20

Figs 19 and 20 Illustrations from works by Vesalius' contemporaries

Fig 19 Plate from the *Tabulae Anatomicae* of Bartolomeo Eustachio (Venice, 1749)

Fig 20 Sketches by Leonardo da Vinci

sents the diaphragm. The gourd-shaped stomach is clasped on one side by a flattened spleen, on the other by a crenate liver, an abbreviated intestine is tied in a lover's knot. Equally rude is the visceral figure from Hundt's *Antropologium*, published in 1501 (Fig 18), and the comparable illustration from Reisch's *Margarita Philosophica*, which appeared in 1503 (Fig 17). In Reisch's illustration (Fig 17), as in Peylgh's (Fig 16), the various labels are placed upon or near the structures. In the picture from Reisch's work (Fig 17), the liver (labelled *epar*), the stomach, and the spleen are of more natural form, yet, curiously (perhaps through the delineator's error), the small intestine, shown uncoiled but neatly piled, opens into the urinary bladder (*vesica*). The reader views the body from the front, not as in Reisch's picture, wherein the head is revolved to face the specimen's back (Fig 16). In the illustration from Hundt's *Antropologium*, the heart is merely superimposed upon the lungs (Fig 18), a relatively enormous liver, with crenate border, clasps a gourd-shaped stomach, the latter is connected with the spleen by a "duct" which is quite as



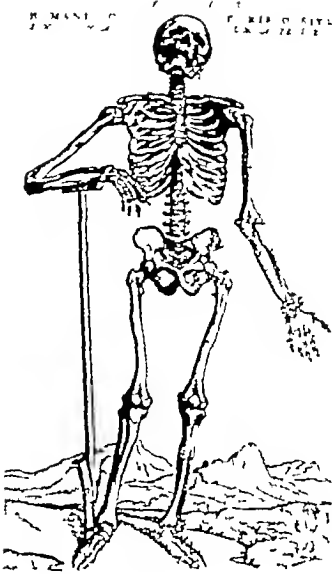


Fig. 21

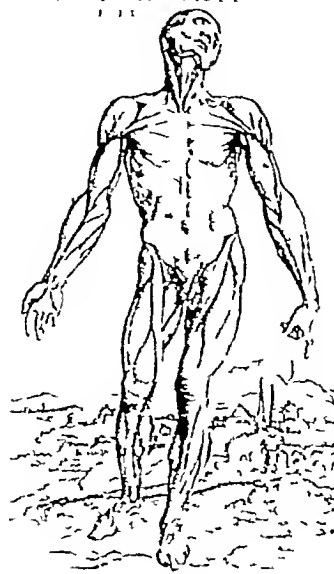


Fig. 22

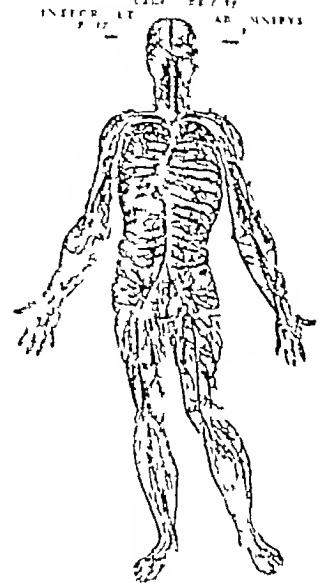


Fig. 23

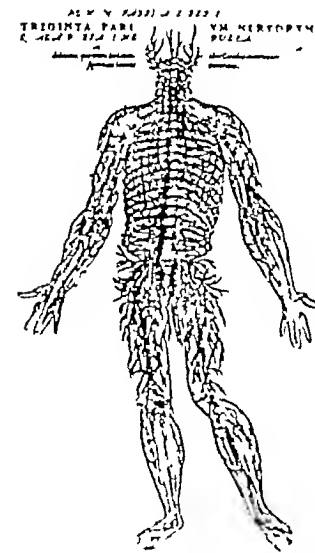


Fig. 24

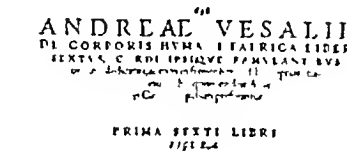


Fig. 25

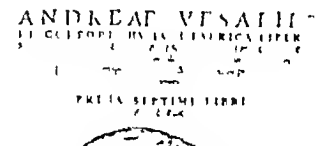


Fig. 26

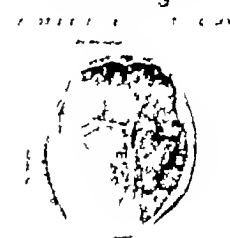
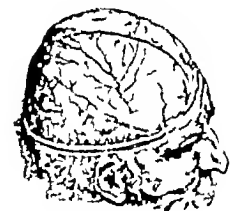
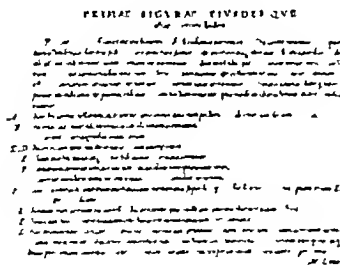
Fig. 21 to 26. Plates from the 1553 edition of Vesalius' *De Corporis Humani Fabrica Libri Septem*

Fig. 21 The skeleton in ventral view

Fig. 22 The musculature viewed from the front

Fig. 23 Superior and inferior cavities and their contents

Fig. 24 The nerves in dorsal view

Fig. 25 Contents of the thoracic cavity

Fig. 26 The brain and the calvarium

prominent is the esophagus (cf. Fig. 16, labeled *oesophagus*). Not content with a short jejunum tied in a single knot, or with one

like a hose, the artist puts the small intestine into a serial interlacement. The kidneys and ureters are conveniently displayed, the urinary bladder

These were the pictorial heritage of the sixteenth century, they were derived from the text of Galen of the second century, repeated by Rhazes in the tenth. To the scholars of ancient Greece, and imperial Rome, to the clergy of the crusading Church, and to the valiant and acquisitive conquerors and colonizers of the New World, the body of man remained an unexplored microcosm. However, before the sixteenth century had reached its fifth decade, ambitious study had been pursued with such renascent vigor that several great volumes on human anatomy had been either completed or planned.



Fig 27 Initial letter, from a manuscript copy of the works of Galen

Actually, four renowned anatomists of the period were engaged in original anatomical investigations Giovanni Canani, whose fasciculus of

gmeny mnyamny conmyeny nymby, & M fulya columeyno-  
nym mnyamny mnyfymym, dym dym & fymym nym  
propym, ucy nym dym bemybm  
propym.



1. *La prima* è la *teoria della relatività* di Einstein, che ha rivoluzionato la nostra comprensione dello spazio e del tempo, dimostrando che non sono assoluti ma dipendono dall'osservatore.

2. *La seconda* è la *teoria della gravitazione universale* di Newton, che ha spiegato come la gravità agisca su tutti i corpi celesti e terrestri.

3. *La terza* è la *teoria della meccanica quantistica*, che ha introdotto il concetto di probabilità e di dualità onda-particella.

4. *La quarta* è la *teoria della relatività speciale*, che ha mostrato che la velocità della luce è costante in tutti i sistemi di riferimento.

5. *La quinta* è la *teoria della relatività generale*, che ha esteso la relatività speciale includendo la gravitazione.

6. *La sesta* è la *teoria della meccanica classica*, che descrive il movimento degli oggetti macroscopici.

7. *La settima* è la *teoria della termodinamica*, che studia le leggi che governano il calore e l'energia.

8. *La ottava* è la *teoria della elettromagnetismo*, che unifica l'elettricità e il magnetismo.

9. *La nona* è la *teoria della fluidodinamica*, che descrive il movimento dei fluidi.

10. *La decima* è la *teoria della acustica*, che studia le onde sonore e la loro propagazione.

11. *La undicesima* è la *teoria della ottica*, che descrive la natura della luce e la sua interazione con la materia.

12. *La dodicesima* è la *teoria della meteorologia*, che studia i fenomeni atmosferici e il clima.

13. *La tredicesima* è la *teoria della geologia*, che studia la struttura e l'evoluzione della Terra.

14. *La quattordicesima* è la *teoria della biologia*, che studia la vita e i processi biologici.

15. *La quindicesima* è la *teoria della chimica*, che studia la composizione e le reazioni della materia.

16. *La sedicesima* è la *teoria della fisica nucleare*, che studia le particelle subatomiche e le reazioni nucleari.

17. *La diciassettesima* è la *teoria della cosmologia*, che studia l'origine e l'evoluzione dell'universo.

18. *La diciottesima* è la *teoria della astrofisica*, che studia i corpi celesti e i fenomeni cosmici.

19. *La diciannovesima* è la *teoria della geofisica*, che studia i processi fisici all'interno della Terra.

20. *La ventesima* è la *teoria della oceanografia*, che studia l'oceano e i suoi processi.

21. *La ventunesima* è la *teoria della climatologia*, che studia il clima e i cambiamenti climatici.

22. *La ventiduesima* è la *teoria della meteorologia*, che studia i fenomeni atmosferici e il clima.

23. *La ventitreesima* è la *teoria della geologia*, che studia la struttura e l'evoluzione della Terra.

24. *La ventiquattresima* è la *teoria della biologia*, che studia la vita e i processi biologici.

25. *La venticinquesima* è la *teoria della chimica*, che studia la composizione e le reazioni della materia.

26. *La ventiseiesima* è la *teoria della fisica nucleare*, che studia le particelle subatomiche e le reazioni nucleari.

27. *La ventisettesima* è la *teoria della cosmologia*, che studia l'origine e l'evoluzione dell'universo.

28. *La ventottesima* è la *teoria della astrofisica*, che studia i corpi celesti e i fenomeni cosmici.

29. *La ventinovesima* è la *teoria della geofisica*, che studia i processi fisici all'interno della Terra.

30. *La trentesima* è la *teoria della oceanografia*, che studia l'oceano e i suoi processi.

31. *La trentunesima* è la *teoria della climatologia*, che studia il clima e i cambiamenti climatici.

32. *La trentaduesima* è la *teoria della meteorologia*, che studia i fenomeni atmosferici e il clima.

33. *La trentatreesima* è la *teoria della geologia*, che studia la struttura e l'evoluzione della Terra.

34. *La trentaquattresima* è la *teoria della biologia*, che studia la vita e i processi biologici.

35. *La trentacinquesima* è la *teoria della chimica*, che studia la composizione e le reazioni della materia.

36. *La trentaseiesima* è la *teoria della fisica nucleare*, che studia le particelle subatomiche e le reazioni nucleari.

37. *La trentasettesima* è la *teoria della cosmologia*, che studia l'origine e l'evoluzione dell'universo.

38. *La trentottesima* è la *teoria della astrofisica*, che studia i corpi celesti e i fenomeni cosmici.

39. *La trentenovesima* è la *teoria della geofisica*, che studia i processi fisici all'interno della Terra.

40. *La quarantesima* è la *teoria della oceanografia*, che studia l'oceano e i suoi processi.

41. *La quarantunesima* è la *teoria della climatologia*, che studia il clima e i cambiamenti climatici.

42. *La quarantaduesima* è la *teoria della meteorologia*, che studia i fenomeni atmosferici e il clima.

43. *La quarantatreesima* è la *teoria della geologia*, che studia la struttura e l'evoluzione della Terra.

44. *La quarantquattresima* è la *teoria della biologia*, che studia la vita e i processi biologici.

45. *La quarantacinquesima* è la *teoria della chimica*, che studia la composizione e le reazioni della materia.

46. *La quarantaseiesima* è la *teoria della fisica nucleare*, che studia le particelle subatomiche e le reazioni nucleari.

47. *La quarantasettesima* è la *teoria della cosmologia*, che studia l'origine e l'evoluzione dell'universo.

48. *La quarantottesima* è la *teoria della astrofisica*, che studia i corpi celesti e i fenomeni cosmici.

49. *La quarantanovesima* è la *teoria della geofisica*, che studia i processi fisici all'interno della Terra.

50. *La cinquantesima* è la *teoria della oceanografia*, che studia l'oceano e i suoi processi.

51. *La cinquantesima prima* è la *teoria della climatologia*, che studia il clima e i cambiamenti climatici.

52. *La cinquantesima seconda* è la *teoria della meteorologia*, che studia i fenomeni atmosferici e il clima.

53. *La cinquantesima terza* è la *teoria della geologia*, che studia la struttura e l'evoluzione della Terra.

54. *La cinquantesima quarta* è la *teoria della biologia*, che studia la vita e i processi biologici.

55. *La cinquantesima quinta* è la *teoria della chimica*, che studia la composizione e le reazioni della materia.

56. *La cinquantesima sesta* è la *teoria della fisica nucleare*, che studia le particelle subatomiche e le reazioni nucleari.

57. *La cinquantesima settima* è la *teoria della cosmologia*, che studia l'origine e l'evoluzione dell'universo.

58. *La cinquantesima ottava* è la *teoria della astrofisica*, che studia i corpi celesti e i fenomeni cosmici.

59. *La cinquantesima nona* è la *teoria della geofisica*, che studia i processi fisici all'interno della Terra.

60. *La cinquantesima decima* è la *teoria della oceanografia*, che studia l'oceano e i suoi processi.

61. *La cinquantesima undicesima* è la *teoria della climatologia*, che studia il clima e i cambiamenti climatici.

62. *La cinquantesima dodicesima* è la *teoria della meteorologia*, che studia i fenomeni atmosferici e il clima.

63. *La cinquantesima tredicesima* è la *teoria della geologia*, che studia la struttura e l'evoluzione della Terra.

64. *La cinquantesima quattordicesima* è la *teoria della biologia*, che studia la vita e i processi biologici.

65. *La cinquantesima quindicesima* è la *teoria della chimica*, che studia la composizione e le reazioni della materia.

66. *La cinquantesima sedicesima* è la *teoria della fisica nucleare*, che studia le particelle subatomiche e le reazioni nucleari.

67. *La cinquantesima sedicesima* è la *teoria della cosmologia*, che studia l'origine e l'evoluzione dell'universo.

68. *La cinquantesima diciottesima* è la *teoria della astrofisica*, che studia i corpi celesti e i fenomeni cosmici.

69. *La cinquantesima diciannovesima* è la *teoria della geofisica*, che studia i processi fisici all'interno della Terra.

70. *La cinquantesima ventesima* è la *teoria della oceanografia*, che studia l'oceano e i suoi processi.

71. *La cinquantesima ventunesima* è la *teoria della climatologia*, che studia il clima e i cambiamenti climatici.

72. *La cinquantesima ventiduesima* è la *teoria della meteorologia*, che studia i fenomeni atmosferici e il clima.

73. *La cinquantesima ventitreesima* è la *teoria della geologia*, che studia la struttura e l'evoluzione della Terra.

74. *La cinquantesima ventiquattresima* è la *teoria della biologia*, che studia la vita e i processi biologici.

75. *La cinquantesima venticinquesima* è la *teoria della chimica*, che studia la composizione e le reazioni della materia.

76. *La cinquantesima ventiseiesima* è la *teoria della fisica nucleare*, che studia le particelle subatomiche e le reazioni nucleari.

77. *La cinquantesima ventisettesima* è la *teoria della cosmologia*, che studia l'origine e l'evoluzione dell'universo.

78. *La cinquantesima ventottesima* è la *teoria della astrofisica*, che studia i corpi celesti e i fenomeni cosmici.

79. *La cinquantesima ventinovesima* è la *teoria della geofisica*, che studia i processi fisici all'interno della Terra.

80. *La cinquantesima trentesima* è la *teoria della oceanografia*, che studia l'oceano e i suoi processi.

81. *La cinquantes*

Fig 28, left Large initial letter T from the 1555 edition of Vesalius' *Fabrica* Introducing the second book (on bones and ligaments)  
Fig 29 Smaller initial letter P from the same edition Introducing chapter IX of the second book

Fig. 29 Smaller initial letter P from the same edition. Introducing chapter IX of the second book.

KUJANI FABRIC LIBEX 1A

[illegible]

## DE MYCYLIS PALPEBRARVM

Cape IX

[illegible]



Fig. 30

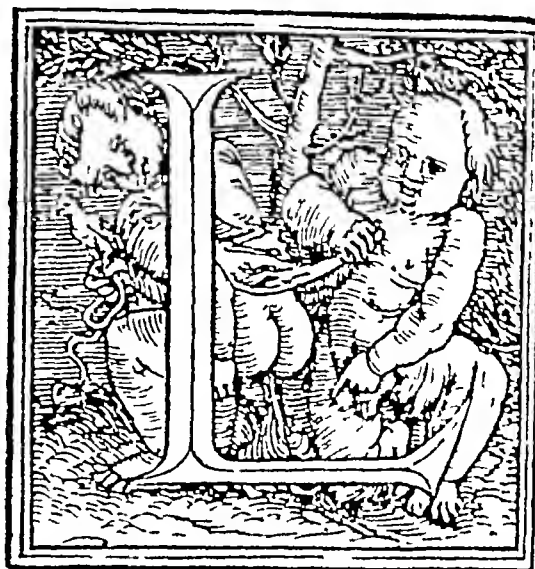


Fig. 31



Fig. 32



Fig. 33

twenty-seven muscle figures published in 1542, was later destroyed by the author himself on the conviction that his work would be inferior to that of Vesalius. Bartolomeo Eustachio whose plates long mislaid were not published until 1714 in the *Tubulae Anatomicae* (Fig. 19) Leonardo da Vinci whose sketches in Tusimile alone stand in evidence of his genius (Fig. 20) and Andreas Vesalius author of the *De Humani Corporis Fabrica* (the *School*) the most influential volume ever printed on the gross structure of the human

body. Vesalius' works in revised form were still copied two hundred years after the publication of his monumental folio.

#### 4. VESALIUS' LIFE AND WORK

In the true sense Vesalius' rise and his brilliant showering of knowledge upon posterity were meteoric in intrinsic character and in lasting effect. His own life was so brief as to be a transient luminosity but then radiated as the source of a lesser luminosity whose claim to fame did



Fig 34



Fig 35

Figs 30 to 35 Large initial letters, *Fabrica*, 1555 edition Introducing the dedication and the several books

pended upon his genius, then, indeed, does he appear as the center of a constellation (portrait, frontispiece)

Vesalius was born in Brussels on the last day of the year 1514. At an early age he matriculated in the nearby University of Louvain. For his graduate thesis he composed a paraphrase of the popular medieval compendium of medicine, the ninth book of Rhazes, to correlate the Arabic writings with those of Galen. In this endeavor he took special pleasure, since a commentary on the books of Rhazes had been prepared by his grandfather. Vesalius' father was one-time apothecary both to the Emperor Maximilian, and to his son, the Archduke Charles, and to the latter when he became Emperor Charles V of Austria.

With an inquisitiveness nurtured by careful study, Vesalius, at the age of eighteen, travelled to Paris to obtain a medical education. At the outbreak of the third Franco-German war, in 1536, Vesalius returned to the University of Louvain. Shortly after the publication of the *Paraphrasis*, Vesalius journeyed to Italy, selecting for residence the prosperous and enlightened Venice. There he practiced minor surgery and conducted public demonstrations. While there, he met Jan Stephan van Calcar, whom he subsequently selected to illustrate his magnificent works. During his stay in Venice, Vesalius prepared his own edition of Guenther's *Institutiones anatomicae* in 1538, others followed, to 1613. Of all the many commentaries on Galen's works printed during the late Renaissance, few proved

more popular than Johann Guenther's manual of four books, which had been specifically prepared for medical students. Vesalius also edited the *Opera Omnia* of Galen, with the aid of other scholars, he converted the original Greek text into readable Latin. Fourteen editions, published between 1541 and 1551, contain some of the Vesalian renderings. Such progress did Vesalius make after reaching Venice that before the year was out, on the 6th of December 1537, just before his twenty-third birthday, he received the celebrated appointment from the Venetian Senate, enabling him to teach anatomy at the University of Padua.

Before his transfer to Padua, Vesalius had, doubtless in collaboration with Calcar, begun work on six anatomical plates (*Tabulae Sex*), which were printed in Venice in April of the following year (1538). They depict the portal system, the liver, kidneys and caval veins, the heart with the aorta and its branches, the skeleton in three views (front, right profile, and from behind).

The printing of these "anatomical fugitive sheets" created a great stir, a set forwarded by Andreas to his father at Court was presented to the Emperor, who praised them highly. They were plagiarized and counterfeited by Jobst de Neckar, printer and publisher (1539), by Aegidius Macrolios (1539), by Walter Ryff (1541), who increased the number of figures to ten, by Johann Dryander (or Eichmann), who copied the figures in his *Anatomia Capitis Humani* (1536). Additionally, in figures of the *De Dissectione* of Charles Estienne (1545), the influence of the *Fabrica* is



Fig 36



Fig 37



Fig 38



Fig 39



Fig 40



Fig 41



Fig 42



Fig 43



Fig 44

Figs 36 to 44 Initial letters of intermediate size, *Fabrica*, 1555 edition Introducing the chapters

clearly apparent in many of the small insets, in the *De Chirurgica Institutione* of Johann Tagault (a popular book, which passed through twenty-two editions between 1543 and 1645), the Calcar figures were abominably copied

These anatomical plates of Vesalius were designed particularly to benefit those who attended his dissections, just as the exhibitor today distributes mimeographed sheets or reprints among

visitors to his booth at a state or national medical meeting

The popularity of even such a modest set of carefully prepared figures must have encouraged Vesalius to undertake the great task of writing a complete work on human anatomy. Possessed of the enthusiasm of a zealot, Vesalius completed the *Fabrica* after three years of strenuous labor. The drawings were done by Calcar. In the same month



Fig 45



Fig 46



Fig 47



Fig 48



Fig 49



Fig 50



Fig 51



Fig 52



Fig 53

Figs 45 to 53 Initial letters of intermediate size continued (Figs 45 to 52), and colophon (Fig 53)

Vesalius finished the *Epitome* of his great work, the *Fabrica*. The plates of the *Epitome* were issued unbound, like the *Tabulae*, they were ephemeral, and hence perfect copies are excessively rare. The *Epitome* contains five plates of the musculature and figures of a nude man and woman.

Only eighteen years after the appearance of the *magnum opus*, at the age of fifty, Vesalius was drowned in a shipwreck off the island of Zante on

his return from the Holy Land, where, according to rumor, he had been sent on a journey of expiation.

## 5 THE FABRICA OF ANDREAS VESALIUS

### a EDITIONS OF THE FABRICA

The original edition of the *Fabrica* appeared in 1543, from the press of Oporinus, in Basil. The





Fig 54



Fig 55



Fig 56



Fig 57



Fig 58



Fig 59



Fig 60



Fig 61



Fig 62



Fig 63



Fig 64

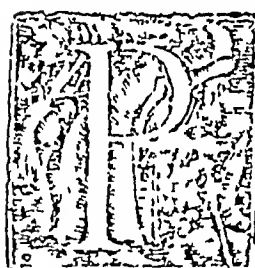


Fig 65



Fig 66



Fig 67



Fig 68



Fig 69

Figs 54 to 69 Initial letters of small size, selected from the indices Figures 54 to 61 from the *Fabrica*, edition of 1543, figures 62 to 69, from the *Fabrica* edition of 1555

work extends over six hundred sixty-three folio pages, it is composed of seven books, and contains twenty-two full-page woodcuts and numerous smaller figures in the text

The frontispiece shows Vesalius beginning to anatomize a female cadaver (cf Fig 70, from the second edition) Because methods of preservation were then unknown, removal of the organs, first

to putrify, was carried out quickly This dissection introduced the three day demonstration In order to record his conviction that the study of anatomy should begin with the osseous framework of the body, Vesalius has the skeleton placed in a position of central importance

Following the appearance of an unillustrated pocket edition (in Lyon, 1552), the second folio



Figs 70 to 75 Title pages of two editions of Vesalius' *Fabrica* (Figs 70, 71) and of anatomical treatises related thereto (Figs 72 to 75)



Fig 70, left *Fabrica*, 1555 edition  
Fig 71 *Opera Omnia* of Hermann Boerhaave and Bernhard Siegfried Albinus (1725)

edition, of eight hundred twenty-four pages, was published in Basil in 1555. This edition is said to have been lavishly prepared for, the paper was to be heavier and the type larger, the latter change necessitated the recutting of all the small initial letters so that they would equal the height of seven lines of the new type. A new block was cut for the frontispiece (Fig 70), and the head of Vesalius was more effectively portrayed. The skeleton now carries a scythe, for concomitant exhibit of comparative anatomical features, lackeys lead a goat, as well as a dog, into the amphitheatre.

A posthumous edition of five hundred ten pages was published in Venice (1568), another of equal length followed, during the first decade of the seventeenth century (Venice, 1604).

#### b CONTENTS AND TABULAE, 1555 EDITION

The edition of 1555 is regarded by many collectors as the preferred volume in this distinguished series. Each of the books, or sections, is ampler than the corresponding parts of the editio prin-

ceps. It will serve as the chief basis of the present account.

The first book, devoted to the anatomy of the bones and cartilages, covers two hundred eight folio pages. Types of cranium are figured, and the skull is shown in all effective views. The presentation of vertebral anatomy would be adequate for present-day, critical use. All flat and long bones are illustrated from every advantageous angle. The book closes with three full-page skeletal figures and as many pages of legend (Fig 21).

The second book, dealing with the morphology of the muscles and ligaments, covers two hundred twenty-seven pages. Its text is supported by a superb set of illustrations, beginning with the musculature of the anterior surface of the body (Fig 22). Like any of the others, these illustrations are explained by didactically clear legends, each approximately two and one-half pages in length. Several of them depict flayed figures, ingeniously displaying muscles in successive laminae.





Fig 72 *Anatomia del Corpo Humano* of Valverde di Hamusco (1560)

The third book, concerned with the anatomy of veins and arteries, covers seventy pages. The figure of the portal system is particularly graphic in its display of venous channels which converge upon the liver. The treatment of the systemic veins is equally fine, the figure showing all regular segmental and axial veins together with the dural venous sinuses (Fig 23).

In the fourth book the cranial nerves are described and figured, this section covers forty-seven pages. Particularly striking are the figures of the recurrent laryngeal nerves and the full course of the vagus, and of all the larger peripheral nerves of the body (Fig 24). The last-named figure shows, with unusual effectiveness, the simple segmental scheme of the thoracic nerves, the cervical and the lumbosacral concentrations, and the lengthening which nerves must undergo to reach the upper and lower extremities.

The fifth book covers one hundred forty-three pages and deals with the "organs of nutrition," a category which includes the abdominal part of the alimentary tract, the urinary and reproductive organs, and the spleen. The figures are not only detailed and topographically excellent, but also

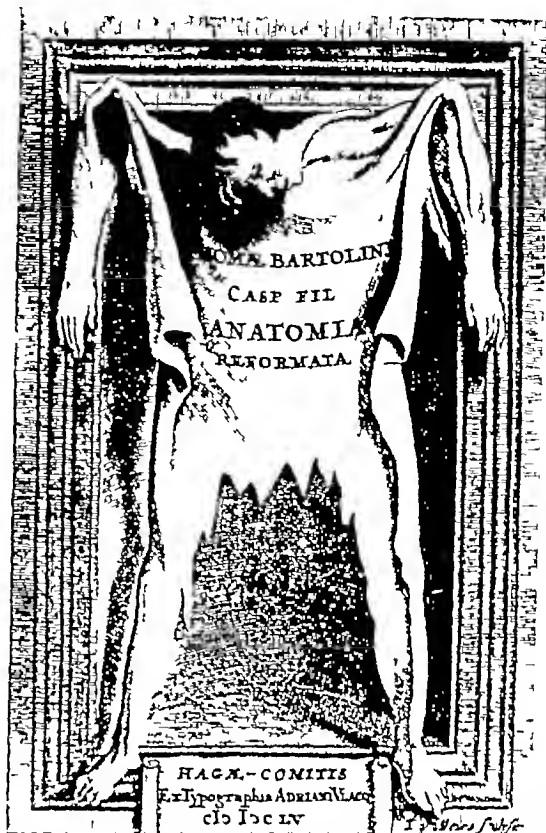


Fig 73 *Anatomia Reformata* of Thomas Bartholin (1655)

attractively statuesque (cf Fig 87), they possess the artistic character, despite partial evisceration, of the Belvedere torso by Apollonius and of the Farnese Hercules of Glycon. Stratification is accounted for from omentum to posterior parietes. In the anatomy of the kidneys, even the capsular vessels are illustrated.

The sixth book covers fifty-seven pages and describes the heart and "servant" organs (lungs, trachea), and the pleural and pericardial investments (Fig 25). Of paramount importance in functional theory was the nature of the septum between the cardiac ventricles. Long regarded as foraminous, for the passage of the elaborated spiritus, descriptions of this wall had been warped to fit an ancient concept of "vascular" movement. Against the influence of centuries of medical, philosophical, and ecclesiastical writing, Vesalius described the partition as he found it, that is, as an impervious interventricular wall. In the 1543 edition of the *Fabrica*, Vesalius repeated the Galenic notion that openings exist in the septum

ΜΙΚΡΟΚΟΣΜΟΓΡΑΦΙΑ  
A  
DESCRIPTION  
of the Body of Man  
TOGETHER  
WITH THE CONTROVERSIES  
THERETO BLLONGING

Collected and Translated out of all the Best Authors of Anatomy Especially out of Galper Baubinius and Andreas Laurentius. By HELKIAH CROOKE Doctor of Physick

Published by the Author Masters of the Station and Warrare according to the Gift  
of the Stationers Company

The second Edition corrected and enlarged.



Printed & Engraved by Thomas and Richard Chis and are to be sold at the Stationers Hall in London 1631

Fig 74 *Description of the Body of Man*, by Helkiah Crooke (1631)

of the heart. In the second 1555 edition, Vesalius corrects the statement, saying that the septum of the heart is as dense and imperforate as the outer walls.

The seventh book extends over seventy pages, describing the brain and each meninx (Fig 26). Cerebral divisions, ventricular spaces with contained chorioid plexuses, dural venous sinuses, the eminences on the dorsum of the brain stem, and the basal ganglia are shown clearly in admirable illustrations.

#### C INITIAL LETTERS, 1555 EDITION

Because the anatomical figures of the *Fabrica* are so utterly superior to illustrations published prior to 1543, the less obvious beauty of the decorative initial letters in the Vesalian masterpiece has captured the attention of relatively few English writers. The woodcut figures deserve appreciative comment, in introduction to which tribute their medieval lineage requires brief discussion.



Fig 75 The same work.

In Germany, during the fifteenth century, the size, form, and style of the printed book was evolved. It was a direct descendant of the ancient manuscript. At the outset particularly it retained some of the ornamental character of the manuscript, wherein numerous border embellishments, supplementing the copied script, were employed either as pure ornaments or as scenes illustrative of the text (Fig 27). Some were page-size, others were initial letters with pictorial background or interlaced Arabesque elements. Their history now requires a review.

In many of the books published during the sixteenth and seventeenth centuries the printers employed ornamental devices to add an attractiveness to their products which letterpress, unembellished, would fail to contribute. These initial letters, head-pieces, tail-pieces, and borders again show the intellectual vigor of a renaissance world.

The earliest initials produced by mechanical means, in the printed book, appeared as early as

# DE CONCEPTV ET GENERATIONE HOMINIS DE MATRICE ET EIVS PARTIBVS, NEC NON DE CONDITIONE IN

FANTIS IN UTERO, ET GRAVIDARVM CIRCA ET OFFICIO  
De partu & parturientium infantumq; cura omnisfana De differentijs non  
naturalis partus & earundem cunis De Mola alijsq; falsis vterumtombus,  
simulq; de abortibus & monstris diuersis, nec non de conceptus signis va-  
rijs De sterilitatis causis diuersis, & de pauptis Matricis exgritudini-  
bus omniumque horum cunis varijs, libris sex, opera claris-  
simi viri IACOBI RVFFI, Chirurgi Tiguri-  
ni quondam congehi

Nunc deinde recogniti & in plerisq; locis castigati. Pissariis usque conuenientissimis se-  
imprimis in utero, deinde leuissime, mox etiam matrem & infirmiorum  
a se vtriusq; promanentium, & extrahendum peruenientium illustrati, ornati, & in-  
sum coram qui parturientibus, & obstetricibus consulere debent, typis enlcati



Francforti ad Manum Anno M D LXXX.

Figs 76 to 81 Title pages of imitative works, continued  
Fig 76, above *De Conceptu et Generatione Hominis* of  
Jacob Rueff (1580)

1457 During the sixteenth century, woodcut initial letters were made in profusion. By the close of the seventeenth, their employment was a rarity.

As might be expected, subjects for these various ornaments were not selected without reason, most frequently their motivation was basically religious.

Perpetuating the tradition of the early manuscript, the monumental folios of the *Fabrica* were decorated with many historical woodcut initials. These ornamental capitals depict cherubic youngsters, usually naked, who, with intent demeanor and solemn visage, act out the parts of curator, laboratory aide, male nurse, orderly, physician and surgeon. The letters B, G, J, K, U, W, X, Y, and Z are wanting in the series. Certain of these, of course, would not appear in Latin writing. The initials I, L, O, Q, T, and V are reproduced with two different backgrounds. In these six instances one of the pair of letters is of the large type (Figs 30 to 35), all of the others are smaller, and of



Fig 77 *Catoptrum Microcosmicum* of Johann Remmelin (1619)

matching size.<sup>1</sup> The large blocks, 73 millimeters square, are placed at the beginning of the dedication and introduce the text of each of the seven books (Fig 28). The letters of intermediate size, 39 by 41 millimeters, head the chapters (Fig 29). Altogether, the initial letters appear a total of one hundred ninety-two times.<sup>2</sup> The

<sup>1</sup>For the dedication and for the seven books of the *Fabrica* five different historiated initials are used while three are repeated. The V (Fig 35) introduces the dedication. Continwog in the succession the initial O (Fig 37) introduces liber primus (p. 1) and T (Fig 34) serves in like capacity for liber secundus (p. 209). The initial O is repeated for liber tertius (p. 456) and T for liber quartus (p. 507). Liber quintus is introduced by title and by a main anatomical illustration of the peritoneum; the text is introduced by a repeated V (p. 589). Liber sextus is similarly arranged: the book opens with heading and illustration of the thoracic viscera while the initial letter Q follows (p. 708)—repeated from early use in the body of the text of liber secundus (p. 255). In liber septimus on similar plan the book is introduced by heading and illustrations of cranial anatomy; the text following seventeen pages later (p. 772) carrying the initial letter I (Fig 30).

<sup>2</sup>In the 1555 edition the individual initial letters are employed the following number of times: A (Fig 36) 10 times; C (Fig 37) 15; D (Fig 38) 10; E (Fig 39) 8; F (Fig 40) 5; H (Fig 41) 9; I (Fig 42) 18; J (Fig 30) 1; L (Fig 43) 10; M (Fig 31) 1; N (Fig 44) 9; O (Fig 45) 3; P (Fig 46) 7; Q (Fig 32) 2; R (Fig 47) 17; S (Fig 33) 2; T (Fig 48) 20; U (Fig 49) 5; V (Fig 50) 12; W (Fig 34) 12; X (Fig 51) 2; Y (Fig 35) 2; Z (Fig 52) 12. In the second (1555) edition owing to the revision of text of the first (1543) edition some twenty replacements of initial letters (chiefly of the chapters) were made by the printer (e.g. E for O in chapter VI of book I; E for L in chapter VIII of book I).



Fig 78 *Institutiones Anatomicae* of Caspar Bartholin (1691)

blocks, and especially those of the larger series, are believed to have been done by Calcar, who also designed the anatomical plates

The initial letters present a full composition dealing with specific anatomical, medical, and surgical activity or with closely allied procedure or incident. The spaces behind the letters are completely filled with the composition. These decorative backgrounds fall into two simple and natural groups, namely, the preclinical and the clinical,<sup>1</sup> there are outdoor and indoor scenes.<sup>2</sup>

Considering first, the six large letters (Figs 30 to 35), the activities therewith depicted are varied. Cherubic curators secure an anatomical specimen in letter I (Fig 30) by robbing a grave, here, outdoors and against a background of masonry arches, the putti exhume a corpse—one holding a candle to illuminate the crypt, another keeping watch. Curiously, a soldier, present and seeming sympathetic, does not interfere with the scientific

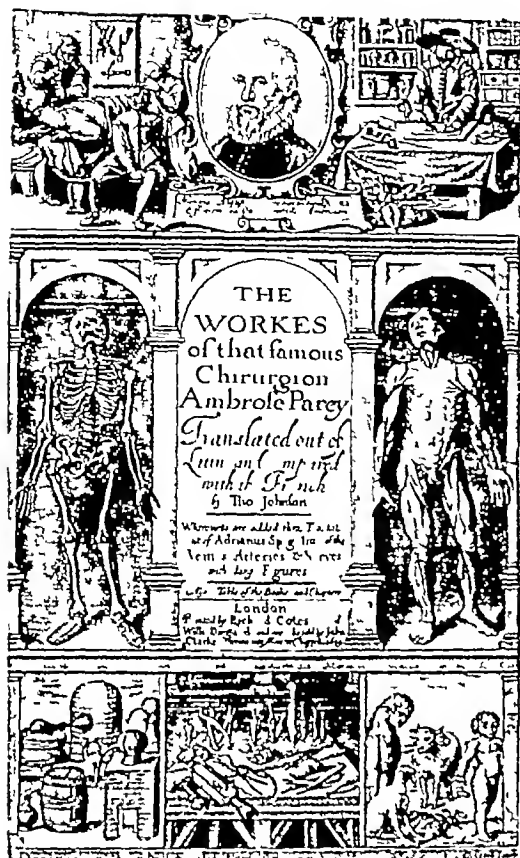


Fig 79 *Opera*, of Ambrose Paré (Paris, 1582)

gathering of laboratory material. As background for the large initial L (Fig 31), and in the spirit of bawdy jest, one putto draws the reader's attention to the intestinal flux of his companion, whose afternoon's adventure in hawking must wait upon certain more fundamental matters. In the initial letter O (Fig 32), a skull is being cleaned in a cauldron which is suspended in a fireplace of ornate design, one putto works the bellows, another prepares to return the skull to the boiling pot, while a third appraises a long bone from which the soft tissues were previously removed. As a border ornament, around the oval letter, clustered leaves appear above, while griffon-like creatures give support from below. Similarly, as corner designs for the letter Q (Fig 33), winged cherubs appear above, their wingless counterparts are busy below, one of the latter idly sharpens a dissection-instrument while the other tests the sharpness of the tail of the letter Q. In the main scene, with the letter itself, eight well-nourished putti are about to carry out a cervical dissection on a pig, with the creature held to table by a chain through the mouth and rings about the legs, one

<sup>1</sup>The following are preclinical Figs. 30 32 33 34 38 43 44 45 46 47 48 49 50 51 and 52. These are clinical Figs. 36 37 39 40 41 and 42.

<sup>2</sup>The following are indoor scenes Figs. 3 33 40 42 48 and 52. These are outdoor Figs. 30 31 34 36 37 38 39 41 43 44 45 46 47 49 50 and 51.

Fig 80 *Workes*, of Paré (London, 1649)

zealous putto wields the knife while a companion reads from a book of instructions. In the initial T (Fig 34), the cross-bar of the letter serves as the crude gallows on which a pig is being elevated for evisceration.

Different from all of the other initial letters, both large and small, is the V (Fig 35), which, first in the volume, heads the laudatory dedication to Charles V. In the highly ornamental background, between the arms of the V, Apollo and Marsyas are in contest for honors as the most skilled magician. As will be recalled, Apollo, having vanquished his opponent, thereby earns the right to do with Marsyas as he will. In the foreground, external to the V, stand the Muses (who have served as judges) on the reader's left, on the right, wearing the sash and crowned with laurel, Apollo now approaches his worsted adversary with purpose not as classical as it is anatomical.

Among the seventeen lesser letters there are scenes of clinical procedures as well as some which have to do with anatomic dissection and procure-

# LES ŒUVRES D'AMBROISE PARÉ,

CONSEILLER ET PREMIER  
CHIRURGIEN DU ROY

DOVZIESME EDITION,

REVUE ET CORRIGEE EN PLUSIEURS ENDROITS,  
Et augmentée d'un ample Traicté des Fievres tant en general qu'en  
particulier, & de la curacion d'ulceres, nouvellement trouuee  
dans les Manuscrits de l'Auteur.

Avec les Voyages qu'il a faict en divers lieux. Et des Portraits de Fievres, avec le Traicté  
que des Instruments de Chirurgie. Et de plusieurs Nouveaux.



A LYON,  
Chez JEAN GREGOIRE rue Merciere  
a l'Enseigne de la Renommée  
M DC LXIV

Fig 81 *Oeuvres*, of Paré (Lyon, 1664)

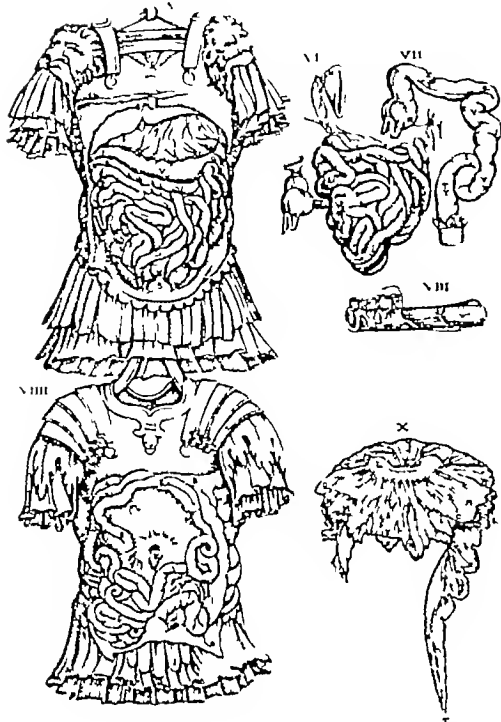
ment, and with experimental study. For the letter A (Fig 36), a corpulent putto submits to urethral exploration, he lies on a well padded bed, in the doubtful privacy of a glade. As the decorative scene for the letter C (Fig 37), four putti transport a rack employed in the reduction of fractures, trees, hills and steeped church appear in the conventional background. The motif of the initial letter D (Fig 38) is again anatomical, three cherubic morphologists saw open a skull, working in a spot somewhat secluded by crags and trees. The scene in the letter E (Fig 39) is again outdoor, putti are reducing a fractured leg, one racks and pegs the injured extremity, while his colleague prepares the restraining bandage. Similar treatment is depicted in the letter F (Fig 40), but the operation is carried out in a canopied room where the apparatus is more ambitious and, hence, less mobile, the patient sits on a low bed.

In a day of bludgeoning warfare, cranial fractures and massive contusions are common, and the frequency with which treatment is discussed and

Tauola II del Lib III

95

TAB V



Figs 82 to 87 Works imitative of, or dependent upon, the *Fabrica* of Vesalius Illustrations of the abdominal organs in the male

Fig 82, above *Anatoma del Corpo Humano* of Valverde di Hamusco (1560)

pictured reflects the surgeon's need for instruction. So, it is not surprising to find such a scene among the historiated initials. In the embellishment of the letter H (Fig 41), there is shown the kind of cauterization which preceded craniotomy. The operation takes place against a background of castle and arch, the patient sits resignedly, one putto applies the iron, a second tends the fire, while two other juvenile "externes" are ready to perform less crucial tasks. Next, in alphabetical order, as a background for the letter I (Fig 43), an urethral examination and catheterization are pictured, the quarters are opulent, the important patient considerably pillowed, yet the putti are, traditionally, naked.

In the succeeding five letters (L to P) putti either garner or study anatomical specimens (Figs 43 to 47). For the letter L, against an austere background of unwooded hills, a corpse is lowered from a crude gallows into the arms of an avid putto (Fig 43). One of the latter's compan-



Fig 83 Pietro Berettini's *Tabulae Anatomicae* (Rome, 1741)

ions holds back a company of monks, in this lesser skirmish in the mediaeval war between Science and Theology. Here the artist was obliged to build a gallows, elsewhere the cross-arm of the letter T (Fig 51) conveniently subserved a comparable function. The letter M (Fig 44) is less lugubriously decorated. Unlike a scene from Hamlet, the background is a cozy town, the putti, here craftily busy on the outskirts of the village, inflate the stomach of an ox. In the N (Fig 45), they carry away a corpse for undisturbed dissection. In the initial letter O (Fig 46) an industrious gleaner prepares to hurry away from an execution, into his wicker basket the head of the victim is being dropped—in the presence of soldiers ahorseback. For the letter P (Fig 47) there is provided a scene depicting curator's industry: the children assemble the bones of human skeleton, at the left an extremity has been articulated, while at the right an earlier stage is represented.

In the next four letters (Q to T, Figs 48 to 51), the activities pictured belong in the present-day

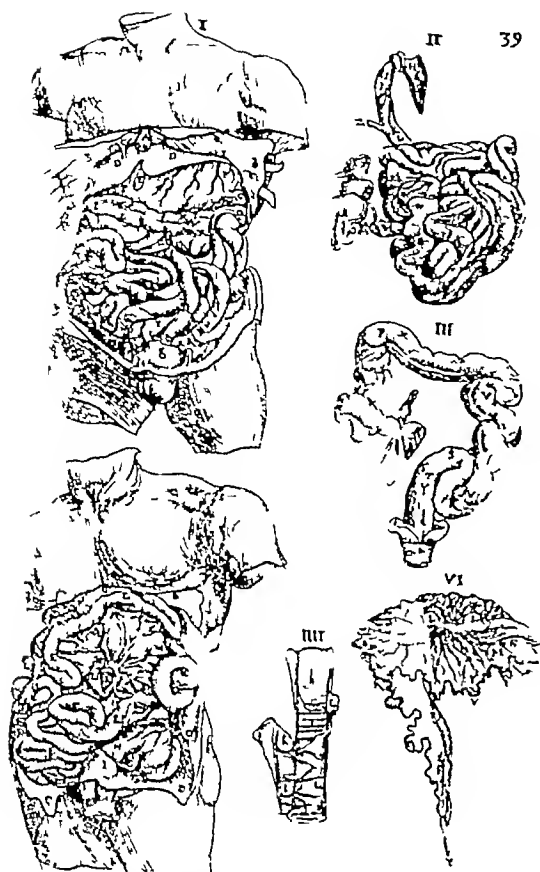


Fig 84 Felix Plater's *De Corporis Humani Structura et Usu*, Tab. XXIX (Basel, 1603)

category of comparative anatomy. Within the medallion-space of the letter Q (Fig 48), five putti take part in the pelvic dissection of a dog, inquisitive cherubs dissect the head of an ox, enucleating the bulb of the eye from the orbital cavity (R, Fig 49), they bleed a dog (S, Fig 50). For the initial letter T (Fig 51), they string up a dog for purposes of experimentation, clubbing the helpless creature to death.

The alphabetical series closes with the letter V (Fig 52), which portrays a venesection, a juvenile surgeon incises the skin with a lancet, to reach a vein in the cubital fossa.

The initial letters of the index make up the third series (Figs 54 to 69). They are the smallest of the three sets, are least attractive, and bear little or no relation to the subject matter of the volume. Except for the A, they are of approximately uniform dimension (1.8 cm square), except for the letter Z, the set employed in the first edition of the *Fabrica* (Figs 54 to 61) was put



Fig 85 Johann Remmelin's *Catoptrum Microcosmici secundum Adam* figure (1619)

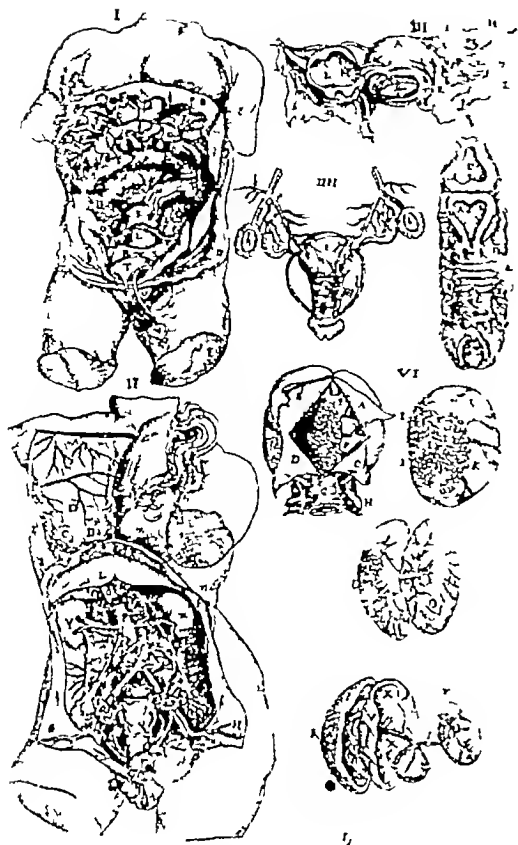
aside in favor of another lot for the second edition (Figs 62 to 69). Some of the blocks are remarkably clear (e.g., Figs 54, 66, and 67), others are so poor as to require hand-lens examination (e.g., Figs 64 and 65). Their decorative features are fabulous birds and mammals (Figs 54 and 55), cherubic musicians (Figs 57, 58, and 60), botanical herding and wayfaring, each finds its place in the groups (Figs 59, 62, and 65, respectively), one putto supports the Z (Figs 61 and 69), while another chin-rests upon the Y (Fig 68). Assumedly these initial letters of the indices were the printer's stock in trade—ready for use in any large volume whose proportions and promise warranted their employment.

The volume closes with a highly ornamental printer's mark (Fig 53). The colophon pictures Arion, poet and musician of ancient Greece. During a voyage at sea, the crew of the ship on which he sailed resolved to murder him for his money, and ordered him to jump overboard. Arion, having obtained permission to sing one song to the music of his cithara, threw himself into the sea. He was received miraculously on the back of a dolphin and carried safely to land. As so to Arion,









Figs 88 to 90 Works imitative of the *Fabrica*, continued. Illustrations of the abdominal and pelvic viscera in the female

Fig 88, above From Felix Plater, *Tabula XLII* (1603)

works passed, totally, through more than seventy-five editions (in Latin, French, Italian, Dutch, Spanish, and English).<sup>1</sup> Among the borrowers and imitators were Boerhaave and Albinus, Valverde, the Bartholins, Crooke, Rueff, R Emmelin and Pare.<sup>2</sup>

Following the pattern set by Vesalius in the *Fabrica* (Fig 70), Boerhaave and Albinus, in their *Opera Omnia*, copied the dissection scene in their

<sup>1</sup>Among the authors of *sequelae*, the following have been named by authorities: Maschenbauer, Leveling, Ravnauld, Geminus, Baudin, Bauman, Boerhaave, and Albinus. Bonavera, Botter, Lontanus, Fuchs, Van de Gracht, Moro, and Montani, Pauw, Plater, Sandifort, Torteblat, Valverde, Parc, Bartholin, Kemmelinus, Crooke.

<sup>2</sup>In Dr. Harvey Cushing's scholarly volume *A Bio-bibliography of Andreas Vesalius* (New York, Schuman's, 1943) the illustrations and text of the several editions of the *Fabrica* and of its antecedents and *sequelae* are fully discussed.

As its title indicates, the treatise contains a bibliography of Vesaliana (451 items) and an authoritative biography, whose portions are chronologically arranged in relation to Vesalius' preparation and publication of his anatomic work.



Fig 89 From Johann R Emmelin, Eve figure (1619)

title page (Fig 71). Valverde relegated a comparable scene to the base of his ornamental page, while bringing skeletons and experimental animals into greater prominence (Fig 72). Thomas Bartholin employed a full human hide to make an arresting title page (Fig 73). Crooke employed a similar device, but caused the stripped musclemen to hold his own skin and the instrument used in removing it (Fig 74). Crooke also copied Vesalius' plan but added lesser scenes of surgical, biblical and moralistic character (Fig 75). Rueff introduced his midwifery with a title page which depicts a birth-chamber, complete with attentive nurses, hungry dog and bibulous servants (Fig 76). R Emmelin pictured scholars and the accouterments of knowledge (Fig 77). Caspar Bartholin exhibited the figures of the medically great—including, of course, Vesalius (Fig 78). Pare's title pages cover various subjects (Figs 79 to 81), the most appropriate being that which appeared in the English edition of 1649 (Fig 80).

Only when Calcar's drawings are compared with those in the *sequelae* does the full quality of the former become apparent. Two brief visceral sets (Figs 82 to 87, and Figs 88 to 90) demonstrate the excellence of the Vesalian illustration.

Juan de Valverde, in his anatomical plates, put the muscle-men to work. In one figure a brawny manikin holds suspended his own cutaneous coat, upright anatomical subjects draw aside the flaps of the abdominal wall with their own hands and lift the omental apron with their teeth, better to display their guts to the barber-surgeons of Seville. Not content with demonstrations of interior structures, Valverde dressed some of his subjects in partial armour, perhaps as a concession to the military trend of Spain's ambitions (Fig 82).

Berettini regrouped the pictorial material, to combine, in each of several plates, myological, nervous, and visceral elements, in one instance, figures of the intestines and stomach appear as bas-reliefs on block-like pedestals, while the flayed muscle-man holds a framed figure of a cervical dissection (Fig 83). Rueff limited his borrowing to illustrations of female pelvic anatomy (Fig 90). Plater adhered rather closely to the Vesalian arrangement of figures (Figs 84 and 88), as did Boerhaave and Albinus (Fig 87), both Remmelin and Paré altered the schema very considerably (Figs 85, 86, and 89). Because of the ingenuity exercised in the preparation of Remmelin's *Tabulae*, and the popularity of Paré's commonplace figures, the works of these writers call for special comment.

Of all the copied forms of the Vesalian *Fabrica*, that by Johann Remmelin displays the most ingenious craftsmanship. Remmelin, a physician of Ulm, artfully arranged the anatomical structures of the human body on plates in such a manner that parts lying at successively deeper levels were shown by means of pictures fastened one to the other like the pages of a book. These pages were published in 1613 under the title *Catoptron Microscopicum*. In this set of plates man (Fig 85) or woman (Fig 89) could view his microcosmic parts as if in a "mirror." The figures were frank copies of those in the *Fabrica*.

In the collected *Workes* of Ambroise Paré, descriptive material and figures were used, without notable replacement, through thirteen French editions, a Latin, and several English editions. The first edition (French) appeared in 1575, in Paré's sixty-fifth year. Editions succeeded each other in uninterrupted succession, to the thirteenth in 1685. Since the volume of collected *Workes* was a medicosurgical encyclopedia, its appeal was exceptionally wide. In being part of such a popular tome, the subject matter of the Vesalian *Tabulae*, debased to the status of figures in the text, was destined to be spread to every land where the influence of European medicine was felt. Anatomy was but a small part of Paré's

## L I B E R

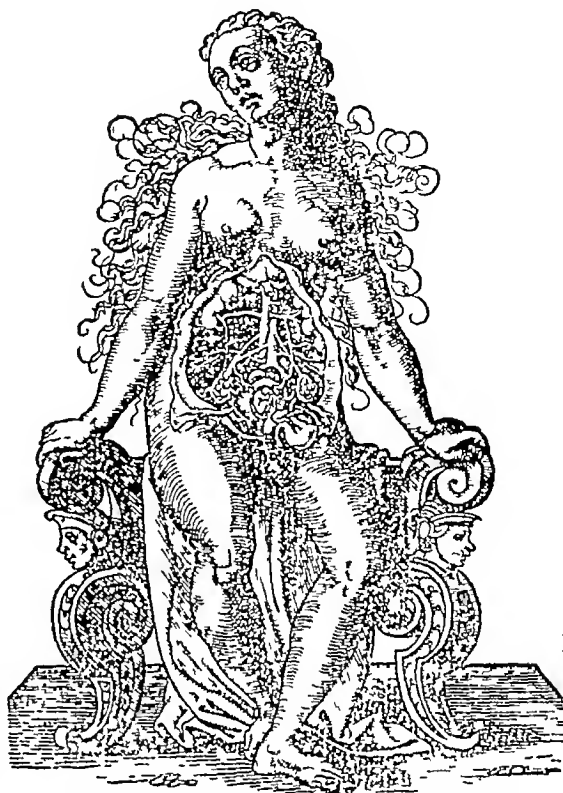


Fig 90 Jacob Rueff, *De Conceptu et Generatione Hominis*, second book (1580)

encyclopedic volume. He discussed dislocations and luxations, means of supplying an artificial nose, ivory teeth held in place by strings, a plate to fill a defect in the palate. He discussed the unicorn and opposed its use as an antidote against poisons, told eyewitness stories of plague-ridden towns, described monsters and prodigies, gout and the French pox, quackery, conception, birth, and the embalming of the dead.

## 6 GENERAL CONSIDERATIONS

In the 1555 edition of the *Fabrica*, as in the 1543, or first edition, ornamentation is lavish, the muscular figures stand effectively against old-world backgrounds, whose elements are the familiar bridges, rivers, and thatched houses of the Paduan environs, the superabundant initial letters are varied, their scenes pertinent, the title page, displaying a dissection scene in an amphitheatre of unexpected grandeur, is an exceptionally attractive introductory piece.

None of the imitative works equalled the *Fabrica* in respect to pictorial engraving. In Creigher's edition of the *Fabrica*, published in Venice in 1568, ornamental backgrounds are omitted, the muscle-men stand merely on plots of sparsely vegetate earth. The initial letters, poorly executed, are employed to head the chapters, they hold no relevancy to the text, being arabesques of conventional design (cf Figs 66 and 67). In the magnificent two-volume folios of Boerhaave and Albinus, published in 1725, for which Jan Wandelaar engraved the *Tabulae* in copper, the dissection-scene appears to particular advantage, as does also the likeness of Vesalius (frontispiece). In the grand full-page figures of the muscle-men, the backgrounds are retained, walled towns, tidy villages, winding paths, meandering rivers, hills and glades, austere mountains, mossy glens and Roman columns, stone bridges and ancient gates, lend such naturalness to the anatomic portraiture that the presence of a gracefully ambulatory specimen seems neither lugubrious nor doleful. Yet, despite the meticulous borrowing of the landscapes, the initial letters, used in all of the chapters of the several books, are merely flowered compositions, the pertinency which characterized the letters in Vesalius' works was sacrificed in the copied versions. Tailpieces, likewise irrelevant to the text material, are repetitiously employed.

In the work of Valverde (1560) the backgrounds are omitted, the muscle-men stand upon plots of hummocky, tufted ground. Initial letters appear in several of the full-page legends (facing the plates of illustrations), they are sparingly used in the text, to introduce each of the seven books, the chapters carry no initial letters. The chapter letters represent mariner, warrior, armorer, fabulous beast, and Neptune astride his sea calves—all in keeping with Valverde's martial display of the visceral specimen, clad in hauberik.

In the anatomies of Crooke and Paré, the title pages are distinctly ornamental. However, as in Valverde's volume, backgrounds are wanting. Initial letters are profusely used, introducing chapters, they match the *Fabrica* in their profusion. However, they are small arabesques of

the kind which might have been available in any busy printery. Headpieces and tailpieces, like the initial letters, bear no relation to the subject matter of the volumes.

In all respects, then, the *Fabrica* is an epochal work, as has been shown, the volume promptly became the repository, textual and pictorial, from which medical writers, less judicious, assiduous and ingenious than Andreas Vesalius, drew wholesale, or, like gleaners, took impatient and fragmentary excerpts. The greatness of the source is attested to by the inability of many of the copyists to maintain the standard set by the original work. Vesalius' *Fabrica* enjoyed the advantages offered by a volume of folio dimensions, his drawings were not required to take shocking reduction. The presswork was excellent, the engraved figures being superior to many reproduced by similar techniques in our own day. The collecting of Vesaliana long ago became a rewarding avocation among the world's medically great. The *Fabrica*, which is now complacently in the fifth century of its existence, is the pre-eminent nucleus for either a personal or institutional library of medical history.

Certainly the embellishment of the *Fabrica*, in the form of title page, historiated initial letters and ornamental background, adds greatly to its bibliophilic charm. The attractive initial letters record the interests and extramural occupations of the anatomist and the surgeon. In handling these subjects, the forbidding and the lugubrious aspects of professional endeavor are converted into pictorial witticisms—the latter note serving as a foil to set off the directly pedagogic objectives of the writer. In shunning the service that such decorations might perform for our modern textbooks, we have lost an opportunity to be subtly instructive and, at the same time, delicately appreciative of the humor of our faithful artists. Nurturing the misconception that scholarship ceases to be impressive when it is no longer stodgily sedate, we persistently fail to employ a device which sweetens textual fodder and supplies the surfeited reader with the alimantal juice of whimsy.

## REVIEWS OF NEW BOOKS

THE first volume has been published of a series of books to be devoted to various methods and techniques used for experimental purposes. The governing board, consisting of Irvine H. Page, A. C. Ivy, Coltin H. MacLeod, Carl F. Schmidt, and David L. Thomson, state in the preface 4 reasons for this series of books: first, to give an appraisal and discussion of the various methods that have been proposed for experimental problems; second, to give a detailed description of methods; third, to give useful modifications of methods that are difficult to find in the literature; fourth, to make available many methods that were developed during the war and which have been described only in official reports. Each volume of *Methods in Medical Research*<sup>1</sup> will be divided into 4 or 5 principal sections, each of which shall, for that volume, represent one of the broad fields of medical research: biochemistry, physiology, pharmacology, microbiology, immunology, and biophysics including radiobiology. From these broad fields, various topics will be discussed by experts in that particular field.

The first volume is divided into 4 sections. Section 1, edited by Henry Welch, deals with the assay of antibiotics—penicillin, streptomycin, tyrothricin, bacitracin; it also includes tests for pyrogens, toxicity, and sterility of penicillin and streptomycin solutions and the histamine content of streptomycin. Section 2, edited by Harold D. Green, is concerned with apparatus and methods for the study of blood flow measurement in the circulation, such as, venous drainage recorders, mean flow recorders, pulsatile flow meters, perfusion systems, indirect methods for regional blood flow, collateral circulation, cardiac output and contractility, and cardiovascular activity. Section 3, edited by A. C. Ivy, concerns selected methods in gastroenterologic research including the assay of choleretic compounds, the preparation and use of the Mann-Williamson dog, and the study of gastric acidity in man. Section 4, edited by Van R. Potter, contains methods for the study of cellular respiration by means of measuring the respiration of intact animals and tissue slices by the homogenate technique, and by the analyses of tissue metabolites with *in situ* freezing techniques.

The book consists of 357 pages, it is well illustrated and contains many references. There are 2 indices, one for subject matter and the other of names cited throughout the book. It is an excellent source of information for anyone engaged in research work and will save a great deal of time in the development of a research problem. After the whole series is completed, the governing board may consider publishing

a volume each year dealing with the newer methods in all branches of biological research.

OPAL E. HEPLER

THE present accumulation of morphological, physiological, and clinical knowledge of each portion of the human body is now great, and almost beyond the comprehension of an individual student or of a practitioner in any single branch of medicine. This is specially true of the head, in which territory the general surgeon, the neurosurgeon and his colleagues in maxillofacial reconstruction, the otolaryngologist, the ophthalmologist, and the anesthetist find urgent demand for more precise and more dependable knowledge. Admittedly, this wealth of material often appears forbidding to the practitioner who desires to review the anatomy of the head and neck, and to the beginning student who may be preparing for a clinical specialty. For either, anatomic architecture must be regarded as basic.

The *Detailed Atlas of the Head and Neck*<sup>1</sup> offers the needed pictorial guidance. So complete is the series of pictures that it may safely be employed to replace the lesser sets of diagrammatized figures which have become the familiar, sometimes misleading, stock-in-trade of the specialist's library. Surface landmarks are emphasized, successively deeper anatomical layers and groups of structures are rationally portrayed, interrelationships are clarified. Not only are series of frontal and transverse sections through the most critical surgical levels included, but, in addition, regional dissections are abundantly illustrated; this combination facilitates the reader's acquirement of a serviceable appreciation of orientation and depth.

As Dr. E. A. Boyden points out in the deservedly laudatory introduction, the drawings in this fine work by Truex and Kellner were all made directly from original regional dissections, the same specimen being used in depicting the anatomy of each series. In order to insure the retention of proper proportions, either scaled enlargements or life-sized drawings were made. The illustrations in each series were uniformly reduced in publication, numerals, which accompany each figure, record the positive proportion to life size. The figures represent serial dissections from superficial to more deeply situated layers, and thus preserve a continuity, from one plate to the next, of the important structures within each region. This logical scheme not only permits visualization of the lammar relationships of fascia, muscles, bones, vessels, and nerves at each of the major cervical and facial levels, but also allows ready

<sup>1</sup>METHODS IN MEDICAL RESEARCH. Van R. Potter, Ph.D., Editor in Chief. Vol. 1. Chicago: The Year Book Publishers, Inc. 1948.

<sup>1</sup>DETAILED ATLAS OF THE HEAD AND NECK. By Raymond C. Truex, M.S., Ph.D., and Carl E. Kellner. New York: Oxford University Press, 1948.

review of the structures traversed, displaced, or excised in the course of the regional dissection. This method has been consistently followed for the anatomy of the neck, face, brain and spinal cord, orbit, ear, pharynx, mouth, larynx, nose, and paranasal sinuses. Additionally, axilla and thorax are handled with sufficient detail to demonstrate the continuity of the cervical organs, vessels, and nerves into the former regions.

Altogether, this volume must be hailed as exceptionally useful, its illustrations portray human structures as they are actually found in dissected and sectioned specimens, not as conveniently idealized or otherwise altered to match stereotyped illustrations of antecedent textbooks. It presents the kind of information which the present-day surgeon needs, and to the possession of which the medical student should early be introduced.

BARRY ANSON

IN the 11 years since Dr Means published the first edition of his book, *The Thyroid and Its Diseases*,<sup>1</sup> a mass of new knowledge about the thyroid gland has been accumulated. Most of this knowledge is in the field of thyroid physiology and has been gained through the use of two new tools (1) the antithyroid drugs, and (2) radioiodine. In spite of the overwhelming amount and complexity of the work with these agents, Dr Means and his collaborators have not enlarged the new edition to any extent. The new material has been assimilated and presented in its rightful place as a part of the whole thyroid picture.

As in the first edition, the writing is simple and straightforward. Many case histories are given to illustrate special points. Charts and graphs are liberally used. The approach throughout is mainly physiologic, yet the clinical picture is clearly set forth, and understanding of it is enhanced by the presentation of the physiologic basis. The completeness of the book has been furthered by the addition of chapters on pathology and tumors by Dr R. W. Rawson, and on surgery by Dr Oliver Cope. Dr Cope's chapter is detailed and contains many practical points for the thyroid surgeon.

The book is divided in much the same way as was the previous edition. The chapter which in the first edition was called "Simple Goiter" is now entitled "Goiters Due Primarily to Extrinsic Causes." Studies on radioiodine and on the goitrogens have pointed out the complexity of this group of thyroid disorders, and Dr Means has wisely dropped the term "simple" from his classification. The chapter formerly titled "Toxic Goiter" is now called "Graves' Disease" and a separate heading is given to adenomatous goiter with hyperthyroidism. Very little is said in the second edition about total thyroidectomy as a treatment for other diseases, a chapter was devoted to this subject in the first edition. "Nodular Goiter" and "Malignant Goiter" have now been combined

into a single chapter entitled "Tumors of the Thyroid." It is interesting also to compare the final chapter "Fact and Fancy in Matters Thyroid" in the two editions. Some questions raised in this discussion 11 years ago have been answered in full or in part, but they have been replaced, as usual, by further questions. The emphasis in the later edition is on physiology and relation of the thyroid to the body as a whole.

This volume is a stimulating dissertation. Each chapter in the book is followed by a concise summary and an inclusive bibliography. The index is excellent. A word of thanks should be given to the publishers for the improvement of the format of this edition over the previous one. As Dr Cope points out, "The surgeon who operates on the thyroid must have special knowledge of the gland, its action, diseases and environment." This statement holds true for anyone who undertakes the diagnosis and treatment of diseases of the thyroid. Dr Means' book contains this special knowledge.

W. M. BALFOUR

THE volume, *Acute Intestinal Obstruction*, is an easily readable 259 page book intended to acquaint the well trained surgeon with the known facts concerning gastrointestinal obstruction between the duodenum and the anus. A broad and very well documented review of the physiological aspects is exceptionally well done. For a work so well founded in the older literature on this subject there is unfortunately a none too strong survey of the physiological and therapeutic developments of the past few years.

There is a reference list of some 350 titles, 2 being case reports of the author's. Rather free reference to many of the workers listed in the bibliography is made, but there is considerable ambiguity in the text as to the origins of the techniques described. Procedures are included which have been abandoned by most students of the subject, and some of the recent excellent contributions are not yet included.

This is a very informative book for the casual reader, and a thought-provoking one for the thoroughly experienced surgeon. The shortcomings indicated above, however, unfortunately render it an incomplete guide in the training of the abdominal surgeon.

CLARENCE DENNIS

THE new American text *Bacterial and Mycotic Infections of Man*<sup>2</sup> is published as a companion volume to Rivers' edition of *Virus and Rickettsial Infections*. There are 34 contributors to the 37 chapters. All of the authors are acknowledged leaders in

ACUTE INTESTINAL OBSTRUCTION. By Rodney Smith M.S. F.R.C.S. With a chapter on radiological diagnosis by Eric Samuel M.D. F.R.C.S. F.F.R. D.M.R.E. Foreword by Rupert Vaughan Hudson F.R.C.S. Baltimore. The Williams & Wilkins Co. 1948.

BACTERIAL AND MYCOTIC INFECTIONS OF MAN. Edited by René J. Dubos Ph.D. Philadelphia London and Montreal J. B. Lippincott Co. 1948.

<sup>1</sup>THE THYROID AND ITS DISEASES. By J. H. Means M.D. 2d ed. Philadelphia London and Montreal J. B. Lippincott Co. 1948.

their chosen field of fundamental research. Each of the chapters presents a precise summary of current investigation in a way that is possible only under the plan of group authorship.

The opening chapters are devoted to an exposition of host-parasite relationships, bacterial morphology and physiology, and the principles of immunity and allergy. Especially outstanding are the sections on bacterial morphology and physiology by Dubos and Pappenheimer and on the allergic state by Chase.

Excellent coverage is given to the bacteria of proved or probable pathogenicity to man. Adherence to the taxonomy adopted in the latest edition of Bergey's *Manual* represents a forward step for clinical bacteriology to follow. Homer Swift's section on the streptococci is excellent, as is Blair's handling of the staphylococci, and Mueller's discussion of diphtheria. The completeness of this portion of the book may be emphasized by reference to the splendid summary of the current studies upon *Streptobacillus moniliformis* and the pleuropneumonia group by Sabin.

The precedent set by Hiss and Zinsser for inclusion of chapters on mycotic infections in bacteriologic texts has been adopted. Conant's sections on the actinomycetes and the fungi imperfecti are concise and clear. Separate handling of the Wolff-Israel bacillus and the nocardia follows American custom and clinical practice.

The concluding chapters embrace a variety of subjects including the technique of bacterial identification, principles of sterilization, and a brief résumé of antibiotic and chemotherapeutic agents. One feels that limited space was assigned to these subjects to gain complete textual coverage. The compromise which has been made is disappointing. Another criticism of the text is the brevity of the sections on the clostridia.

The book is to be regarded as a valuable and thoroughly up to date review of academic and investigative bacteriology. It has all the qualifications of a text for students of bacteriology and should appeal to the clinician as a reference in the thoughtful contemplation of clinical problems in specific infections.

CHAMP LYONS

## BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

FACTS ABOUT THE CHANGE OF LIFE. By E. C. Hamblen, M.D., F.A.C.S. Springfield, Ill. Charles C. Thomas, 1949.

FOOD AND FACTS FOR THE DIABETIC. By Joseph H. Barach, M.D., F.A.C.P. New York: Oxford University Press, 1949.

HISTOLOGY AND HISTOPATHOLOGY OF THE EYE AND ITS ADNEXA. By I. G. Sommers, M.D. New York: Grune & Stratton, 1949.

TUMORS OF BONE. By Charles F. Geschickter, M.D., and Murray M. Copeland, M.D. 3d ed. Philadelphia, London, & Montreal: J. B. Lippincott Co., 1949.

OBSERVATIONS ON THE PATHOLOGY OF HYDROCEPHALUS. Medical Research Council Special Report Series No. 265. By Dorothy S. Russell. London: His Majesty's Stationery Office, 1949.

EL DIAGNOSTICO DEL EMBARAZO CON BATRACIOS MACHOS. By Carlos Galli Mainini. Buenos Aires: A. Impaghone, 1948.

ONESITY. By Edward H. Ryneason, M.D., F.A.C.P., and Clifford F. Gastineau, M.D. Springfield, Ill. Charles C. Thomas, 1949.

ANUS RECTUM SIGMOID COLON, DIAGNOSIS AND TREATMENT. By Harry Illicott Bacon, B.S., M.D., F.A.C.S.,

F.A.P.S., F.I.C.S., F.R.S.M. 3d ed. Vols. 1 and 2. Philadelphia, London, and Montreal: J. B. Lippincott Co., 1949.

NUTRITION AND DIET IN HEALTH AND DISEASE. By James S. McLester, M.D. 5th ed. Philadelphia and London: W. B. Saunders Co., 1949.

THE PRINCIPLES AND PRACTICE OF RECTAL SURGERY. By William B. Gabriel, M.S. (Lond.), F.R.C.S. (Eng.) 4th ed. Springfield, Ill. Charles C. Thomas, 1948.

FUNDAMENTAL CONSIDERATIONS IN ANESTHESIA. By Charles L. Burstein, M.D. New York: The Macmillan Co., 1949.

CLINICAL RADIATION THERAPY. By Ira I. Kaplan, M.D., F.A.C.R. 2d ed. New York: Paul B. Hoeber, Inc., 1949.

PATHOLOGY AND SURGERY OF THYROID DISEASE. By Joseph L. DeCourcy, M.D., and Cornelius B. DeCourcy, M.D. Springfield, Ill. Charles C. Thomas, 1949.

THE TECHNIQUE OF PULMONARY RESECTION. By Richard H. Overholt, M.D., and Lazaro Langer, M.D. Springfield, Ill. Charles C. Thomas, 1949.

MEDICINE THROUGHOUT ANTIQUITY. By Benjamin Lee Gordon, M.D. Foreword by Dr. Max Neuburger. Philadelphia: F. A. Davis Co., 1949.

HOW TO BECOME A DOCTOR, a Complete Guide to the Study of Medicine, Dentistry, Pharmacy, Veterinarian Medicine, Occupational Therapy, Chiropractic, and Foot Surgery, Optometry, Hospital Administration, Medical Illustration, and the Sciences. By George R. Moon, A.B., M.A. Philadelphia, and Toronto: The Blakiston Co., 1949.

# CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

DALLAS B. PHLEMISTER, Chicago, *President*  
FREDERICK A. COLLIER, Ann Arbor, *President-Elect*

PRELIMINARY PROGRAM FOR THE 35th CLINICAL  
CONGRESS—THE STEVENS, CHICAGO,  
OCTOBER 17 TO 21, 1949

WILL hotel headquarters at The Stevens, the thirty-fifth Clinical Congress of the American College of Surgeons will be held in Chicago from October 17 to 21, 1949. On the 1st day, October 21, the Sixth Inter-American Congress of Surgery, for which the Clinical Congress will be host, will open a three-day series of sessions. The plans for the Inter-American Congress are described in a separate article. The American College of Surgeons is a member of the Association of Inter-American Congresses of Surgery.

Operative and nonoperative clinics will be held in some twenty hospitals in the Chicago area each day during the Clinical Congress. The hospitals which will participate in the clinical program are approved by the American College of Surgeons for graduate training in surgery. The schedule of clinics, which will cover general surgery, obstetrics and gynecology, fractures and other traumas, orthopedic surgery, thoracic surgery, neurosurgery, genitourinary surgery, and ophthalmology and otorhinolaryngology, will be published in a *Daily Clinical Bulletin* which will be issued each day during the Clinical Congress. The clinic schedules will also be posted on bulletin boards.

Operations will be telecast, in color, to the hotel from one or more of the hospitals at scheduled periods each day. The successful demonstrations of television at the Clinical Congress in New York in 1947, and at the Clinical Congress in Los Angeles in 1948, make it highly desirable to continue the use of this medium. Television has proved itself to be an ideal means of furthering the "Show me" purpose which was the main incentive for the founding of the Clinical Congress of Surgeons of North America in 1910, three years before the American College of Surgeons was organized. That first Clinical Congress was held in

Chicago. The 1949 meeting will be the ninth held in that city.

A varied and comprehensive program of meetings will be held at the headquarters hotel. A general assembly for both surgeons and hospital personnel will be the opening session on Monday morning, October 17. Scientific sessions, official meetings, hospital conferences, showings of medical motion pictures, and telecasts will follow during the five days, and many surgeons will undoubtedly wish to remain for the sessions of the Sixth Inter-American Congress of Surgery on Saturday and Sunday. Delegates and visitors to the latter meeting will likewise be welcome at clinics and other sessions of the Clinical Congress of the American College of Surgeons. All will be interested in the extensive display of technical exhibits in the exhibition hall on the lower level and in the scientific exhibit on the mezzanine floor of the hotel.

## PRESIDENTIAL MEETING

The Presidential Meeting will be held on Monday evening, October 17. At this meeting the officers-elect consisting of Dr. Frederick A. Coller of Ann Arbor, president, Dr. Donald G. Tollefson of Los Angeles, first vice-president, and Dr. Robert M. Moore of Galveston, second vice-president, will be installed. The outgoing president, Dr. Dallas B. Phlemister of Chicago, will preside and will deliver the Presidential Address.

Sir James R. Learmonth of Edinburgh will deliver the fourth Martin Memorial Lecture. His subject will be "Collateral Circulations, Natural and Artificial."

## CONVOCATION

The formal initiation ceremonies for the new Fellows will be a colorful feature of the annual Convocation which will be held on the final evening, Friday, October 21. Honorary fellowships

will also be conferred on this occasion Lord Webb-Johnson of London, president of the Royal College of Surgeons, will deliver the Fellowship Address

#### EVENING SCIENTIFIC SESSIONS— GENERAL SURGERY

The program and speakers for the Tuesday evening general surgery session will be as follows  
Symposium—Acute Surgical Emergencies in Gynecology and Obstetrics

General Introduction NEWELL W. PHILPOTT, M.D., F.A.C.S., Montreal

Tubal Pregnancy, Its Diagnosis and Treatment LEWIS C. SCHEFFEY, M.D., Philadelphia

Pelvic Peritonitis Occurring in the Obstetrical or Gynecological Patient FRANK GLENN, M.D., F.A.C.S., New York

Emergency Cesarean Section WILLIAM E. STUDDIFORD, M.D., F.A.C.S., New York

The program and speakers for the Wednesday evening general surgery session will be as follows  
Fracture Oration Fracture Hazards ORTO J. HERMANN, M.D., F.A.C.S., Boston

Symposium—Blood Coagulation and the use of Anticoagulants

The Significance of Different Methods for Prothrombin Estimation and their Relative Values JOHN H. OLWIN, M.D., Chicago

Studies on Antithrombin and Etiologic Factors in Phlebothrombosis JOHN H. KAY, M.D., New Orleans

A Further Report on Dicumarol Prophylaxis against Venous Thrombosis in Women Undergoing Surgery GEORGE VAN S. SMITH, M.D., F.A.C.S., Brookline, Massachusetts

The program and speakers for the Thursday evening general surgery session will be as follows  
Symposium—Malignant Disease

Chemotherapy in Malignant Neoplastic Disease CARL V. MOORE, M.D., St. Louis

Hormone Therapy of Cancer CHARLES B. HUGGINS, M.D., Chicago

The Use of Radioactive Iodine in Studying the Pathologic Physiology of Thyroid Cancer RULON W. RAWSON, M.D., New York

What We have Learned from Isotopes Concerning Depletion and Repair in Surgical Patients FRANCIS D. MOORE, M.D., F.A.C.S., Boston

#### GENERAL SURGERY PANEL DISCUSSIONS

General surgery panel discussions will be held on Monday, Tuesday, and Wednesday afternoons,

from 1:30 to 3:00 and from 3:30 to 5:00 o'clock. The subjects and the names of the moderators follow

#### Monday—1:30 to 3:00 p.m.

Surgical Lesions of the Breast GEORGE G. FINNEY, M.D., F.A.C.S., Baltimore

#### 3:30 to 5:00 p.m.

Fractures of the Skull ELDRIDGE H. CAMPBELL, M.D., F.A.C.S., Albany

#### Tuesday—1:30 to 3:00 p.m.

Massive Upper Abdominal Hemorrhage JOHN H. MULHOLLAND, M.D., F.A.C.S., New York

#### 3:30 to 5:00 p.m.

New Surgical Technique in Drug Treated Infections CHAMP LYONS, M.D., New Orleans

#### Wednesday—1:30 to 3:00 p.m.

The Management of Acute Emergencies Occurring During Operations I. MIMS GAGE, M.D., F.A.C.S., New Orleans

#### 3:30 to 5:00 p.m.

Preoperative and Postoperative Care and Anesthesia for Infants THOMAS H. LANMAN, M.D., F.A.C.S., Boston

#### SPECIALTY SESSIONS

Plans will be announced later for the sessions in ophthalmology, otorhinolaryngology, orthopedic surgery, plastic surgery, urology, thoracic surgery, neurological surgery, and obstetrics and gynecology. Friday afternoon will be devoted to panel discussions in the surgical specialties, but a definite schedule has not yet been completed for other sessions.

#### FORUM ON FUNDAMENTAL SURGICAL PROBLEMS

The Forum on Fundamental Surgical Problems will be held on Monday through Thursday afternoons, and Tuesday through Friday mornings. Brief reports of original clinical and experimental observations relating to the broad aspects of surgery and the surgical specialties will be presented, under the general direction of Dr. Owen H. Wangenstein, chairman of the committee, Forum on Fundamental Surgical Problems.

#### HOSPITAL CONFERENCES

The twenty-eighth Hospital Standardization Conference will be held during the first 4 days of the Clinical Congress. Its opening meeting will constitute the first formal session of the Clinical



## SIXTH INTER-AMERICAN CONGRESS OF SURGERY

THE thirty-fifth Clinical Congress of the American College of Surgeons will be host to the sixth Inter-American Congress of Surgery when it convenes in Chicago on October 21, 22, and 23. On its first day it will overlap with the Clinical Congress. The delegates and visitors from Latin American countries will be welcome to attend all sessions of the Clinical Congress, and the operative clinics at the hospitals.

The American College of Surgeons joined the Association of Inter-American Congresses of Surgery by vote of the Board of Regents on June 27, 1944.

This action was preceded by an invitation from Dr. Luis Vargas Salcedo of Santiago, Chile, dated July 21, 1942, to send two delegates as guests of honor to the first Inter-American Congress of Surgery in Santiago, held November 14 to 19, 1942. Dr. Leo Eloesser attended as delegate, and it was upon his enthusiastic recommendation that the College accepted the invitation to join. He also attended the second Congress held in Buenos Aires, October 10 to 15, 1943. Dr. Alton Ochsner was delegate to the third Congress, held in Rio de Janeiro from September 6 to 15, 1947. The fifth Congress was held in La Paz, Bolivia, October 17 to 21, 1948, with Dr. E. Payne Palmer of Phoenix and Dr. Hu Crim Myers of Philippi, West Virginia, as delegates and co-relators.

The surgical societies of the following countries, in addition to the United States, are members of the Association of Inter-American Congresses of Surgery: Argentina, Brazil, Bolivia, Chile, Cuba, Ecuador, Mexico, Panama, Paraguay, Peru, and

Uruguay. Dr. Arnaldo Caviglia of Buenos Aires is the Secretary-General.

A preliminary outline of the program for the Sixth Inter-American Congress of Surgery follows:

*Friday morning, October 21*

Inaugural Ceremony

*Friday afternoon, October 21*

Delegates may attend the specialty panels of the Clinical Congress

*Saturday morning, October 22*

Main Theme: Acute Cranio-cerebral Trauma

Relator: E. Jefferson Browder, M.D.,  
F.A.C.S., Brooklyn

Co-relators: To be appointed by each country

*Saturday afternoon, October 22*

Main Theme: Treatment of Injuries in the Region of the Ankle with Complications and Sequelae

Relator: Harrison L. McLaughlin, M.D.,  
F.A.C.S., New York

Co-relators: To be appointed by each country

*Saturday evening, October 22*

Official Banquet

*Sunday morning, October 23*

Business Session

*Sunday afternoon, October 23*

Main Theme: Pulmonary Carcinoma

Relator: Everts A. Graham, M.D., I.A.C.S.,  
St. Louis

Co-relators: To be appointed by each country

July, 1949

**SURGERY**  
**GYNECOLOGY AND OBSTETRICS**  
*Supplement*

**INTERNATIONAL ABSTRACTS**  
**OF SURGERY**

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# INTERNATIONAL ABSTRACTS OF SURGERY

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## COLLECTIVE REVIEW

### NEUROLOGICAL SURGERY THROUGH THE YEARS OF WORLD WAR II

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**N**EUROLOGICAL surgery received its greatest impetus from two sources. The first was a great personality who chose that field of surgery for his life's work and whose intellect, ability, capacities, and idealisms quickly called attention to the opportunities for surgical therapy and research which challenged solution. The second was the occurrence of World War I and the large number of soldiers who suffered from injuries of the brain, spinal cord, and peripheral nerves.

The many contributions made to surgical progress by the men who devoted their energies to the problems of neurological surgery in the interim between the end of World War I and the beginning of World War II laid the foundation for the expectation of better results than were compiled in 1918. It appeared likely that improvement would depend on newly acquired and more widely practiced surgical skills and upon the new antibiotics which seemed to offer such great assistance in meeting the challenge of compound wounds of the nervous system. It was hoped that the confusion and failures of the military medical services in World War I in assimilating the necessary and tremendous numbers of civilian doctors suddenly brought into their corps would be avoided by 25 years of peace in which their leaders would have been able to work out a smooth organization.

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#### ORGANIZATION

Between World Wars I and II the British Army had recognized neurological surgery as a specialty and, after Munich, plans had been formulated for utilizing in the most efficient way the limited number of neurological surgeons available to the Army. This was accomplished by the appointment of a Consultant Neurological Surgeon to the Director General of the Army Medical Services, who made the policies and assigned responsibilities, as he desired. He was not tied to a desk at the War Office, but, on the contrary, had the greatest freedom in keeping in touch with patients, with university research which was applicable to neurosurgical problems, and with neurosurgical trainees. At the same time the Consultant was able to maintain close contact with the Director General and his group of administrators at the War Office.

In contrast, the American Army was decentralized into theaters of operation, in one of which there was a Consultant Neurological Surgeon and in two of which the responsibility for the direction of neurosurgical policy was assumed by the general surgical consultant. A neurosurgical consultant to the Surgeon General in the zone of the interior functioned only through the Chief Surgical Consultant. All of these individuals acted separately and, as a matter of fact, liaison and consultation between them on neurosurgical policies was actively discouraged. The neurosurgical consultant in a theater of operations was therefore independent and unaware of the policies for the



cause the tables of organization in the forward hospital units made no provision for neurosurgical operations. In the zone of communications, neurosurgeons were attached to general hospitals but often under the appellation of "septic" or "aseptic" surgeon. In the zone of the interior, a neurosurgeon with a properly equipped service was established in the large general hospitals. Neurosurgical teams consisting of a qualified neurological surgeon, an assistant, anesthetist, nurses, and orderlies were a part of a large auxiliary surgical group, and many of the teams were assigned to evacuation hospitals, which were fixed large bed units, without proper flexibility or mobility. No neurosurgical unit in the Army of the United States had a trained neurologist assigned to it as one of its component members. Cairns has said, "At all levels of neurosurgical work in the Army (British) co-operation of neurologists and neurosurgeons proved to be essential." The observations of Ritchie Russell and his colleagues upon the sensory disabilities resulting from lesions of the parietal cortex are invaluable. That neurologists and neurological surgeons can co-operate in the American Army and produce a successful result is attested to by the contributions which came from the combined electrodiagnostic and electromyographic study of peripheral nerve injuries which was carried on in one of the large general army hospitals in the zone of the interior. Part of the responsibility for the failure to use neurologists properly in World War II by the Army of the United States must be laid, where it belongs, upon the apathy and almost total lack of interest exhibited by the neurologists of this country in presenting the opportunities for service to the wounded and in research which their specialty could offer. The specialty of neurology in World War II was completely overshadowed and many of its leaders were overwhelmed by psychiatry. Whether or not the latter specialty will have made any lasting contribution to either the care of the wounded or the civilian population as a result of experiences in the war still remains to be proved.

The National Research Council organized committees in the various fields of medicine and surgery under the auspices of the Office of Scientific Research and Development. Contracts were made between the latter and responsible investigators usually associated with medical school faculties, for financial grants to aid research which was deemed to be of value in prosecuting the war. On the whole, the application of the results of the research was quite direct. The Subcommittee of Neurosurgery was established under the Com-

mittee of Surgery and was very active in stimulating and encouraging research that yielded results which were of value to the war effort in the care of the wounded.

It is questionable whether the organizational problems and difficulties encountered by the civilian medical profession, when it was called upon suddenly to assume the tremendous responsibilities of World War II, will be avoided in any future conflict. The bureaucracy of the War Department does not learn its lessons easily and, even if it did, its inflexibility is stupendous. The only hope is that there will be in peacetime a sufficient number of alert, intelligent, and aggressive doctors in the regular army medical corps who will keep abreast of the advances in medicine and who will be receptive to the requirements of the civilian doctor when he is called to war. The civilian professional in every specialty in turn must do his share to educate the regular army medical officer to the needs of progressive medicine in time of war.

#### CRANIOCEREBRAL WOUNDS

That the brain and meninges were able to resist infection to a remarkable degree was a fact that had been learned in World War I. The fact that Cushing recognized that it was usually infection which had defeated him in the surgical treatment of head wounds, that is, meningitis, abscess, and encephalitis, did not change that fundamental fact. Consequently, in the last war the problem was one of assisting the brain to exercise this power, perhaps by more expert handling and by intelligent use of the newly discovered antibiotics.

In World War I, Cushing's mortality in moderately deep head wounds was 36.6 per cent, in the cases in which the ventricles were opened it was higher, while in through-and-through wounds of the head and in the wounds of the brain which also involved the paranasal sinuses or the mastoid, the mortality was from 70 to 80 per cent. Jefferson estimated that of 28 of his own patients in World War I with head wounds, only 4 had died because of the irrecoverable nature of the brain injury itself. In all the others death was due to infection. In World War II not only did a larger number of patients with head wounds survive but, what is more significant, the percentage rate of primary healing, which is so important in these wounds, was about 85 per cent.

Anaerobic infections, particularly gas gangrene, had overwhelmed the surgical procedures in World War I, and it was thought likely that penicillin and the sulfonamides would not be the com-

plete answer to the invading clostridial organisms present in cultivated earthy soils. The reports of the British 21st Army Group, which fought in World War II over the same area in which many of World War I battles took place, showed that gas bacillus infections were not as frequent as they had every right to expect from the reports of the 1914-1918 experiences. In 11 months a total of only 356 such infections was encountered, and the recovery rate was 78 per cent.

Graschenko studied the bacteriology of cranio-cerebral wounds in the Red Army and stated that after 3 to 4 weeks, 12 per cent of the wounds showed a flora of pathogenic anaerobes, 20 per cent showed aerobes, 70 per cent showed cocci and from 8 to 10 per cent were infected with putrid anaerobes. Of the 203 per cent of patients in whom pathogenic anaerobes were found, 14 per cent died in 6 or 7 days of severe gas gangrene infections. Subacute anaerobic infections of the brain were found in all large brain fungi, and of 12 patients with such infections, 9 died. Thirty-two cases of chronic anaerobic infection of the brain were studied and among these there were 10 deaths. Among 34 cases of mild anaerobic infection of the brain which were studied there were no deaths. Graschenko found the *Clostridium perfringens* (*Clostridium welchii*), *Clostridium sordelli*, *Clostridium fallax*, *Clostridium oedematiens*, *Clostridium oedematiens maligni*, and the *Streptococcus anaerobicus* to be the prevalent anaerobic organisms. A polyvalent serum was used against gas gangrene infections which contained the *Clostridium histolyticum*, *Clostridium perfringens*, *Clostridium oedematiens*, and *Clostridium oedematiens maligni*. Prophylactic doses of 10,000 international units were given intramuscularly and therapeutic doses of from 30,000 to 40,000 units were used intravenously and intramuscularly. When the surgical mission to Russia visited Moscow in 1943, Graschenko had at his disposal gramacidin, but not penicillin. The sulfonamides were used intravenously, and in 1 case 10 c.c. of an 0.8 per cent solution were injected into the spinal fluid every day for 12 days with a successful recovery and without damage to the patient. Sulfathiazole, sulfanilamide, and streptocide (sulfapyridine) were then available.

*Surgical technique.* In World War II, suction, electrosurgical apparatus, and the hemostatic agents, such as fibrin foam and gelatin foam, were the outstanding technical contributions to surgery which aided the neurological surgeon. The principles of excision and primary suture which had been laid down by Cushing and others were the

basis upon which the treatment of uncomplicated wounds of the brain was evolved. Early in the war, many head wounds which were partly excised in the forward areas of the British Army were then seen after more than 1 week following the injury at the neurosurgical units. Ascroft reported upon 276 patients with brain wounds who were treated in the Middle East, in 1943, 75 of these developed brain abscess and many required more than one additional operation before they could be cured of the infection. He showed that in a high proportion of these cases, retained bone fragments in the brain were the cause of the abscess. He advised immediate reoperation upon all patients of whom the x-ray films of the skull showed bone chips or a single large chip present in the brain, even if the external wound had healed primarily and the patient was free of symptoms. Obviously, retained macerated cerebral tissue, which made a peculiarly favorable media for the growth of bacteria, was also retained with the bone chips. This principle, however, was confirmed time and time again in the American army. When the British neurosurgical units, with their extreme mobility, received their head wounds early and performed meticulous excision of the wounds, they closed them and obtained healing per primam. The incidence of postoperative infection and any need for second or third operations decreased. As time went on the importance of an incomplete débridement of a wound track with resultant hematomas and eventual respiratory embarrassment was more and more apparent.

In World War I Cushing had emphasized the tripod incision for repairing scalp defects. In World War II, advancements in the field of plastic surgery pointed the way for the use of sliding and rotation flaps of the scalp to cover a defect produced by thorough excision of a scalp wound. This materially reduced the incidence of cerebral fungus and good healing resulted, so that eventually the tripod or relaxing incisions were abandoned.

Fascia lata and pericranium grafts and, later, fibrin film, were used to close defects in the dura mater. It was found necessary to close penetrating wounds which involved the paranasal sinuses, and large defects in which postoperative herniation of the brain would be followed by serious cerebral damage. German neurosurgeons advocated the routine closure of all dural defects to prevent postoperative infection and the formation of a fungus. This procedure was followed by some inexperienced American neurological surgeons to the point of absurdity, but the experi-

enced American neurological surgeon confirmed the fact, first established by the British, that careful excision of the wound and meticulous closure of the scalp were the most important factors in preventing postoperative infection, and not closure of the dura mater, except in the instances mentioned above.

Martin and Campbell clearly stated the principle concerning the use of drainage in craniocerebral wounds. Their view was that in deeply infected wounds of the brain a drain was unnecessary if débridement was done thoroughly, but if débridement was not complete a drain did not suffice. There was some disagreement with this viewpoint, nevertheless in the closing stages of the war the use of drainage became less common.

The operative treatment of craniocerebral wounds may be summarized by saying that it was based upon an ever increasing ability of the surgeon to cleanse and débride the track of the wound thoroughly. Closure of the scalp and dura with more extensive employment of technical methods of plastic surgery was an evolution which materially affected the successful results obtained. Whereas in World War I the wound track was débrided and cleansed by syringing, in World War II the track of the wound was visualized and cleansed by suction with emphasis upon the removal of all foreign materials, blood clots, and pulped brain tissue. It was concluded that these materials were far more dangerous than the risk of spreading contaminated material through the brain at operation. In World War I the dictum was that wounds more than 24 hours old should be packed open, which in fact was followed in other wounds of the body in World War II. Seriously contaminated wounds of the brain and other wounds seen 3 days after injury or even later were closed after complete cleansing and débridement. Purulent wounds were also closed completely by the British with a small tube left in place for the introduction of penicillin.

*Chemotherapy* It has become a trite statement that the sulfonamides and penicillin are not substitutes for meticulous surgical procedures. However, there are those craniocerebral wounds in which pathogenic organisms gain access to the subarachnoid spaces or ventricular system regardless of the care with which operative procedures have been carried out. Toennis reported a large series of deaths in the German army from infection of the brain and its meninges after wounds of the paranasal sinuses. Cushing and his team in France in 1917 lost almost 1 of every 3 patients from ventriculitis, meningitis, or some other type of brain infection.

Cairns and his colleagues advocated the use of 18 gm of sulfadiazine on the first day and 12 gm daily thereafter in the treatment of meningitis. In fact, this drug was used as a prophylactic measure. It is obvious that the proper pH of the urine must be maintained to avoid renal complications, and it has been found that this can be accomplished best by the intravenous administration of N/6 sodium lactate solution. Powdered sulfonamides had been applied locally to brain wounds and Ascroft reported no ill effects therefrom. However, Pilcher and others in America showed that sulfathiazole, particularly, produced convulsive seizures when applied directly to the brain. Ironicity and neutrality are the important factors when any substance is brought into contact with the brain.

Cairns and his colleagues also established that penicillin given intrathecally is successful in the treatment of meningitis from organisms susceptible to penicillin, provided of course that there is no block in the cerebrospinal fluid pathway and that the source of the infection has been adequately treated. They showed also that in grossly infected wounds with superficial suppuration, cellulitis of the scalp, osteomyelitis of the skull, and infected brain fungus, systemic administration of penicillin is of great value. Contrary to the workers in America, they saw no convulsive seizures develop from the intrathecal or intraventricular use of penicillin when the proper dosage was given. The work of Wyck in Australia confirms these findings, as do experiences with individual patients presenting pneumococcal meningitis in civilian practice. The relative value of local and systemic administration of penicillin in the prevention of gram-positive infections after the excision and suture of brain wounds was not completely proved by Cairns and his co-workers, but it must be emphasized that it was the facility with which Cairns, the Consultant in Neurological Surgery to the British Army, moved about, saw results first hand, and had the opportunity to encourage and stimulate his younger colleagues in their work that made these valuable fundamental contributions possible.

*Penetrating wounds and retained missiles* In an attempt to determine the exact course of events in penetrating wounds of the brain, Pilcher studied a group of dogs into the heads of which unsterile foreign bodies penetrating the ventricle and still protruding through the skin invariably produced a rapidly spreading and fatal infection of the meninges, brain, and ependymal lining of the ventricles. If a foreign body was removed within 12 hours the incidence of fatal infection was



greatly reduced Failure of the foreign body to reach the ventricle greatly reduced the likelihood of death from a fulminating infection Pilcher concluded that an unsterile foreign body, deeply imbedded but not communicating with either the skin or the ventricle, does not cause fatal infection unless at some time the ventricle was penetrated His experiments, therefore, showed that a foreign body communicating with the skin, subarachnoid spaces, or ventricle should be removed as early as possible, but if the object is located deep within cerebral tissue and does not communicate with the ventricle or the outside, it is usually best to leave it in place unless local destructive symptoms develop In the British Army, missiles in the brain were removed in less than one-third of the cases in which they were present Ascroft, in 1943, concluded that it was retained bone chips rather than the retained missile which gave rise to a brain abscess, but later in the war the occurrence of abscess about a missile, although the bone chips had been completely removed, was frequent enough to direct closer attention to removal of the missile Electromagnets were replaced for the most part by the simple procedure, advocated by Schorstein, of using a piece of magnetized steel held in a pituitary rongeur

Relatively speaking, the occurrence of intracranial hematoma is uncommon in missile wounds of the brain Ascroft reported that intracranial hematoma caused death in 13 of 359 fatal cases of brain wounds Schorstein reported 57 recoveries in 83 cases and called attention to the fact that hematoma occurred most often as the result of small penetrating missiles of high velocity when the wound of entry was too small to allow escape of the clot

Reference has been made to the experience of the German army, that brain wounds which involved also the paranasal sinuses were overwhelmingly fatal In civilian neurological surgery the problem of closing a dural defect of the anterior fossa which communicated with the frontal sinuses had been attacked in several ways and its importance was widely recognized At the Head Injuries Hospital in Oxford, England, during World War II, 400 operations were performed for closure of the torn dura over the paranasal sinuses As experience increased it was found there that intradural repair with fascia lata through an osteoplastic flap was the most satisfactory method However, each wound presents a specific problem and often exenteration of the sinuses or an extradural method of repair proves more effective The time and place for such operation, which are time consuming if they are performed as they

should be—with meticulous regard for details—may be difficult to prescribe in war injuries Certainly, they should not be undertaken routinely under less than ideal conditions, as they were in some units of the American army

*Repair of skull defects* In the American army it became the policy early during World War II to repair skull defects by the use of various types of material, but finally tantalum was most widely used, while acrylic resin was less frequently employed In civilian life prior to World War II, several neurological surgeons had employed acrylic resin in several instances and found it to be quite satisfactory There was no established policy for the repair of skull defects as far as size and location of the defect, the time and place for repair, or the symptoms which indicated the need for skull repair were concerned As a result, small defects of the skull without accompanying symptoms of any kind were covered with a tantalum plate as frequently as large defects in the frontal area with accompanying loss of the orbital ridges In only one Army general hospital in the United States were preoperative encephalograms or ventriculograms taken to provide an accurate record of the state of the ventricular system and subarachnoid spaces before the tantalum plates were applied The policy regarding resection of the underlying scar of the brain varied with the individual neurological surgeon from resection of the brain down to the underlying ventricular wall to no interference whatever, not even dissection of the dura mater away from the overlying edges of the defect In no Army general hospital were postoperative air studies performed as a part of the procedure of closing skull defects Therefore, in the majority of instances the operation became a mechanical one of carpentry As a result, the effect of closing skull defects by plastic methods upon the occurrence of epilepsy following head wounds, or the change in status of the ventricular and subarachnoid systems following the operation will never be accurately determined in the American wounded Neurological surgeons now engaged in service in the Veterans hospital facilities are obliged to remove tantalum plates from the skulls of patients in whom they were placed unwisely because of persisting infected and draining sinuses and osteomyelitis of the surrounding bone The advantages of acrylic resin over tantalum on x-ray studies of the ventricular and subarachnoid systems are obvious

*Posttraumatic convulsions* The frequent occurrence of convulsive seizures following craniocerebral injuries of warfare has been a matter of great concern since World War I, as Schmidt pointed

out In some patients the injury to the brain is so great that regardless of their care, convulsions may be expected to occur In others, unwise surgery, particularly injudicious zeal in extracting an indriven missile with no regard for the destruction required to remove it, or infection of the brain, meninges, and skull may be etiological factors Ascroft reviewed the case histories of 317 patients who received cerebral gunshot wounds in World War I in 1941 One hundred seven of these patients suffered from convulsive seizures 4 years or more after receiving their wound Thirty-three of this number were having major convulsions with a focal onset, frequently an aura Many cases of petit mal seizures were of a focal character Attacks were twice as frequent in the cases of cerebral injury in which the dura mater was penetrated, compared to the cases of injury without dural tears Patients from whose brains metallic foreign bodies had been removed were much more commonly subject to convulsions than patients who had not undergone such surgery at the time of their injury or who still retained the missile Scalp wounds of all kinds were followed by convulsions in 24 per cent of the patients, probably because of the more severe underlying brain injury than that occurring with the usual scalp injury in civilian life Ascroft also found that although convulsions more certainly follow direct injury to the sensorimotor cortex than injury to some area removed from the rolandic area, yet the exact site of cortical damage did not seem to have such an important bearing on the production of convulsions The first seizure might occur within a few hours or as late as 20 years after the original injury, but usually the onset of convulsions was sometime during the first 2 weeks after injury

*Protection against craniocerebral injuries* According to Cairns, little work was done on the protective value of the steel helmet against craniocerebral wounds However, there were many individual cases in which what would probably have been a penetrating wound presented itself as a simple wound of the scalp and skull because of the helmet Cairns perfected and had adopted a protective helmet which was worn by motorcyclists in the British Army, and its value was demonstrated on many occasions

The regular issue steel helmet worn by the American soldier admittedly furnished excellent protection against craniocerebral injuries However, it was not designed for the use of the crews of aircraft or tanks and could not be used to advantage by them, mainly because of its size, shape, and weight Nevertheless, the desire of

one copilot for protection to his head from bursting 20 mm Oerlikon shells led him to remove the liner of his helmet and pull on the outer steel shell over his regulation leather flying helmet The effectiveness of this protection was emphasized by the fact that his pilot, wearing only a leather helmet, was struck in the head by the fragments of an Oerlikon shell which burst between them He immediately lost consciousness, developed a left hemiplegia, and a complete left homonymous hemianopsia While the copilot's helmet was punctured in several places by the high velocity fragments, it afforded complete protection from even a scalp laceration

It became obvious that members of an aircrew needed adequate protection from craniocerebral injuries However, any helmet designed for their use had to meet certain specifications

- 1 It had to be close fitting and comfortable so that it would simulate as closely as possible an ordinary leather flying helmet and be considered a personal possession which might gather "good luck," like a favorite, battered felt hat

- 2 It had to allow free and unrestricted movements of the head in all directions, and could not interfere in any way with the field of vision

- 3 It had to be light in weight and afford protection from the heat and cold

- 4 It had to afford protection, at least equal to that afforded by the regular issue steel helmet, against craniocerebral injuries produced by fragmenting Oerlikon shells and antiaircraft flak, or concussion due to direct, blunt trauma If these requirements could be met for aircrews the same type of helmet would serve for tank crews that used a fiber helmet which the soldier found unsatisfactory for protection, efficiency, or comfort

The percentage of wounds to the head, comparing its surface area to that of the body, is approximately 12 per cent It was found that the larger number of craniocerebral injuries in airmen resulted from the fragmentation of 20 mm Oerlikon shells, followed in turn by the larger pieces of antiaircraft flak, and concussion due to direct trauma When an Oerlikon shell bursts, it fragments into thousands of pieces which vary in weight from less than 1 mgm to 20 gm However, the largest number of "effective" Oerlikon shell fragments bursting in an area 5 feet in diameter and capable of causing incapacitation to the person exposed is 260 The majority of these 260 fragments weigh between 10 and 50 mgm and their velocity varies between 400 and 600 meters per second

Many materials were suggested and subjected to accurate ballistic and other tests It was finally

concluded that an acrylic resin, properly manufactured, offered the largest number of advantages for the purpose and most closely met the specifications for velocity resistance, tensile strength, impact resistance, hardness, specific gravity, inflammability, nonconduction of heat and cold, and tissue reaction. A model helmet was made by molding pieces of acrylic resin to conform to the frontal, temporal, occipital, and vertex portions of the skull covering them with leather, and lining them with chamois skin and fleece. Such a helmet allowed for complete movement of the head in all directions, provided complete protection over the frontal and occipital areas, and weighed 18 ounces, compared with the steel body of the regulation helmet which weighed 35.84 ounces. A commentary on the organization within the Army is that this type of helmet was field-tested and adopted for Marine and Navy flyers, but further work upon it by the Quartermaster Corps of the Army was prevented by a directive which forbade this corps to interest itself further in protective clothing of any description for the Army Air Corps.

**Blast injuries.** Investigation of the cerebral symptoms after blast injuries was carried on by Zuckermann and his associates for the Ministry of Home Security in Great Britain, where, of course, the greatest opportunity existed during the Battle of Britain. They found no evidence of cerebral lesions in experimental blast, and the cause of the clinical symptoms still remains in doubt. However, others did report hemorrhagic cerebral lesions in patients without any wounds of the head. Cairns believes that the possibility of cerebral fat emboli still remains in question, although in some cases fat was looked for in the brain lesions and not found.

**Mechanics of craniocerebral injuries.** A series of recent investigations has emphasized the facts that nerve tissue, blood, and cerebrospinal fluid have about the same density as water, that the brain substance does not change its size appreciably when subjected to hydrostatic pressure, and that the brain offers very little resistance to changes in shape as compared to the resistance it presents to changes in size. Obviously, the rigidity of the skull is enormous compared to that of the brain.

Deformation of the skull has been recorded electrically and is, as would be expected, most severe near the point of impact where there is compression distortion. Simultaneously on the opposite side, there is tensile deformation. Since the brain substance is extremely incompressible and yet easily altered in shape, its constituents

are pulled apart in proportion to the degree of sliding type of deformation.

Another mechanism acts to injure the brain; it is due to the changes in velocity of the head produced by the blow. Linear or rotational acceleration forces, or both, may be set up, and of these the latter are the most injurious. The small amount of motion allowed the brain in its closed box is possible only because of the to-and-fro movement of the cerebrospinal fluid. When the head is subjected to rotational acceleration forces, the brain lags behind and a type of shearing strain results. Denny-Brown and Russell found it difficult to produce concussion in animals if the head was prevented from moving when it was struck.

#### INTRACRANIAL ABSCESS

The influence which the antibiotics have had upon the result of the surgical treatment of intracranial abscess has been almost miraculous. There was a time not far distant, however, when this intracranial lesion was one of the most disappointing which beset the surgeon. The sterilization of the contents of the abscess, the safety with which one can wait until the abscess wall is well established, the avoidance of ventriculitis and meningitis, and, finally, the success which has attended removal of the abscess in its entirety, without the development of widespread encephalitis, constitute a real contribution to this field of surgery. Chorobski has recently reported upon removal of the abscess in its entirety in 26 cases.

#### SPINAL CORD INJURIES

The record attained in the treatment of patients with spinal cord injuries in World War I was not an enviable one and the methods of treatment of traumatic paraplegia were not improved a great deal by the experiences of that war. The contributions of Riddoch, Holmes, and Head to the physiology of the spinal cord, which resulted from their meticulous study of the relatively few patients who survived following injury to the spinal cord in World War I, are unequalled in clinical observation. In the succeeding years the majority of the patients were injured in industrial or traffic accidents, and the greater part of the injuries were of the closed fracture-dislocation type. A second opportunity for improvement in the methods of treatment of spinal cord injuries was at hand with the beginning of World War II and the tremendous number of wounds of the spinal cord from every conceivable cause. It is doubtful if careful and accurate clinical studies of the 2,000 odd traumatic paraplegic patients who are still alive after World War II were made during the time

they were being cared for in military hospitals. Such studies are now being undertaken in Veterans Administration hospitals where these patients are now under care.

It is unfortunate that many paraplegic patients misunderstood the assurances given them by the Army that over 80 per cent of them would walk. These tragic individuals have learned in these last few years the difference between ambulating and walking. They, quite naturally, had expected to walk in the manner to which they were accustomed before their injury and irrespective of the level of that injury. This overenthusiastic approach did more harm than good and led to ill advised actions by members of Congress and other well meaning laymen which made the paraplegic patient consider himself in a group set aside from other seriously wounded and permanently handicapped veterans. The problems of the care and treatment of patients with paraplegia must be thoughtfully carried out to a solution. There is no doubt but that the problems of these patients have been built up too strongly in the public mind. They have become the center of much interest, not all medical, which may eventually make their care even more difficult. The very word "paraplegic" is objectionable. It is frequently heard from the lips of patients and lay persons, singling out and stamping these patients as doomed with a special and completely hopeless disability. A less pointed, less specific term should be adopted. These patients are seriously and tragically injured persons and should be treated as such, but they should not be singled out for overindulgent publicity from those with other types of injury just as serious and, in many cases, more disabling.

**Surgical treatment.** Even with the large experience gained from spinal cord injuries in World War II there is still no agreement upon a course of surgical procedure which should be carried out in the treatment of the patients immediately after injury. This should not be surprising. On the contrary, it is surprising that it should be expected that these injuries, which exhibit so many different symptoms, could be typed so strictly that any one particular group of therapeutic steps would be the correct one in all instances. The greatest unanimity of opinion, and undoubtedly the greatest contribution that has been made as a result of World War II experience, has centered on the rehabilitation of the patient. The high quality of the early care of the patients with spinal cord injuries in this war has kept them alive so that rehabilitation could be effected.

In the past, the term "spinal shock" has been used frequently and without critical meaning.

The term should be discarded because attempts to interpret it often have deprived the injured patient of the sorely needed help of a surgical procedure. Any patient with an injury of the spinal cord, with or without concomitant injury to other parts of his body, may suffer from a fall in blood pressure, a low body temperature, and a poor pulse and give evidence of poor peripheral circulation. Unfortunately, the term is interpreted by some to mean that the patient has a complete anatomical section of the spinal cord because he may be flaccid and without reflex responses of any type below the level of his injury. As a matter of fact, early in the phases of a spinal cord injury the differentiation between a complete anatomical and a complete physiological lesion cannot be made upon the basis of clinical symptoms. It has been said that plantar flexion of the great toes is usually the only reflex movement that can be elicited upon scratching of the sole of the foot during the first few weeks after a complete transverse lesion of the spinal cord, and that the appearance of a Babinski sign within the first 2 weeks after injury is evidence of the incompleteness of the lesion.

Most surgeons will agree that the patient should be recovered from the primary shock of his injury before treatment is begun, whatever may be indicated. Similarly, most surgeons are agreed that the final position of the patient with an injury to the thoracic or lumbar spine, with or without cord injury, and whether or not the patient is subjected to laminectomy when the cord has been injured, should be that of hyperextension. Fixation upon a special hyperextension bed with a reverse spring mechanism, or by means of rolled blankets under the mattress, and without a plaster cast, should be obtained. Plaster casts, so dear to the hearts of the orthopedic surgeons, create many problems of nursing care, contribute to the formation of decubiti and add to the general discomfort of the patient. Manipulation of the spinal column to reduce a fracture-dislocation is only mentioned to condemn the practice emphatically. Some form of skeletal traction is preferable in the care of cervical fracture-dislocations, and to the majority of neurological surgeons the use of skull tongs has proved the simplest, most effective, and safest method of obtaining traction. It has become standard practice to apply tong traction early in cases of fracture-dislocation of the cervical spine when there is no open wound and when there is no evidence of indriven bone spicules or other foreign bodies.

The greatest point of contention in the treatment of injuries of the spinal cord concerns the

problem of when, if ever, laminectomy is to be performed. The Queckenstedt test offers the most reliable method of demonstrating the presence or absence of a block in the subarachnoid space, whether it be due to edema of the injured cord or to pressure upon the cord by dislocation of the vertebrae. It offers a method of following the release of that block by subsidence of the edema or by closed methods of re-establishing the free circulation of the cerebrospinal fluid. Or, it establishes the indication that a laminectomy must be performed to relieve the block. The surgeon cannot repair the injured spinal cord, he can only relieve compression and provide every opportunity for the spinal cord to regain its function. The differentiation between complete anatomical and physiological interruption cannot be made in the period which is important to the patient's future. Therefore, the Queckenstedt test is important in defining the responsibilities of the surgeon.

A large number of patients with spinal cord injuries who have had a subarachnoid space block from the time of their injury have been observed in a Veterans Administration hospital. In the majority of these cases, the continuity of the spinal cord had not been interrupted anatomically. One can only surmise what the course of the patient might have been had the subarachnoid space block been followed up persistently and the compression relieved early after the injury. If it was not relieved by closed methods of traction and hyperextension then certainly a laminectomy should have been performed to have given the patient every opportunity to recover part or all of his cord function.

Certainly, decompressive laminectomy weeks and months after injury rarely offers any benefit when evidence of a complete transverse lesion has persisted. However, this is not true, even in late operations, when the lesion has been incomplete and not progressive. Early or late, operation has much more to offer in injuries of the cauda equina than it does in injuries of the spinal cord. When the injury is in the cervical cord, skeletal traction should always be tried first. Early and premature cervical laminectomy, within the first few hours or days, is bad surgical judgment and is the one instance in which surgery contributes to the already poor prognosis of the case.

The open wounds of warfare require the usual meticulous débridement that all such wounds require. It was common practice in World War II to remove all bone fragments and make a clean toilet of the wound without opening the dura mater in the potentially infected field. Indriven spicules of bone and foreign bodies, if accessible,

were removed. Dural rents were closed either by suture, if possible, or by the application of living fascial grafts in order to stop the cerebrospinal fluid leak. In the fresh open wound only the bone that was actually damaged or in danger of not remaining viable was removed. The excellent healing and frequent return of function, particularly in incomplete lesions, which resulted from such treatment has provided fresh hope in the care of these patients. The aid of systemic chemotherapy has been as great a boon in this field of neurological surgery as it proved to be in cranio-cerebral open injuries.

*Rehabilitation.* The time finally arrives in many injuries of the spinal cord, in particular those of the cervical and thoracic segments, when all active treatment for the injury itself is futile. The patient must be prepared for existence as a bed patient, a wheelchair patient, or as an ambulant patient with the need for crutches, braces, or walker, this depending entirely upon the level of his lesion. World War II gave a tremendous impetus to the re-education of the patient with a spinal cord injury. The programs for the rehabilitation of these patients in certain Veterans Administration hospitals are being carried out on a broad and detailed scale, but they are no different, actually, from those which have long been advocated by many neurological surgeons in the care of patients with similar injuries received in civilian life. Carefully supervised recreation, physical therapy, occupational therapy, and study in trade schools are all parts of a general program to improve the morale of the patient, to help him readjust himself to a happy and, if possible, useful existence, and to give him the maximum chance for physical recovery. The great force promoting such a program has been, happily enough, the United States Government, as reflected through the care given these patients by the many civilian doctors who have given of their time and abilities to the Veterans Administration hospitals and the hospitals of the Army and Navy.

*Late care of the patient.* The primary responsibility of the care of the patient with a spinal cord injury should be that of the neurologist, with the aid of the neurological surgeon, the urologist, the orthopedic, general, and plastic surgeons, and particularly of the internist who can consult in problems of general medical care and nutrition which constantly arise. When the patient is thus handled, he requires no more special psychiatric care than any other type of patient with a chronic illness.

The special difficulties of nursing care are multiple and a large personnel is needed to give pri-

tients with spinal cord injuries a consistently maintained high level of attention. The daily nursing problems which attend the care of the bowels, bladder, decubiti, nutrition, cleanliness of the skin, and morale require a persistent attitude of optimism on the part of all the ward personnel. This cannot be obtained by the written order in the book, it must be implemented by the supervision of competent, interested doctors and nurses, particularly the latter whom the patient sees more than any one other person. A hopeful, friendly, interested approach has proved to be a great factor for good.

*Nutrition* The value of the correct blood protein level and the albumin-globulin ratio has been demonstrated repeatedly in the care of these patients. The diet must be carefully supervised to provide a high protein intake and an average caloric supply of about 2,800 calories a day. It is not primarily the purpose to have the patient gain weight, although well fat-padded weight-bearing points are less likely to develop decubitus ulcers. It is the latter which seriously deplete the plasma proteins. A high vitamin diet is also desirable, and for the purposes of improving the status of the bladder a generous fluid intake should be urged.

*Decubitus ulcers* Every meticulous detail of nursing care must be insisted upon to avoid rather than to heal the decubitus ulcer. Weight bearing points on the body must be rested frequently by turning the patient, and by massaging and drying the skin. Sheets must be clean and smooth. The skin must be bathed frequently and kept dry and free from feces, urine, and perspiration. Attention to the avoidance of decubitus ulcers must begin within the hour after injury and can never, for the rest of the patient's existence, be relaxed at any time. There is no questioning the fact that delayed and inadequate nursing care during the first few days after injury, in the theater of operations, was the main source of bed sores. It was for this reason, among others, that doctors insisted upon evacuation priority for these patients, oftentimes unsuccessfully against the obstinate obstruction tactics of laymen in other echelons who were preoccupied in the transportation of matériel and personnel designed to make their own existences more comfortable.

Once a decubitus ulcer has developed, it should be treated with all of the meticulous care necessary to prevent the introduction of further infection, as sloughs appear they should be carefully removed, the base of the ulcer which consists of granulation tissue should be kept fresh and clean. The use of ointments, no matter how brightly colored, upon the ulcer does not conform to the

sound surgical principles established for the successful treatment of this kind of a wound. The purpose is to close the wound as quickly as possible after the disappearance of infection. This can be accomplished most quickly by excision and closure in the small ulcers, but in others free grafts or rotation flaps must be used. Eventually some ulcers will epithelize but the healing process is a slow and tedious one and the patient is handicapped in his rehabilitation by the long period required.

*Development of automatic micturition* The establishment of efficient urinary function is one of the primary goals in the care of the patient with an injury of the spinal cord. It avails little to rehabilitate the patient successfully in various other spheres if eventually he does not have adequate control of his urine, for in such a chronically disabled patient the inability to void with some means of control will alone prevent his return to a socially acceptable state. Furthermore, proper urinary function, in so far as it can be developed, is important for the preservation of life itself.

It has been accepted as fact that the appalling death rate among the wounded of World War I who suffered spinal cord injuries was due to urinary sepsis probably induced by early repeated manual catheterization. It would seem that in World War II, the method of choice in the care of the bladder was early suprapubic drainage with a large tube placed well above the symphysis pubis. Later when the patient reached adequate hospital facilities, the tube was removed and replaced with a permanent indwelling catheter. It has been established as a principle by testimonials and not by proved facts that a suprapubic tube was necessary "for purposes of transportation." It was the experience of more than one neurological surgeon to receive the patient at a base hospital with urine oozing out around a plugged-up suprapubic tube (which promoted the formation of decubitus ulcers), with a necrotic fistula, or, on occasion, with the neglected tube rotted off and lying free in a mass of calculus in the bladder. The British have described a "trocar" method of performing the suprapubic cystostomy with insertion of the tube immediately above the symphysis, but observation of several British wounded with spinal cord injuries showed that this method of management was not proof against the thoughtless or careless doctor.

Tidal drainage, generally popular in America, requires attention from the doctor, nurse, and patient. It is not a simple, self-regulating mechanism as many assume, but it affords a means of continuous cystometric study, it is a means of

Of these 471 patients, 126 complained of pain so severe as to require the consideration of active steps for its relief. In 8 of these patients the cervical spinal cord was injured, in 73, the thoracic portion of the cord, and in 45, the lumbar cord and cauda equina. In general, the pain experienced by the patients could be classified as (1) root pain, (2) burning, tingling, and poorly localized pain, and (3) visceral pain, characterized by its cramping, diffuse, and vague character.

The onset of root pain usually occurred within a few days to a few weeks from the time of the injury. Only 1 of the patients with an injury of the cervical spinal cord complained of this type of pain. Twenty-eight of the 73 patients with thoracic spinal cord injuries and 38 of the 45 with lumbar cord and cauda equina injuries suffered similar pain, which was unrelieved by medication but in many cases gradually abated in severity, although it never disappeared entirely without surgical attempts directed toward its relief.

Every one of the 126 patients complained of continuous, burning, tingling pain which was diffuse, was never localized narrowly, and almost never corresponded to the peripheral distribution of a dorsal root. Segments of the body below the level of the spinal cord lesion with complete loss of sensation to the usual sensory stimuli were involved, such as both feet or both legs below the knee. The most common description was that of burning, "shooting like electricity," "tingling like that following frostbite," and a "feeling like pins and needles." Many patients described this type of pain as being more severe with the onset of cold and damp weather, in many the pain was increased when they became excited or depressed, in others it was increased by the light contact of a finger or the touch of a wisp of cotton. Movement of the body, jarring of the bed, fatigue, attempts to concentrate upon moving the toes, and smoking were all described as factors in making the pain worse.

The onset of this pain occurred immediately after injury to several months later. Holmes stated that in the cases he observed it reached its maximum upon the second or third day after its onset and began to subside toward the end of the second or third week. He knew of no patient in whom this type of pain persisted unabated beyond a month or so after injury. In general, the patients also described this burning pain as gradually increasing in severity for a time after its onset and then becoming less severe, but in many instances the pain has persisted for 4 years and in all of them constitutes a major complaint for

which they intermittently seek relief. There is no question that personality is a definite dominating factor in this type of pain. The nature of the pain assumes different attributes depending upon many emotional factors. The hot, burning pain would be replaced at times by severe crushing pressure, by sensations of viselike pinching or of streams of fire running down the legs into the feet and out of the toes, or by a pain such as produced by the pressure of a knife being buried in the tissue, twisted around rapidly, and finally withdrawn all at the same time. Many of the less well adjusted patients related this pain to the existing or healed bed sores from which the burning seemed to originate. In many respects, this pain resembles that complained of in phantom limbs, particularly with regard to its peripheral projection.

The type of pain that is classed as visceral pain must be sharply differentiated from the root pains and the diffuse, burning, unlocalizable, painful sensations just described. It is a sensation of fullness in the abdomen related directly to distention of the urinary bladder, with cramping, vague, diffuse, periumbilical, and hypogastric pains which occur when the patients receive enemas and the fluid is injected rather high, and the bowel is distended. In these patients the painful sensations continued until the bowel or bladder was completely evacuated. Many of the patients had a feeling of nausea, sudden profuse sweating, flushing of the face, headaches, and pilomotor erections. In fact, in many patients a headache and flushing of the face and neck constituted the only warning that the bladder was full and was about to evacuate automatically. These visceral sensations of pain occurred in more than 80 per cent of all the patients regardless of the level of the spinal cord injury, but they were presented by the patient as complaints for which he wished relief in only 6 cases of thoracic cord lesions.

Cordotomies were performed on 18 patients for the relief of pain, 23 operations were performed, and 1 patient had 3 operations. Only 1 patient received lasting relief from the burning diffuse pain following cordotomy, 2 received relief for 1 and 2 weeks, respectively, after which the pain returned exactly as it was before operation. Four patients received complete relief from severe root pains, and 13 had no relief from root pains following the operation. These operations were performed in Army general hospitals and in the majority of instances by inexperienced and unqualified neurological surgeons. In 6 of the patients who had lesions of the cauda equina and



who had no relief from the cordotomy, the sensory level and motor loss were at a higher dermatome level following the operative procedure, with a greater loss of automatic bladder function than had previously existed

In 2 patients with cauda equina lesions who had both root pains and diffuse, burning pain in their legs, paravertebral alcohol injections of the lumbar sympathetic trunk had been made. In 1, temporary relief of the root pains for 3 days was obtained, but in neither patient was there relief from the burning pain

Thirty patients who complained bitterly of burning, diffuse pain were given intravenous injections of tetraethyl ammonium chloride to determine what effect this strong vasodilator drug might have upon their pain. In all of them, coldness of the lips, dizziness, slight nausea, and weakness occurred, but there was not a uniform striking drop in the systemic blood pressure and in none of them was there any significant relief from the pain

The clinical course of each of these patients was characterized by the administration of all types of sedatives, and in some it has been necessary to relieve the patient of narcotic addiction. There was no drug or combination of drugs which afforded them any more relief from the burning pain than did an occasional capsule of aspirin, phenacetin, and caffeine. It must be emphasized that more than 90 per cent of the total number of patients complained at some time following their injury of the diffuse, burning pains that have been described but, with the exception of this series of 126 patients, the pain either disappeared entirely and without any specific treatment, or the patient became completely adjusted to its presence and was aware of it only after an emotional upset or for some minutes immediately before he fell asleep

**Reflex activity** The loose employment of the terms, "mass reflex," "spasm," "paraplegia in extension," "paraplegia in flexion," and "spinal shock" leads to confusion in any discussion of one of the most serious problems which must be faced in the care of the patient with a spinal cord injury. These conditions are all manifestations of the same general state of altered spinal reflex activity. It is difficult, probably unnecessary, and not even desirable, to categorize all the variants of these alterations. An understanding of the nature and cause of bizarre reflex activity in man after spinal cord injury must come from a study of man

The large number of patients with spinal cord lesions who have survived long periods following

their injuries, because of the excellent care they received in comparison with World War I, has made it possible to observe and study the reflex activities which are present and when they made their onset, also their character and their relation to the general physical state of the patient.<sup>1</sup> Abnormal reflex activity, appearing early or late, may manifest itself in the responses to plantar or other superficial stimulation, to muscle stretching, to genital stimulation, and to the stimulation of either the bladder or bowel. The vasomotor, pilomotor, and sudomotor responses which accompany the various striated muscle contractions may be entirely erratic. Certainly, the patterns of reflex responses in these individuals are rarely repeated often enough to make them reliable for diagnostic or prognostic use

It is commonly stated that after a severe injury to the spinal cord the condition of "spinal shock" ensues (in man for 3 or 4 weeks), during which time reflex activity is absent. The term "spinal shock" is an unfortunate one. After the first few hours are past, the truly shocking effects of the trauma have worn off, and the patient has had the customary supportive care (including surgery if that is necessary), the patient is usually comfortable, shows satisfactory blood pressure, pulse, respiration, and temperature readings, and is normally active above the level of the lesion. The exception, of course, is the midcervical or high cervical lesion which so commonly results in early death. It is hardly tenable, furthermore, that shock can be said to persist for weeks at a time with the patient in good condition save for his paralysis. This interval should be designated as one of *decreased reflex activity*. However, all reflex activity is rarely gone. In fact, the genital reflexes (active ischiocavernosus and bulbocavernosus muscle reflexes with erection) may appear immediately to be persistent over a long period of time. Erections occurring immediately have been noted in patients with transected or incompletely crushed cords, both in the cervical and thoracic regions, and this reflex has been seen to remain active and easily provoked for as long as 4 years after injury. Indeed it is through stimulation of the external genitalia (but not with nocuous stimuli), the perineal skin, and the inner surfaces of the thighs that one may first note the onset of the second stage, or the state of *heightened reflex activity*.

<sup>1</sup>Four hundred ninety patients have been observed and studied in civilian practice in Army general hospitals and in a Veterans Administration facility. Some of the patients were taken care of immediately after their injury and followed up through their entire course; others were taken care of immediately and later followed up in Veterans Administration hospitals. Still others were seen for the first time in the latter hospitals as long as 5 years after their original injury was received.



With the beginning of this second phase, there appear the early visceral and vasomotor reflex changes, and flexion, extension, or adduction of parts of the lower extremities. After the first day or two, there is frequently, although not characteristically, an almost normal appearing flexor movement of the toes on plantar stimulation. During this period there is retention of urine and catheter care is necessary. The bowels require enemas, but ordinarily automaticity of the bowels, if it develops at all, will begin at an earlier date than similar function of the bladder. Knee and ankle jerks are absent during the early days after injury. Bladder irrigation and enemas seldom cause flushing, sweating, headache, or "crampiness" in the abdomen before the fourth week has passed. The skin below the level of the lesion becomes quite dry, pale, and lifeless, especially on the feet and ankles, and tissue turgor is poor. It is during these first few weeks when vasomotor stability is lost in the skin that bed sores are most likely to develop.

Except for the ever present specter of decubitus ulcers, the patient is usually a nursing problem of ordinary degree during the period of depressed reflex activity, taking into account the special attentions to the bladder, the skin, and the state of nutrition. Neurological recovery, if it is to occur, will show some signs fairly early, and the persistence of depressed reflex activity, with or without any plantar responses, usually means that a complete physiological, if not anatomical, lesion exists. Sherrington discussed the period of "shock" in a few paragraphs, hardly improved upon to this date, when he stated, "Spinal shock appears to take effect in the aboral direction only. Section behind the brachial enlargement disturbs little if at all the reactions of the fore limb, although the number of headward running channels of conduction ruptured by such a section is enormous."

On the aboral side of the transection depression is profound. The view of Goltz and his school that 'spinal shock' is a longlasting inhibition due to irritation by trauma is not, I think, really tenable. Were the mere irritative actions of the trauma the cause, it is not easy to see why the nervous centers near the trauma should not be depressed on either side of, for instance, a spinal transection, headward as well as backward.

There remains the further question as to whether spinal 'shock' is a phenomenon of inhibition. The condition of the spinal reflex-arcs in spinal shock appears to resemble a general fatigue rather than an inhibition. It renders difficult and uncertain the process of conduction along the reflex-arc as judged by the discharge from the ter-

minal neurone. This suggests a loosening of nexus between the links of the neurone-chain composing the arc, a defect of transmission at the synapse. I think, therefore, that spinal shock is neither due to irritation by trauma, nor in the main a phenomenon of inhibition. The rupture of certain aborally conducting paths appears to induce it."

The genital reflexes and the occasional flexion of the toes on plantar stimulation, particularly with nocuous stimuli, occurred in patients as early and as actively regardless of whether or not the cord was completely transected or severely crushed, or whether any other form of trauma was the cause of interruption of normal physiological function. Furthermore, the profoundness of the absence of other forms of reflex activity will be found to be the same when there is complete physiological (with or without complete anatomical) interruption of the cord. The problem which remains unanswered, therefore, is the cause of this sudden and persistent state of depressed reflex activity, increasingly profound as one ascends the phylogenetic scale.

Riddoch apparently also accepted the theory that separation of the effector mechanism from cerebral control was the cause of the altered post-traumatic reflexes. It seems to us, however, that if the conditions of altered reflex activity were due solely to loss of cerebral direction because of neuronal interruption, the state of change should remain the same from the time of injury, since the interruption, once effected, is final. It would seem more logical that at least one factor in the appearance of these reflex states would be a change, in the intact and adequately vascularized segment of cord and its peripheral nerve and end organs below the level of the lesion, of a histological and chemical nature. If that were true, it is possible that during the state of depressed reflex activity the various parts of the reflex-arc, including the myoneuronal junctions, are inactive in a period of re-orientation and reorganization of function and in a state of autonomous function of a primitive nature. In this state of autonomy, however, the organs most affected, the muscles, do not atrophy apparently because of the viable cord, even though connection with the upper motor neuron is lost.

It is unfortunate that in neither animals nor man can the complete anatomical and complete physiological lesion be differentiated early. By far the greater number of patients with early complete loss of all neurological function but without gross anatomical section of the cord remain as profoundly and persistently lacking in return of function as do those known to have had the cord actually severed. There is little difference in the

deep tendon reflexes, plantar responses, muscle spasms, and genital and viscerovisceral reactions in patients with clean anatomical cord section and in those with crush, preservation of continuity of the cord, but permanent failure of neurological recovery. Gross anatomical section assures the physiologically complete lesion, but a severely contused cord undergoes such softening, with later gliosis, that it, too, is in a microscopic sense anatomically severed.

Be the injury cervical or thoracic, or open or closed, with a complete lesion of the cord as indicated either by surgical verification or by the long persistent failure of recovery, the severity of the heightened reflexes varies from patient to patient. There are those patients who never at any time develop anything more than the mildest degree of spasm, while others early and rapidly progress to such a condition of hyperactive reflexes that the persistent deformity calls for specific medical or surgical care. It has been observed that the early care of the patient has much to do with his later period of heightened reflex activity. When the proper surgical care has been given early, and all supportive measures, such as early ambulation of the patient, physical therapy, proper care of the bladder, the avoidance of decubiti, and other sources of sepsis and general debilitation have been attained, patients have been spared later excessive reflex activity and all the attendant ills. The greatest single factor that is under the control of those who care for such patients in securing a smooth convalescent course is the avoidance of sepsis, especially that which arises from the urinary bladder. Spasm has been greatest in the patients injured in a theater of war, whose early care was often incomplete or in whom a state of sepsis and malnutrition was established. Invariably, patients ideally cared for in civilian life have not been found to develop such severe and disabling reflex activity. The incomplete lesion, as would be expected, produces less severe spasm according to the degree of neurological loss.

The *date of onset* of the phase of heightened reflex activity is not affected by the severity of the lesion, its completeness, or whether it is in a patient with a closed or open wound of the cord. Many patients have been observed with incomplete lesions, whether verified surgically or by the results of neurological examination and continued observation, who developed increased reflex activity as soon as patients with complete lesions. However, in many patients with incomplete lesions recovery will manifest itself within a few hours or days, and with the appearance of neurological recovery the state of "shock" must be said

to have terminated. Few incomplete lesions show symmetrical bilateral loss, and therefore the resultant state of hyperactive reflexes is seldom the same in the lower extremities. The patient with a completely severed or a hopelessly crushed cord will usually develop the state of heightened reflex activity no sooner or later than the patient with the contused cord which never shows any neurological function later. The date of surgical treatment, if given and regardless of its type, has not been found to affect the date of onset of the heightened reflexes. Patients have been seen with essentially an immediate onset of hyperactive, bizarre reflexes who never exhibited a period of decreased reflex activity for more than a few hours. The date of onset of heightened reflexes varies widely. It occurred in 1 patient with a complete lesion of the cord at the sixth cervical segment at the end of a full year, and in a patient with a complete lesion at the eighth thoracic segment at the end of 23 months. The average time of onset of the state of heightened reflexes was 15 months in the group of cervical injuries, and 25 months in the group of thoracic injuries. Small signs of beginning reflex activity, such as the upgoing great toe or beginning flexion withdrawal of the limb may be manifest in a feeble manner for several days, so that the transition from the state of depressed to heightened reflexes is not an abrupt one.

Many different factors affect the *nature of the reflex response*. In patients known to have partial loss of cord function the reflex patterns are most commonly extensor in type and at all times are less violent in nature. The stimulus applied, however, need be no stronger to produce a response in such a patient than in a patient with a complete lesion. In complete anatomical severance of the cord or in those patients with severe crush and persistent lack of neurological change, the reflex pattern is usually one of flexion, or flexion with adduction. Variations are many and even in a patient with complete transection of the cord well above the lower end of the cord, the response is seldom of exactly the same pattern or sequence in the two lower extremities. In its most violent form the abdominal muscles contract (when the lesion is sufficiently high), the thighs adduct, and the foot rises dorsalward, all together with flexion at the knees and hips. Several patients have developed, at some time in their hospitalization, contractions severe enough to dislocate the femur on one or both sides. One patient with an incomplete lesion at the tenth thoracic segment had extensor spasm when up walking in braces (effect of posture), but flexion-adduction of a severe degree when lying in bed and making no voluntary effort.

Ordinarily, the stronger the stimulus the more prompt and violent will be the response. Furthermore, repetitive small stimuli may, in summation, become great enough to evoke a response, a fact known to all students in the physiology laboratory. The point of stimulation is an important factor, for while on theoretical grounds the reflex appears segmentally according to the level of the stimulation, actually it is not quite that accurate. Midline stimulation, as on the skin of the pubis, genitalia, or perineum, will customarily evoke a bilateral flexor-adductor response of the lower extremities, at least as low as the knees, but plantar stimulation on one side almost invariably produces a more prompt and violent reaction on the ipsilateral side. Painful stimuli will more promptly evoke reflex activity of the lower extremity than any other form of stimulation.

Riddoch frequently mentioned the fact that many stimuli of an innocuous nature produce penile erection, often with the ejaculation of semen. It has been observed, in confirmation, that priapism may appear immediately after injury, particularly when the lesion lies above the sixth thoracic segment, and may persist throughout the period of "shock" and for months and years afterward, without decrease in the excitability of the ischiocavernosus and bulbocavernosus muscles. In the early days following injury the priapism comes and goes apparently independent of any applied stimulus, as if it were a part of the general state of vasomotor instability. Later, during the stage of heightened reflex activity, washing or stroking of the lower extremities, passing a catheter, bathing the genitalia, or turning the patient upon his abdomen may bring on the erection. In the patient with easily evoked flexor responses, a strong pricking of the soles may produce what Riddoch called the "coitus reflex" with contraction of the abdominal muscles, extension of the lower extremities, and erection of the penis. It has been observed that characteristically during this reflexly induced erection the cremaster muscles contract with elevation of the testicles and the muscles of the bulb may be felt to contract. However, the glans and corpus spongiosum never have been found to become as turgid or to persist in an erect condition so long as do the corpora cavernosa, and the penis seems more ballooned up by a sudden influx of blood rather than actually erect in the usual sense. The emission of semen has never been observed and upon extensive questioning it is the exceptional patient who has seen that phenomenon. Occasionally semenlike material in small quantity may be seen at the meatus around the catheter, or the patient may report he has seen

a quantity of white ropery material in the freshly passed urine. The few patients admitting masturbation report the failure of any seminal emission. Nocuous stimuli to the erect penis produces a prompt return of the organ to the flaccid state.

It is commonly stated that perspiration does not occur below the level of a complete lesion. On the contrary, with lesions as high as the fourth thoracic segment, such profuse, dripping perspiration over the buttocks and thighs as to be a threat to the development of macerated skin and decubiti has been seen. These same facts were described in detail by Head and Riddoch. It has been observed, especially in the upper thoracic lesions, that a full bladder, just before its automatic evacuation, or a bowel distended by an enema, may produce an extensive flush of the body above the lesion, headache, perhaps nausea, "gooseflesh" on the skin of the lower extremities, and, finally, on evacuation, a return to normal color of the skin of the face, neck, and arms, with the sudden appearance of beads of sweat over the thighs and trunk. Rarely with a lesion at any level have the ankles or feet shown more than a minimal amount of perspiration. In many patients these same visceral responses may follow strong stimuli that produce flexor activity, such as pricking of the soles of the feet. After the first 8 or 10 days, during which the bowels are usually constipated, manipulations of the lower extremities, bathing the patient, or changing his position may result in the sudden evacuation of the bowels. As the months wear on, however, the bowels develop a tendency to either spontaneous evacuation or evacuation after enemas or digital stimulation of the rectum, but, in any case, with a decreasing tendency to take part in the generally heightened reflexes. The visceral reflexes tire easily, more readily than those of the striated muscles, but they are equally sensitive in the resting patient. Given a patient who has been lying quietly in bed without even the stimulation of covers touching his exposed skin, the slightest touch on the thigh or groin may cause a spurt of urine, whereas a series of such minimal stimuli are usually necessary to evoke a notable response of the muscles of the lower extremities.

Every one of 372 patients with spinal cord injury had, during some period of his record, some degree of spasm in the lower extremities following the first few days or weeks of decreased reflex activity. By no means was the spasm of such degree to cause the patient concern or require treatment in all of the patients.

In the vast majority of these patients adequate nursing care, well directed physical therapy, and the maintenance of the general physical well being

of the patient (especially by the avoidance of a septic bladder and bed sores) have kept the patients comfortable and allowed them to be sufficiently mobile to permit some mechanical aid to ambulation, such as a wheel chair, crutches, or braces.

The treatment of the patients whose condition demanded relief of the spasm has been either medical or surgical, or, in some instances, both. In general, the use of the common sedatives, such as bromides, has not affected the hyperactive reflexes. Curare in its various forms has been used on a considerable number of patients but as yet a prolonged effect and the avoidance of undesirable side effects have not been attained. Posterior rhizotomy, as well as the intrathecal injection of alcohol, has been used in isolated instances without effect. In the patients treated by posterior rhizotomy, no untoward effects on the skin of the affected segments have been noticed. Anterior rhizotomy as high as the tenth thoracic segment, inclusive, has been uniformly successful when applied over a sufficiently great enough number of segments, but the operation should be studiously avoided until it has been established beyond all doubt in the patient's mind that the lesion is complete. It is not always easy to isolate the anterior from the posterior roots at operation, nor is it always a simple matter accurately to identify the segments. This is true especially when the injury is at the spinal levels of the eleventh or twelfth thoracic, or the first lumbar segment.

Scarff and Pool have proposed the theory that the so-called mass reflexes and severe muscle spasms are influenced by scar tissue at the site of the lesion on the end of the distal cord segment. They believe that this cicatrix heightens the irritability of the isolated segment of cord, and that removal of the cicatrix, excision of all local degenerated tissue, and surgical section of the dorsal columns in the upper portion of the lower cord segment helps to allay or completely remove this condition. In 2 patients the scarred proximal and distal ends of the severed cord were freshly resected with the local removal of all irritating factors, such as abnormal vascular ingrowths, bone fragments, ligamentous cicatrix, and callus, but without prolonged or noticeable effect.

Some patients who suffered predominately from adductor spasm, and in whom the tendency for the lower extremities to cross has been a real impediment to their otherwise possible ambulation, have had immediate relief with improvement in their use of canes, crutches, or braces following the bilateral section of the obturator nerve, as approached through the lateral reaches of the space

of Retzius. Walking is not interfered with by this procedure, which has been performed in 22 patients. There is a smaller group of patients who, after months of deformity due to severe flexor-adductor spasm, are not relieved by anterior or posterior rhizotomy because of tendon contractions. These patients should be treated by tenotomy at the involved joints.

The very facts that certain patients develop extremely little "spasm," that some develop spasm very early and others very late, that some show extensor and other flexor responses with the same type of lesion, that the viscerovisceral reflexes are very marked in some patients, and that in some patients the spasm may spontaneously become greatly abated, as well as the fact that in the majority of patients sepsis definitely increases the severity of spasm, indicate that the adaptability of the isolated cord and its attached peripheral mechanisms to its new independence varies in patient to patient, and that this adaptability, as indicated in the variety of responses, is a matter of intrinsic change, anatomical or chemical, or both, within the various parts of the arc. It is toward a knowledge of these changes that our attentions should be directed, rather than solely to the observation and recording of the dramatic neurological changes demonstrated by physical examination.

#### RUPTURED NUCLEUS PULPOSUS

Some orthopedic surgeons still deny vehemently that there is such a pathological lesion as rupture of the nucleus pulposus through the annulus fibrosis with impingement upon and irritation of the nerve root. There are also those surgeons who believe that every pain in the back which radiates down the leg is due to such a lesion and, in fact, attribute these symptoms to "concealed discs." As is usually the case the truth lies in the middle ground.

In the European Theater of Operations of the United States Army, the policy was adopted that a patient with severe back distress and radiation of pain down an extremity along the course of the sciatic nerve should be treated conservatively by bed rest and other measures directed by the bone and joint surgeons. If these failed to give him relief and if he showed a postural defect, spasm of the sacrospinalis muscles, impairment of the active and passive straight leg raising movement, subjective and objective sensory disturbances in the distribution of the affected root, absence of the Achilles reflex, and a positive defect upon myelography, an operation for the removal of a ruptured nucleus pulposus was to be performed. It

was decided to keep separate the indications for removal of a ruptured nucleus pulposus and those for fusion of the lumbosacral spinal column. This policy has been found to be a very satisfactory one at a Veterans Administration hospital and in private civilian practice.

The results of these operations in military practice were on the whole quite unsatisfactory, but there were many complicating factors which influenced the result. If, after this operation, intensive and persistent physical rehabilitation exercises designed to strengthen the back muscles are insisted upon and carried out faithfully by the patient, the results will prove excellent as judged on the basis of a successful return to the former social and economic position. Removal of a ruptured nucleus pulposus will cure sciatic pain, but it will not cure a spinal column which needs a fusion operation.

#### PERIPHERAL NERVE INJURIES

The most significant advances in our knowledge of peripheral nerve injuries during World War I were made in the fields of diagnosis and physiology. There were a considerable number of British neurologists, physiologists, and surgeons, but only a few Americans, who made valuable contributions.

Unfortunately, the records of the studies made and the operations performed upon the patients with such injuries in the U. S. Army were completely lost, as far as any organized effort to follow the results was concerned. It was a bitter disappointment to the American neurologists and surgeons interested in peripheral nerve injuries and their British colleagues when the centers established immediately after the war for continued study of these patients failed to attain their objectives.

An effort was made in World War II to avoid the repetition of such wasted opportunities. A peripheral nerve registry was established by the Surgeon General's office and now, following the war, the Veterans Administration has allocated funds for follow-up examinations and studies upon the patients. However, a completely organized and well directed plan for accomplishing the best possible care of the patient and, at the same time, obtaining data which would answer many of the challenging questions that existed was never properly formulated and effected from the beginning. Certainly, anyone who had the opportunity of seeing the co-ordinated efforts in the care of peripheral nerve injuries at the Wingfield-Morris Hospital at Oxford, under Seddon, cannot have a great deal of hope for what may eventually come from our

belated, complicated, confused, and incomplete efforts.

Early in the course of the War, a great amount of energy and time was wasted by many of the younger group of neurological surgeons in proving to themselves that the work of Huber and his associates upon peripheral nerve problems during World War I was correct. There was a considerable preoccupation with mechanical matters, such as wrapping tantalum foil around a suture line, which effectively blocked its vascularization, using metallic tension sutures through the trunk of a nerve so that separation of the nerve ends might be followed roentgenographically, and attempting to find a suture material superior to fine silk. While some few operations performed made use of nerve grafts, the results were recorded long before one could possibly hope for regeneration through the transplant to occur and the use of homogenous grafts was damned. Yet, the answer to this question must come from the human being because in experimental animals microscopic proof of recovery with function by means of homogenous grafts has been obtained. The opportunity was presented in the Army general hospitals which were both amputation and neurosurgical centers. Fresh homogenous grafts could be obtained and immediately transplanted into patients with continuity defects which could be bridged in no other way. Granting that the grafts might fail, the patient had nothing to lose and everything to gain. So, we must continue to gather material slowly and laboriously from civilian cases in which transplants may be indicated, and they multiply slowly. The few cases in civilian life in which fresh homogenous nerve grafts have been employed have proved that they do not disappear by lysis, and in several instances the electrodiagnostic and clinical symptoms of regeneration are sufficiently encouraging to demand a careful assessment of the problem in the human being on a statistically significant number of patients.

A considerable amount of experimental research on peripheral nerve problems was planned and implemented through the Office of Scientific Research and Development and the National Research Council during World War II. Tarlov's work upon the use of plasma glue for the union of nerve ends which could be approximated without tension, the effect of the sulfonamides locally on nerve regeneration, the traumatic degeneration produced by the concussive effect of gunshot wounds which did not sever the nerve trunk (different as it is from Wallerian degeneration), the demonstration of new staining methods (other than the old accepted silver stains) of the

different patterns of nerve regeneration in end-to-end sutures and autogenous and homogenous grafts, and the electrodiagnostic and electromyographic methods elaborated for the study of denervated and reinnervated muscles were among these projects

Following animal experiments and studies carried out upon patients in an Army general hospital, Pollock and his associates emphasized the fact that faradic stimulation is effective throughout degeneration, denervation, and regeneration, provided that sufficient amperage is employed. The changes of response to galvanic stimulation of "infinite time" which characterize the complete reaction of degeneration are (1) hyperirritability of the muscle to galvanic stimuli, (2) sluggishness of the relaxation of the contraction wave, (3) lessening of the ratio between the amperage necessary to produce tetanus and the rheobasis to almost unity, and (4) increase of the efficacy of the anodal closing stimulus to equality with the cathodal closing stimulus. These workers also stated that the unequivocal signs of recovery are (1) a sudden increase in the rheobasis, (2) an increase of the ratio between the amperage necessary to produce tetanus and the rheobasis, and (3) an increase in the efficacy of the cathodal closing stimulus as compared with the anodal closing stimulus. A very high ratio or a very high threshold amperage is indicative of regeneration, and these electrical signs of recovery antedate the recovery of motion and sensation by many weeks.

The practical application of these electrodiagnostic methods can hardly be overemphasized. When a sufficient time after injury has elapsed to permit the development of the state of denervation and the characteristics of denervation are not found by electrodiagnosis, the nerve is spontaneously recovering and should not be operated upon. If, after a severed nerve is sutured, the characteristics of the denervated state are not found, it may be assumed with certainty that recovery is taking place. When a sufficient time has elapsed following nerve injury for regeneration to have occurred and the characteristics of denervation are found, then the nerve must be operated upon.

The question of how nerve fibers regenerate after division has been the subject of innumerable contributions beginning with Howell and Huber in 1892 and Ranson in 1912. The use of the silver staining technique precluded a simultaneous study of the nerve fibers, endoneurium, the Schwann cells, the perineurium, the epineurium, and the capillaries. This became possible when nerve sections were stained with silver and counterstained with fuchsin. The mesodermal tissue is the first

to react following any nerve injury by proliferating. This proliferation takes place at the site of the lesion and from there on into the gap between the severed nerve segments, in the degenerated distal nerve segment, and in the perineurium and the epineurium of the central as well as the distal nerve segment. Regenerating nerve fibers follow the path of proliferating histiocytes and collagenous fibers. Wherever this proliferative mesodermal reaction takes place, regenerating nerve fibers may be seen following the course of the mesodermal fibers, even deviating into the epineurium of the distal segment or, as retrograde fibers, into the epineurium of the central segment, or invading the surrounding muscles. This observation appears to be evidence against the generally accepted theory that the regenerating distal segment of a cut nerve exerts a chemotropic influence on regenerating nerve fibers growing out of the end of the central segment.

The mesodermal tissue plays a primary role in the organization of autogenous and homogenous grafts in laying down a scaffolding which is followed by the regenerating nerve fibers. Depending upon the degree of survival of the mesodermal elements in the graft and the degree of necrosis which took place, this scaffolding follows the original nerve structure or becomes irregular, deviating, and confused in its course, and thus influences the course and the efficacy of the regenerating nerve fibers.

A very definite contusion effect within the nerve may be found following gunshot injuries which do not interrupt the continuity of the nerve. Extensive traumatic damage is present for a long distance centrally and peripherally from the site of trauma. It leads to a process of necrobiosis and dissolution of the ectodermal elements with survival of the mesodermal elements, and results in an obliteration of the endoneural structure and a marked confusion in the course of the regenerating mesodermal and nerve fibers.

Young and Medawar in England and Tarlov in this country carried out a series of experiments, using concentrated blood plasma gel as a method of uniting divided nerve ends. There is no doubt that this method can be used to advantage in experimental nerve sections and in the human being when the nerve ends can be approximated easily. The microscopic evidence of the advantages of plasma gel over other suture material is quite definite, and it remains to compare a considerable series of operations upon animals, using plasma and fine silk suture material, both microscopically and for the return of function in the denervated muscles. Plasma gel has a definite place as a

suture material when nerve transplants are employed, particularly in the smaller nerve trunks such as the digital nerves

There were many cases of causalgia observed among patients with peripheral nerve injuries in World War II. There is some confusion as to what constitutes this condition mainly because the classic description first made by S. Weir Mitchell was not adhered to strictly. There are some who believe that causalgia, Sudeck's atrophy, painful osteoporosis, and other so-called "minor causalgias," or painful "phantom limb" are different clinical manifestations of the same underlying disorder. Mayfield and Devine presented the most accurate and careful study of cases of causalgia which they encountered. They correlated the symptoms and trophic changes with the blood flow in the extremity affected, and the results of their studies suggest that the pain of causalgia does not result from alteration in the blood flow, because some patients were found in whom the injured extremity was in a state of vasodilatation, while others showed vasoconstriction. Sympathectomy gave prompt relief regardless of the state of the blood vessels, a fact which is somewhat difficult of explanation.

Seddon called attention to the severity of the injury to a peripheral nerve from traction without disruption of the anatomical continuity of the nerve trunk. For example, the peroneal nerve may be stretched tightly across the head of the fibula. He pointed out that patients with this condition showed evidence of severe damage by a delayed return of function or no return whatever. This type of injury to the elements of the nerve trunk is similar to the effects of concussion from a high velocity bullet passing near a nerve trunk without interrupting its anatomical continuity. The difference between this type of traumatic degeneration and true wallerian degeneration has been described and emphasized by Hiller and his colleagues.

The question of the opportune time to operate upon peripheral nerve injuries was widely discussed during World War II, mainly because Seddon stated that an interval should elapse between the receipt of the injury and repair of the divided nerve trunk. With this all inclusive viewpoint, American neurological surgeons, who had had experience with operations upon peripheral nerve injuries and long continued follow up studies upon the results, would not agree. Certainly, a patient who receives a laceration of the wrist with division of the flexor tendons and the ulnar or median nerves by thrusting his hand through a window glass, should be operated upon as quickly

as possible after the injury, and the tendons and nerves should be promptly repaired. If the same injury has resulted from an accident by which the wound was severely contaminated, and if the surgeon first encounters the patient from 12 to 24 hours later, the chances for the development of infection are serious, although infection might well be avoided by meticulous cleansing of the wound and the use of chemotherapy. But again, the tendons and nerve ends should be repaired immediately. If infection develops the nerve ends are approximated, and the amount of neuromatous tissue to be resected later will be less and traction of the nerve ends will be prevented. If, however, there was destruction of a nerve trunk with a large gap in continuity which can not be bridged by the usual methods of obtaining end-to-end apposition, then repair may be deliberately delayed. Certainly, repair should be delayed if the wound is grossly contaminated and infection is highly probable, regardless of whether or not the ends can be approximated by movements of the adjacent joints.

It was shown experimentally that trophic ulcers developed invariably when nerve ends were allowed to remain separated, but when the ends were approximated, even when it was accomplished by nerve transplants, ulcers did not occur. The amount of atrophy which developed in the muscles was certainly less in the experimental animals under the same conditions. Clinically, there is no doubt that the best results have been obtained, regardless of the nerve involved, when the nerve ends have been apposed as early as possible after the injury.

It has been shown experimentally that if a denervated muscle can be stimulated electrically rather constantly, atrophy can be prevented. In the human patient this is difficult of proof, but it has been generally accepted that electrical stimulation to the denervated muscles, plus intensive massage, active and passive movements, and proper splinting improve recovery of the patient considerably.

#### COMMENT

Neurological surgery is a specialty of surgery. A background of fundamental knowledge of neurology is a prime requisite, and to a lesser degree ophthalmology and roentgenology. Good training in the basic sciences is necessary for every good surgeon, whose aim should be to restore his patient as nearly as possible to the physiological normal. There is no reason to assume that the neurological surgeon is an expert neurologist. Certainly, the surgeon would not agree that the



neurologist can, without proper training and persistent effort, be an expert surgeon. There should and must be a co-ordination of efforts, a meeting of minds, and exchange of ideas directed toward giving the patient the best possible care and advancing the possibilities of treatment for the neurological diseases. The contributions which each individual can make in his chosen field of endeavor must be recognized and utilized for the common goal. The neurological surgeon must not be diverted from that goal by gadgets and surgical stunts. Preparation for wars must include the medical profession which has given more to the military services than any one other professional class in the past. We must not again allow 1,500 military medical men, out of touch and disinterested in the progress of medicine, to agree in principle and obstruct in practice the objectives of the civilian profession in the care of the wounded.

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# ABSTRACTS OF CURRENT LITERATURE

## SURGERY OF THE HEAD AND NECK

### EYE

**Proptosis Due to Neuroblastoma of the Adrenal Cortex (Hutchinson's Syndrome) Report of a Case**  
RONALD A COX *Arch Ophth*, Chic 1948, 39 731

A male child 15 months old revealed on first examination a proptosis of the left eye, enlarged glands at the angles of the jaw, a mass in the upper left quadrant of the abdomen, and a striking anemia (hemoglobin concentration, 56 per cent). The roentgenogram showed extensive destruction in the left ethmoid, sphenoid, and frontal bones, and radiolucent areas in the upper end of each femur and humerus. The patient became increasingly lethargic, and death occurred 40 days after admission. The diagnosis of neuroblastoma of the left adrenal cortex was confirmed at autopsy.

In neuroblastoma of the adrenal cortex the orbit is always involved, and frequently the eye gives the first indication of the disease. Invariably a fatal termination follows in from 2 to 5 months. Only 291 cases have been previously reported. The average age for the Hutchinson type is 3 years, 10 months.

Tumors composed of undifferentiated neural cells, such as neuroblastoma, are highly malignant, while tumors from differentiated neural cells (ganglioneuroma, paraganglioma, pheochromocytoma) are benign. In the Pepper syndrome, the neuroblastoma predominantly involves the mesenteric lymph nodes and liver, in the Hutchinson type, the skull and periorbital area are particularly affected.

The diagnosis is probable in young male children when pain in the bone, bulging of the eyeball, an abdominal mass, and anemia are present. To be differentiated are lymphatic leukemia, lymphosarcoma, chloroma, Hand-Schüller-Christian disease, and Ewing's sarcoma. Thus far, no treatment has proved effective. Surgical intervention is usually followed by death within a short period.

JAMES E. LEBENSOHN, M.D.

**Allergic Conditions of the Eye Keratitis Rosacea**  
VERA B. WALKER *Brit J Ophth*, 1948, 32 759

The term "allergy," as applied by the author, denotes an altered reaction rather than a hypersensitivity. Most allergic conditions are acute in onset and, if recognized and treated at once, clear up quickly, often within a few minutes or hours, leaving no permanent damage to the tissues involved, but it must be realized that once a tissue has remained in an abnormal physiological condition for some time, as in recurrent keratitis or iridocyclitis, there are secondary changes due either to inflammation or infection, which must be healed by routine treatment, although the allergist may be able to help in

preventing a recurrence of the lesions. It is not known why one tissue rather than another should be the "shock" tissue in any patient, and we are left wondering whether some damage, possibly congenital and probably traumatic, must have been a forerunner of the condition. The presenting clinical signs and symptoms will depend upon the underlying structures of the various tissues involved. Depending on which tissue is sensitized to the offending allergen, i.e., the "shock" tissue, we may see angioneurotic edema, blepharitis, conjunctivitis, keratitis, iritis, iridocyclitis, keratitis rosacea, retinal hemorrhage or detachment, choroiditis, glaucoma, cataract, or migraine.

Keratitis rosacea, a relatively common abnormality of the skin of the face of adults between the ages of 20 and 50 years, is frequently accompanied by ocular manifestations, varying in degree from a mild conjunctivitis, through all the states of blepharoconjunctivitis, episcleritis, and keratitis, to eventual visual incapacity. As numerous as are the lists of possible causes of keratitis rosacea, almost all authors agree that the condition is metabolic rather than local, digestive upsets, deficiency diseases, and hormonal disorders all play a part and must be appropriately treated, but even after all these have been corrected and all bacteria removed, there is still an underlying condition which predisposes to recurrence. From a survey of 76 cases, it is seen that allergy plays a fundamental part in the syndrome.

Local treatment consisted of (1) removal of secondary infection with penicillin ointment, sulfa-thiazole, or antiseptic ointments, (2) the application of dithranol (0.1 per cent dihydroxyanthranol) cream to the skin twice daily for at least 2 weeks. General treatment consisted of desensitization with specific antigens by a 6 weeks' course of injections, nonspecific desensitization of others with histamine azo-globulin by 10 graded intramuscular injections (0.05 cc, 0.1 cc, 0.2 cc, 0.3 cc, 0.4 cc, 0.5 cc, 0.6 cc, 0.7 cc, 0.8 cc, and 1.0 cc) at the rate of 2 injections a week for 5 consecutive weeks. If at a later date a recurrence of symptoms of either eye or of the face occurs, then 0.5 cc of histamine azo-globulin is given immediately, and repeated after 4 days.

It appears that 70 per cent of the patients with keratitis rosacea have not had a recurrence of symptoms within the 2 years following their treatment, many of these are still symptom free after 3, 4, or 5 years. It is significant that there is a difference between the group in which specific allergens were found, and the group in which all patients were treated with histamine. In the first group, the percentage of patients who remained symptom free was nearly twice as great as in the second group.

The author emphasizes the urgency of referring all cases of keratitis rosacea to the allergists for investigation, as well as other cases of keratitis of unknown origin, especially in patients with a family history of acne, eczema, and urticaria, even though their own skin manifestations have not yet become obvious

MICHEL LOUTFALLAH, M D

#### Allergic Conditions of the Eye Migraine VERA B WALKER *Brit J Ophthalm*, 1948, 32 764

Migraine is of importance to ophthalmologists, first because all humans with severe headaches, from whatever cause, eventually find their way to an eye hospital to be checked for refractive errors, and second because 50 per cent of individuals with migraine have eye symptoms, often very severe in onset

The study was made on 100 consecutive cases of migraine investigated during the period from 1943 to 1947, and 54 were proved to be allergic either by clinical trials, by skin tests or, more often, by both methods. With each patient, an attempt was made to produce a migraine attack before prophylactic treatment was begun. Typical examples of such patients' histories were given and, when the allergy was confirmed by clinical trial, the treatment consisted in avoidance of contact with the offending allergen, or desensitization

While these cases show that if a patient has allergic migraine he can be helped tremendously by avoiding those allergens to which he is specifically sensitive, or by being desensitized, it must be remembered that the other 46 per cent of patients should be excluded from these somewhat tedious investigations as they can derive no benefit from them, they do not belong to allergic families and do not present other manifestations of allergy themselves. Realizing that all patients are reluctant to give a detailed family history or an accurate personal history, other clinical methods for separating the 54 per cent allergic from the 46 per cent non-allergic patients have been sought and, during routine general examinations, significant differences of systolic blood pressures in the two groups were observed, there was no marked difference in pulse pressures. From the study, it becomes clear that although all migraine sufferers do not have low systolic pressures and all migraines are not of allergic origin, if a patient with true migraine has a low systolic pressure, then allergy should be suspected and treated appropriately

The author concludes that migraine in patients with low systolic pressure are manifestations of allergy

MICHEL LOUTFALLAH, M D

#### Symposium Corneal Transplantation Selection of Cases R. TOWNLEY PATON *Am J Ophthalm*, 1948, 31 1365

The author stresses that each case being considered for corneal transplantation must be evaluated individually, but he lists a few basic considerations

Environmental factors, age, and the physical condition of the patient are carefully considered. If

other more simple surgery can improve vision, corneal transplantation should be reserved

The cases for surgery are classified as

1 Those favorable to improvement of vision. These should present no active disease, no increased intraocular tension, and no vascularization. Vision should be less than 20/200 corrected

2 Those partially favorable to improvement of vision. They may have some vascularization of the cornea and an opacity may be present but it should be surrounded by clear cornea

3 Those unfavorable to improvement of vision. These would present amblyopia, marked nystagmus, corneal scars from lime, or severe burns

4 Those amenable to cosmetic improvement, the transplantation being used to replace the old tattooing operation

5 Those presenting descemetocoele. The results in these cases are excellent if other factors are favorable

6 Cases in which preliminary surgery or treatment is necessary

EARL H. MERZ, M D

#### Symposium Corneal Transplantation Technique JOHN M McLEAN *Am J Ophthalm*, 1948, 31 1370

In this report the actual surgical techniques of corneal grafting were discussed. A résumé of the history of corneal grafting showed progress from 1887 to the present time

The various techniques then discussed were total keratoplasty, rotating autokeratoplasty, superficial lamellar keratoplasty, and partial penetrating keratoplasty. The partial penetrating keratoplasty is most successful in ordinary cases. In this operation a relatively large graft is used and held in place by sutures in the cornea but not in the graft. Either round or square grafts are used, and the anesthesia is local. The pupil is widely dilated. The postoperative care is similar to that of cataract, with dressings only every 4 to 5 days

EARL H. MERZ, M D

#### Symposium Corneal Transplantation Complications RAMON CASTROVIEJO *Am J Ophthalm*, 1948, 31 1375

The author divides the complications into several groups and discusses each group

1 *Complications during the operation.* The corneal epithelium may be damaged on either donor or recipient. This does not interfere with surgery but increases the possibility of infection. The incision may not be centered on the cornea, or a thin cornea may be perforated when the graft is outlined. In either case one may proceed with or postpone the procedure, as desired. If the suture is broken during the operation it can be tied, but the knot must be drawn away from the graft to prevent opacification. The lens may be injured during the operation. The section should be completed and the lens material removed with as much capsule as possible. Extra suturing is needed to prevent vitreous prolapse. If the pupil is not fully dilated after section and cannot be dilated, an iridectomy is advised

### 2 Complications during the postoperative period

The graft may be completely displaced outside of the corneal opening. Reimplantation is necessary, with added suturing if possible, or a new graft is prepared. If this is impossible a conjunctival graft is advised. If an iris prolapse occurs it is advisable to wait 3 weeks and then incise the iris and suture the graft. Prophylactic treatment should be started for infection.

Synechiae are very common and require freeing either with mydriatics, myotics, or surgery. Surgery is not attempted before the fourteenth postoperative day nor after 3 weeks. The procedure is given in detail.

3 *Infections* Glaucoma, vascularization, inflammation, and edema are all discussed briefly and their treatment is described. **LARL H. MERZ, M.D.**

### Symposium Corneal Transplantation Physiology

**A. F. MAUMENÉ and WALTER KORNBLUTH** *Am J Ophthalm.*, 1948, 31: 1384

The first portion of this article deals with 4 separate experiments on the fate of the grafted cornea. The conclusions drawn were as follows:

1. There is no massive replacement of the cells in an autogenous or homologous graft at any time.

2. The wandering macrophages of the recipient animal probably contribute from the beginning in a limited degree to the replacement of the donor cells in a corneal graft.

3. Viable donor cells are essential for a successful take of a transplant, at least for the first 2 weeks after operation, until the dependence of the donor graft on the recipient cornea is fully established. The donor cells are not essential to the clarity of the graft once the tissue has become firmly attached to the recipient cornea.

The second portion of the article deals with factors which influence the results of keratoplasty. The factors are divided into the condition of the grafted tissue, the status of the recipient cornea, and the operative complications.

The authors conclude that the donor cornea should be viable tissue and as untraumatized as possible. The continued viability of the graft is not essential after the second postoperative week. The recipient cornea should not be completely opaque nor edematous. Good apposition of the graft should be obtained. **LARL H. MERZ, M.D.**

### Symposium Corneal Transplantation Results

**W. C. OWENS, J. J. IRANK, BRINDAN LEAHEY, P. E. MESSIER, and OTHERS** *Am J Ophthalm.*, 1948, 31: 1394

A statistical study has been made of the results of 417 corneal transplantation operations.

The graft remained clear in 36.5 per cent of the cases.

The percentage of clear grafts varied greatly with the cause of the corneal opacity. The best results were obtained in cases of keratoconus (65.2%), hereditary dystrophy (58.8%), interstitial keratitis

(49.0%), and nonspecific inflammatory scars (46.9%). Poor results were obtained in cases of active keratitis or corneal ulcer (23.1%), scars from chemical burns (20.8%), trauma (18.2%) and gonococcal ulcers (8.7%). No clear grafts were obtained in cases of Fuch's dystrophy.

The larger the size of the corneal opacity and the greater the extent of corneal vascularization, the less were the chances of obtaining a clear graft.

In a group of 79 cases selected as having the most favorable prognosis, 68.3 per cent of the grafts remained clear.

Of 229 patients with preoperative vision of 20/200 or less, 36.2 per cent obtained a postoperative vision of 20/100 or better. A group of 58 patients with preoperative vision of 20/200 or less was selected as having the most favorable prognosis. Of these, 55.2 per cent obtained a postoperative vision of 20/100 or better.

The visual results after corneal transplantation in patients with preoperative vision of 20/100 or better do not warrant the risk of the operation.

**LARL H. MERZ, M.D.**

### Anterior Flap Sclerotomy with Basal Iridencleisis, A Preliminary Report

**H. B. STALLARD** *Brit J Ophthalm.*, 1948, 32: 753

The operation proposed consists in reflecting a conjunctival flap, fashioning a scleral flap hinged on the corneoscleral junction, a limited cyclodialysis, and the inclusion of a basal tongue of iris between the lips of the sclera, leaving the sphincter pupillae intact. The operation has been performed in 29 cases of chronic glaucoma and in 2 cases of acute congestive glaucoma, with encouraging results. Iritis occurred 3 weeks after operation in one case. In this respect the postoperative course differs from that following the trephine operation in which some degree of iritis commonly occurs. The technique is as follows:

A suture is passed through the tendon of the superior rectus muscle and is clamped down in the frontal region. A subconjunctival injection is made about 3.5 mm from the limbus from 10 to 2 o'clock so as to raise the episcleral tissues and conjunctiva. The conjunctiva is grasped by smooth forceps 2.5 mm anterior to the insertion of the superior rectus. The conjunctiva is then snipped for about 5 mm down to the sclera. The blades of the scissors are spread and the conjunctiva is undermined laterally on both sides. The conjunctiva and episcleral tissues are then undermined down to the limbus. One blade of the scissors is now passed underneath the conjunctiva on the temporal side and slightly downward, and the conjunctiva is cut for about 8 mm from the midline. Similarly, another incision is made on the nasal side. The conjunctival flap thus formed is turned forward and downward over the cornea with a few strokes of a small applicator. With a double-pronged conjunctival hook, the conjunctival flap is now held downward by the assistant. With a few strokes of

the corneal splitter, a clear view of the episcleral tissue just above the limbus is obtained. Any bleeding points can be checked by a touch from a heated probe. This probe also seals off any superficial episcleral vessels in the line of the scleral incision to be made 5 mm long, 2 mm above and concentric with the limbus. A fine scleral hook is inserted into the sclera in the 12 o'clock meridian 2 mm above the limbus, this steadies the eye during the scleral incision and also retracts the anterior lip of the incision. The scleral incision is made with either a sclerotome or a ground-down cataract knife vertically in the sclera. When the ciliary body shows in the incision, any remaining scleral fibers are divided by a few light strokes with the point of the cataract knife. The scleral hook in the anterior lip of the scleral incision is now slightly raised and a cyclodialysis spatula is passed through the center of the incision into the anterior end of the suprachoroidal space, then on to separate the scleral spur and to enter the anterior chamber. In the anterior chamber, the spatula is moved in turn to each side of the scleral incision so as to effect a cyclodialysis 5 mm long. Aqueous flows out of the incision during this procedure. The cyclodialysis spatula is withdrawn. With the scleral hook still in place, one blade of the scissors is passed on the flat into one end of the scleral incision for 2 mm. The blade is then rotated so that its cutting edge faces forward, and its blunt end is level with the corneoscleral junction and 1 mm nearer to the midline than the end of the scleral incision. The blades of the scissors are closed and a converging cut is made in the sclera down to the limbus. A similar procedure is done at the other end of the scleral incision. When this is completed, a hinged scleral flap is made, based on the limbus. A pair of iris forceps, closed, is now introduced into the center of the incision, and the iris is grasped 2.5 mm above the pupillary margin and drawn up into the center of the scleral wound as the conjunctival flap is being drawn down by the assistant. A snip about 1.5 to 2 mm long is made with fine blunt-ended scissors in the iris immediately in front of the forceps. One blade of the scissors is passed through the snip toward the temporal side, and a cut 3 mm long is made toward the iris root. A blade of the scissors is then directed through the iris incision nasally toward its root, and a cut is made for about 3 mm. The folded tongue of iris based on its root is then laid on the sclera so that about 2.0 to 2.5 mm projects above the upper lip of the scleral incision. It may be necessary, in some cases, to reposit the iris, often it is sufficient to apply the iris repositor to the upper part of the cornea and make a downward stroke over its surface.

Postoperative treatment has been simple. There is no need for digital massage, atropine is used at the first dressing and omitted thereafter. The patient is allowed up in a chair on the fourth day and is allowed to leave the hospital on the eighth

day. The anterior chamber is reformed on the day after operation. Small hyphema occurred in 6 cases without further complication.

MICHEL LOUTFALLAH, M D

**Studies in Experimental Ocular Tuberculosis. The Effect of "Promin" and "Promizole" on Experimental Ocular Tuberculosis in the Immune-Allergic Rabbit.** ALAN C WOODS and EARL L BURKY. *Arch Ophthalmol*, Chic., 1948, 39 471

Promin and promizole are sulfonamide compounds which have been shown to have a deterrent action on tuberculosis in experimental animals. The present study concerns the effect of these drugs on ocular tuberculosis in immune-allergic rabbits. Rabbits were inoculated in the groin with a virulent human strain of tuberculosis which caused a definite hypersensitivity to tuberculin and a resistance to reinoculation. Inoculation of the anterior chamber of such immune-allergic animals was followed by the formation of small, hard tubercles on the iris and cornea with a moderate inflammatory action which became inactive in from 3 to 6 months. Such animals were treated with 1.5 gm per rabbit per day of the drugs, beginning the sixth week after inoculation of the anterior chamber. After 3 months of treatment the eyes were sectioned for histologic study. In another similar group the uveal tract was removed after treatment and, after appropriate extraction, injected into the anterior chamber of normal rabbits.

The treated rabbits began to improve after 3 weeks of treatment and by the twelfth week, at which time the control eyes were markedly inflamed, the ocular tuberculosis in the treated group was almost completely inactive. Promizole and promin seemed equally effective although promin was the more toxic. Sections of the eyes indicated that the untreated animals had many more lesions which were larger and more active than the few lesions found in the treated animals. Inoculation of the uveal tract extract into the anterior chamber resulted in ocular tuberculosis in all animals injected with material from the control group. The uvea of one of the 3 rabbits treated with promin produced ocular tuberculosis upon inoculation, but only after the very long incubation period of 2 months. The uvea of rabbits treated with promizole did not produce tuberculosis on inoculation. It is concluded that both promin and promizole have a definite deterrent action on ocular tuberculosis in the immune-allergic rabbit but do not produce a complete cure. The action may be due to either a degradation or attenuation of the virulence of the organisms, allowing the reaction of the host to become more effective, or to a direct bactericidal action on the bacteria.

FRANK W NEWELL, M D

**Bacitracin in Ocular Infections.** J G BELLOWES and C J FARMER. *Am J Ophthalmol*, 1948, 31 1211

Ocular tissues have a tolerance to bacitracin in concentrations up to 1,000 units per milliliter of saline solution given externally and up to 100 units

mine for these tests in simple glaucoma, but there is danger in narrow-angle glaucoma or preacute glaucomatous eyes

#### PRESSOR CONGESTION TEST

This test is the lability test of Bloomfield and Lambert, based on a combination of the cold pressor test and the jugular compression test

An initial tonometric reading is made with the patient in the supine position. The sphygmomanometer cuff is placed around the neck of the patient while one of his hands is immersed to the wrist in chipped ice and water. The cuff is inflated to between 50 and 60 mm Hg, for 1 minute. A reading is made and repeated after the pressure is released and the hand has been removed from the water.

In 192 normal eyes, this test gave an average increase of 3.6 mm Hg (range -2 to +9 mm).

The pressor-congestion test tends to increase the intraocular pressure, particularly when there is any defect in the mechanism controlling intraocular pressure. The author also believes that this test increases the tonus of the extraocular muscles and this would raise the intraocular pressure too. An increase over 9 mm Hg or the elevation of tension over 30 mm is suggestive of chronic simple glaucoma according to Bloomfield and Lambert. In this series of glaucomatous eyes, the pressure exceeded this 9 mm in less than one-half of the cases and the normal series revealed a pressure of 30 mm or over in only 20 per cent of the eyes. The anterior chamber puncture test was normal in 4 of the cases with tension of 30 mm or more.

#### WATER AND PRESSOR CONGESTION TEST

This test was performed 2 hours after breakfast or lunch on normal and glaucomatous eyes. The tension was recorded, 1 liter of water given, and the pressor congestion test applied in 0.5 hour.

The average increase of intraocular pressure in 71 normal eyes was 5 mm Hg (range -3 to +10). Three eyes revealed a pressure of 38 mm Hg.

The results in glaucomatous eyes reveal that a greater increase in tension is shown with this test than with any of the others. Further comparison of these tests on the same eyes seemed to substantiate the earlier findings both in normal and glaucomatous eyes.

An increase of over 10 mm Hg of pressure would certainly indicate a positive reaction. A negative result does not rule out glaucoma.

#### CONCLUSION

Combined water and pressor congestion tests give higher readings than either test alone.

In the water tests, a positive result represents an increase of over 9 mm or a rise to over 32 mm; in the pressor congestion test a positive result represents an increase of over 9 mm or a rise to over 33 mm; in the combined tests a positive result represents an increase of over 10 mm or over 38 mm Hg.

The caffeine test was of no value.

Mydriasis is safe in simple glaucoma but has not given a significant rise in pressure. In narrow angle eyes it is the test of choice, but it should be controlled by miotics.

In borderline cases of simple glaucoma repeated tonometry is an important diagnostic test.

J. WOODHULL OVERTON, M.D.

**The Pressor Test for Glaucoma** GEORGE T. STINE  
*Am. J. Ophth.*, 1948, 31: 1203

This author confirmed the work of Bloomfield and Lambert as to the reliability of the lability pressor test for chronic simple glaucoma of the wide angle type.

The pressor test is based upon vascular variations within the globe in which a sudden strain is introduced so that increased lability manifests itself clinically. This test allows for an increase of blood flow into the eye and a mechanism for decreasing the outward flow of blood.

The patient is seated at a 30 degree angle from the horizontal. A sphygmomanometer cuff is applied around the neck, pontocaine (1½%) is instilled into the eyes, and the tension is measured (Schiøtz). The hand and wrist are placed in cold water (4°C) and the sphygmomanometer cuff is inflated to between 50 and 60 mm Hg for 1 minute. The tension is taken at that time.

Patients with normal and abnormal eyes were used. The narrow angle cases were chosen mostly for this work but some wide angle cases were also checked.

The mean rise in pressure in the normal group, wide angle group, and narrow angle group was 1.01, 13.82, and 2.0 mm Hg, respectively. This seems to be a valid test for wide angle glaucoma. Criteria for a positive test were (1) a rise greater than 9 mm of Hg and/or (2) a rise to more than 30 mm of Hg. In this series of 35 patients, only 4 failed to show a rise above 30 mm of Hg.

The increase in tension in narrow angle glaucoma approximates the normal so these two groups cannot be differentiated with this test. In 112 normal eyes tested by Bloomfield in this series, there were only 2 false positives. Narrow angle glaucomas are diagnosed on the basis of visual fields, the fundus picture, and mydriasis tests. The mean rise in pressure in the normal group, the narrow angle group, and the wide angle group under mydriasis was 1 mm Hg, 14.33 mm Hg, and 3.60 mm Hg, respectively. Every eye classified as narrow angle glaucoma gave a positive test.

The pressor test seems to be a good clinical test for diagnosing the wide angle type of chronic simple glaucoma. It is thought that the rise in the wide angle group is due to pathology in the drainage mechanism in the trabecula and canal of Schlemm while in the narrow angle group the iris base blocks the angle. Patients who had a positive pressor test despite normal tension under miotic were all found to have visual fields and visual acuity. However, the pre-

tients who had a negative pressor test had been without appreciable field loss for some time. There were only 14 eyes in this series.

The author summarizes his article as follows:

1. The pressor test should be used in conjunction with a gonioscopic examination for the best results.

2. The pressor test seems reliable for the detection of the wide angle type of chronic simple glaucoma, while mydriasis was the method of choice for the narrow angle type.

3. The mechanisms involved seem to be entirely different for the two groups.

4. The pressor test may be of value in progress of the visual field loss in the wide angle group.

J. WOODHULL OVERTON, M.D.

## EAR

**Observations Upon the Loudness Recruitment Phenomenon, with Especial Reference to the Diagnosis of Disorders of the Internal Ear and Eighth Nerve.** M. R. DIX, C. S. HALLPIKE, and J. D. HOOD. *J. Lar. Otol.*, Lond., 1948, 62: 671.

The authors present the results of, and their observations upon, loudness balance tests carried out in 30 cases of unilateral deafness due to Ménière's disease and in 20 cases of degeneration of the eighth nerve, due to neurofibroma of the eighth nerve and other varieties of space occupying lesions of the cerebellopontine angle. This choice of the two disorders was made by the authors because in the one, Ménière's disease, the primary lesion is now known to affect the endolymph system of the cochlea with its contained cochlear end-organs, while in the other, the primary lesion is of the cochlear nerve fibers within the internal auditory meatus.

The 30 cases of Ménière's disease all gave a characteristic history of paroxysmal vertigo, deafness and tinnitus, with the deafness substantially limited to one ear in the great majority. None gave any history of head injury, and general neurological examination revealed no abnormalities. On the other hand the 20 cases of eighth nerve degeneration which were studied included 11 cases of neurofibroma of the eighth nerve, in all of which the clinical diagnosis was confirmed by operative or postmortem findings. In addition, the remaining 9 cases studied in the category were other varieties of cerebellopontine angle lesions exhibiting well marked involvement of function of the eighth nerve and of these, 6 diagnoses were confirmed by operative or postmortem findings. Thus, the cases studied would appear to be well authenticated.

The loudness recruitment pattern with the audiograms, in 3 representative cases of their results in the 30 cases of Ménière's disease, are shown in the article. The authors state they found loudness recruitment to be present and complete in all 30 cases of Ménière's disease. The test results in 5 characteristic cases of eighth nerve degeneration are also shown, and the authors' summary of the results in the cases of eighth nerve degeneration showed loud-

ness recruitment to be absent in 14 of the 20 cases. In the remaining 6 cases a slight amount of recruitment was present, and in some of these there was found a fixed upper loudness limit in the affected ear.

Thus, the loudness recruitment was shown to be characteristically present in a disorder of the end-organ of hearing, and to be characteristically absent in a disorder of the cochlear nerve fibers, in the latter case, a type of response which is identical with that found in middle-ear deafness.

Since this latter finding sharply contravenes the existing views, namely, those of Lonente de No and Fowler, upon the neurological mechanism of recruitment, the authors advance new hypotheses in explanation of their results, based upon recent experimental work on the physiology of hearing.

According to the authors, their finding of an unvarying occurrence of the recruitment phenomenon in Ménière's disease, a disorder of the end-organ of hearing, appears to be related to Pumphrey and Gold's theory, based on their recent experimental work, that the microphonic potentials of the cochlea arise somewhere in Corti's organ and play a vital part in determining both its sensitivity and frequency selectivity. The essayists find it pertinent to observe that the very nature of the recruitment phenomenon corresponds very well with a type of derangement well known in certain microphones. The example given is a carbon microphone which, in good order, yields an electric response which is linear over a wide range of sound pressures. However, in a faulty carbon microphone the response at low sound pressures may be very defective, while at high pressures it may be nearer the normal value.

The authors suggest that the absence of loudness recruitment in degeneration of the eighth nerve can be explained on the following assumptions:

1. That the nerve degeneration engendered by tumor pressure or infiltration is an evenly diffused one with a definite fiber survival rate.

2. That the relationship between stimulus intensity and loudness sensation depends upon a definite fractional increase in the number of activated cochlear nerve fibers which accompanies each ascending step of the loudness scale.

EUGENE L. DERLACKI, M.D.

**Lempert Decompression Operation for Hydrops of the Endolymphatic Labyrinth in Ménière's Disease.** JULIUS LEMPERT. *Arch. Otolaryng.*, Chic., 1948, 47: 551.

Ménière's disease has as its basic pathology a hydrops of both the vestibular and cochlear portions of the endolymphatic system. Treatment should be designed to relieve both the vertigo, which is vestibular in origin, and the tinnitus which is most likely cochlear in origin.

Partial section or electrocoagulation of the vestibular portion of the endolymphatic system, through a fistula created in the external semicircular canal, usually relieves vertigo but seldom relieves tinnitus. The histologic study of experimentally fenestrated

rhinus monkeys demonstrates that destruction of the vestibular endolymphatic system may occur without degeneration of the remaining endolymphatic system and organ of Corti

An operation to effect complete degeneration of the endolymphatic system is described. The tympanic cavity is approached endaurally by eversion of a skin flap from the posterior wall of the canal, and enlargement of the bony meatus by a dental burr. The posterior one-half of the tympanic membrane is then reflected anteriorly and the opening is widened at the annulus tympanicus. The long process of the incus is severed and the stapes is removed. A burr is then used to remove the round window membrane and enlarge the window. The various steps are described and illustrated in detail.

Of the 10 patients operated on by this technique, 9 were freed of vertigo and tinnitus and 1 was freed of vertigo only. JOHN R. LINDSAY, M D

### MOUTH

**Facial Injuries Followed by Meningitis, with Recovery** A J B PHILLIPS *Brit J Plast Surg*, 1948, 1: 172

The author's patient suffered severe, soft tissue injuries in a fall, face foremost, from a height of 17 feet. Multiple lacerations extending in the midline from the hairline to the symphysis menti were impregnated with coal dust, those of the tip of the nose, both lips, and chin were full thickness in depth, and the laceration of the forehead exposed the frontal bone but there was no visible fracture.

Twelve hours after the injury, after a preoperative dose of 500,000 units of penicillin and antitetanic serum, the wounds were débrided and sutured in layers. The only fractures which were noted were of the nose.

Penicillin was administered regularly. The following morning, a fever of 100 degrees was noted with a productive cough. A course of sulfadiazine was started. This was discontinued after 6 gm had been administered because of cyanosis. A serous fluid from the nostrils was designated as cerebrospinal rhinorrhea. The general condition and the condition of the facial wounds were satisfactory and the temperature was normal on the third day. The patient had had 2,700,000 units of penicillin intramuscularly and 6 gm of sulfadiazine orally.

On the fourth day, loss of consciousness occurred with a temperature of 103.6 degrees, stertorous breathing, and marked rigidity of the neck. Lumbar puncture revealed turbid fluid under pressure and culture later revealed the *Staphylococcus aureus*. Penicillin (15,000 units) was given intrathecally upon diagnosis of the meningitis, an additional amount was given intramuscularly and sulfadiazine was given orally. Recovery began within several hours.

In the treatment of the established meningitis, 8,600,000 units of penicillin were given intramuscularly, 90,000 units of pure penicillin were given intrathecally, and 24 gm of sulfadiazine were given

orally. Recovery was rapid and on the seventeenth day when the temperature and pulse were normal, penicillin was discontinued. The patient felt good from the tenth day onward and was allowed up on the twenty-first day. Up to the present time no abnormal symptoms, mental or physical, have resulted from the meningitis. EARL H. KLABUNDE, M D

### NECK

**The Clinical Aspects of Chronic Thyroiditis** HOWARD PATTERSON and GEORGE STARKEY *Ann Surg*, 1948, 128: 756

Chronic thyroiditis is not a rare disease, and it is most important for the patient that the situation is fully recognized at operation. Chronic thyroiditis may be divided into three groups: (1) struma lymphomatosa of Hashimoto, (2) struma fibrosa of Riedel, and (3) the giant cell type of DeQuervain.

Hashimoto's disease is characterized by a diffuse lymphocytic involvement of the thyroid gland, it is very rare in males and occurs chiefly in women at or near the menopause. Adhesions to the surrounding structures do not occur, but the thyroid is usually diffusely enlarged, pressure symptoms are mild, and the patient is apt to be myxedematous. The author performs symmetrical conservative thyroidectomy followed by x-ray therapy.

Riedel's disease, or struma fibrosa, occurs in both sexes but predominantly in women. The process is at first localized and spreads over the gland, the involved portion is pale and stony hard with dense masses of fibrous tissue, and is usually very adherent to the surrounding structures. Freeing of the trachea by excision of the isthmus is all that is indicated. The disease is often confused with malignancy, and unwise and harmful surgery may follow.

The giant cell type of thyroiditis of DeQuervain does not involve the thyroid gland diffusely, but there is some tendency toward adherence to the surrounding structures. The pathological picture may closely simulate tuberculosis. X-ray therapy following positive diagnosis may be the treatment of choice.

F J LESEMANN, JR., M D

**The Frequency of Hyperthyroidism, Its Causes and Therapy** (Ueber die Häufigkeit hyperthyreotischer Zustandsbilder, ihre Ursachen und ihre Behandlung) J WALDSCHÜTZ *Wien med Wschr*, 1948, 98: 510

A comparison is made between a group of patients with hyperthyroidism treated between 1919 and 1921 and another group treated between 1945 and 1947, with special attention to relations between the disease and the nutritional changes, and the mental and physical traumas caused by the war.

Exophthalmos was recorded in 19 per cent of the first and only 11 per cent of the second group. The receding frequency of this phenomenon has been reported by several other writers.

Nystagmus, never found in the first group, was reported in 4 per cent of the second group and was apparently of central origin.



An enlargement of the thyroid gland was present in 75 per cent of the first and 65 per cent of the second group. In most cases the gland was smaller and softer in the last mentioned group than in the first.

Tachycardia was noticed in 65 per cent and 40 per cent, respectively. Fifty per cent of the patients in the first group and 60 per cent of those in the second group were complaining of anxiety, dyspnea, precordial pain, and other cardiac symptoms.

Excessive perspiration was reported by 52 per cent of the first group as contrasted to 42 per cent of the second group.

Hyperthermia was recorded in 8 per cent of the first group as contrasted to 3 per cent of the second.

While gastrointestinal disturbances were registered in only 8 per cent of the first group, they occurred in 20 per cent of the second group.

Considerable losses of weight beyond those that could be attributed to malnutrition were found in 45 per cent and 28 per cent, respectively.

Disturbances caused by food and vitamin deficiencies or poor quality of food, such as amenorrhea, dysmenorrhea, alopecia, and loss of libido, were noticed in 4 per cent of the first and 12 per cent of the second group.

A great frequency of chronic deforming arthritis, probably of neurotrophic origin, was found in both groups.

Tremor was recorded in 75 per cent of the first and 35 per cent of the second group.

JOSEPH K. NARAT, M.D.

#### **The Treatment of Thyrotoxicosis** D. M. DUNLOP *Edinburgh M. J.*, 1948, 55, 257

Dunlop observed 149 thyrotoxic patients. Of these, 19 were treated by thyroidectomy and the remainder were treated by antithyroidal drugs. Eighty-three were hospitalized, while 66 were treated as out-patients throughout. The author used 0.2 gm thiouracil three times a day.

Blood cholesterol and basal metabolism determinations were discarded early as criteria for the efficacy of treatment. Weight seemed to be a good means of judging. Tachycardia was slow to respond and occasionally persisted even after the basal metabolic rate had become normal. Auricular fibrillation reverted occasionally to normal rhythm but usually required quinidine for control. Innocent glycosuria was cured by thiouracil or thyroidectomy, severe diabetes frequently was ameliorated by either. Exophthalmus was unaffected by thiouracil, but lid retraction was more effectively influenced by thyroidectomy than by thiouracil.

Enlargement of the thyroid due to overstimulation by the thyrotropic hormone of the pituitary gland occurs when the patient is overdosed with thiouracil. Myxedema induced by thiouracil is temporary, but when it is induced by thyroidectomy it is permanent.

Sixteen patients (11%) showed toxic effects which led to abandonment of the drug in 6 (6%) of the

entire group or 56% of those who developed reactions. There was no mortality in this series, although a mortality of 0.5 per cent was reported in the older literature.

In order to avoid relapse, treatment should last a year or longer.

Nineteen, or 13 per cent, of the entire series of 149 patients were treated by thyroidectomy. The reasons were for the sake of appearance in large goiters and mechanical pressure signs. One patient had uncertain results, 7 patients had drug reactions, 2 were drug resistant, and 3 were persistent fibrillators.

Dunlop believes that the drug treatment is the treatment of choice in primary hyperthyroidism, recurrent goiters, and elderly patients, while thyroidectomy is preferable when the goiter is large or nodular, or there is resistance or sensitivity to the drug.

F. W. S. MODERN, M.D.

#### **Cancer of the Larynx: A Statistical Study** LE ROY A. SCHALL and JOHN J. AYASH *Ann. Otol. Rhinol.*, 1948, 57, 377

The authors followed up 418 cases of laryngeal cancer. Only 8 per cent occurred in females. The average age of the males was 60 years and that of the females 40 years. Tracheotomy was required in 80 cases, in 46 of these, it was preliminary and in 34 it was done during or shortly after irradiation. Two hundred and forty-six patients were treated by external irradiation. Carcinoma (grades 1 and 2) is more curable by surgery and irradiation. Limited lesions of grades 3 and 4 are best treated operatively followed by irradiation.

The success of external radiation depends on the site and extent of the lesion. The more localized the lesion is the more radiosensitive it is, while cord lesions which have infiltrated the opposite side are radioresistant, and those beyond the confines of the larynx are nearly hopeless. Cancer arising from the false cords and epiglottis is radiosensitive, but becomes resistant if it infiltrates and fixes these structures.

Among 59 patients treated by laryngofissure only 39 were ideal cases, and even among these 10 developed recurrences. The recurrences developed mostly when the cancer passed the commissure. The nasal tube is inserted before anesthetization.

Ninety-seven patients were treated by laryngectomy with 4 operative deaths.

Closure without drainage seemed feasible.

Laryngectomy can still be done if external radiation fails, although healing may be delayed. The survival rate following laryngectomy for more than 5 years was 64 per cent.

In 19 cases of distant metastases 11 lesions were in the lung, 3 in the brain, 2 in the spine, and others were scattered.

Early rehabilitation of the patient by means of the esophageal voice is important.



# SURGERY OF THE NERVOUS SYSTEM

## BRAIN AND ITS COVERINGS, CRANIAL NERVES

**Hypertensive Syndromes Due to Craniovertebral Malformations** Clinical, Radiologic, Neurosurgical Observations (Sindromi ipertensive da malformazioni cranio-vertebrali rilevati clinici, radiologici, neurochirurgici) G VERCELLI, F MASCHERPA, and G M TASTANI *Chirurgia*, 1948, 3 243

The authors report 3 cases which illustrate the value of surgical treatment for the correction of the serious disturbances of the nervous system caused by some malformations of the occipital bone and of the first cervical vertebra. The first patient presented a fusion of the atlas with the occipital bone, the second a malformation of the atlas and axis, and the third a typical example of basal impression in which the floor of the occipital fossa was convex and the external occipital protuberance in the horizontal plane passed through the mastoid apices. In the first and third patients the symptoms were caused, at least to a great extent, by blockage of the circulation of the cerebrospinal fluid which resulted in the formation of a ventricular hydrocephalus, while in the second patient the symptoms were the result of direct compression of the bulbomedullary tissues.

Experience has shown that the anatomic lesions at which surgical intervention must be aimed are essentially the following: (1) the decreased capacity of the cerebellar fossa due to upward displacement of the mass formed by the foramen magnum and the adjacent portions of the occipital bone, (2) the change in form of the foramen magnum, which is often greatly reduced in one of its diameters, (3) the changes in the dura mater which are modelled on the bone changes and are capable of exercising a compressive action even after removal of the bone malformation, (4) the changes in form and capacity of the upper opening of the spinal canal, which vary with the different types of vertebral malformations, (5) the adhesions which fix the cerebellum to the cerebral trunk and the medulla, and contribute to the compression of these structures and to the disturbance of the circulation of the cerebrospinal fluid, (6) the impaction of the cerebellar tonsils into the occipital foramen and the spinal canal, and (7) the hydrocephalus due to obstruction of the basal foramina as a result of the foregoing defects.

The surgical treatment must consequently be carried out in accordance with the following program: (1) removal of a more or less extensive portion of the occipital bone and of the posterior border of the foramen magnum, (2) removal of the posterior arch of the first and, if necessary, of the second and third cervical vertebrae, (3) ample opening of the dura mater, which should not be reconstructed, (4) liberation of the cerebellar tonsils, and (5) search for and section of adhesions between the cerebellum and the

cerebral trunk to allow free passage of the cerebrospinal fluid.

A special procedure had to be used in the third patient, in whom occipital and vertebral decompression and removal of the obstruction of the foramen of Magendie had resulted in disappearance of the subjective and objective symptoms, but after a few months the signs of intracranial hypertension reappeared because of renewal of the adhesions between the cerebellum and the cerebral trunk, and of the obstruction of the fourth ventricle. Under the circumstances a supraotic ventriculostomy was performed and led to definitive cure.

RICHARD KEMEL, M D

**Delays and Errors in the Diagnosis of Brain Tumor** FREDERICK C REDLICH, REMBRANDT H DUNS MORE, and EUGENE B BRODY *N England J M*, 1948, 239 945

This brief article should have wide circulation and be read not only by psychiatrists and surgeons, but by neurologists, internists, and general practitioners as well.

The authors have emphasized how frequently the presence of brain tumors is overlooked in a cursory examination of the patient, and in their review of 100 consecutive proved cases of intracranial tumor they find that all too much importance is placed on the mechanical methods of diagnosis rather than the careful eliciting of history and the repeated (if necessary) careful neurological and physical examination. They stress the importance of a thorough investigation of the causes of physical impairment, of headache, and of epileptiform seizures.

It is admitted that functional and psychological factors may delay the complete diagnosis, and while public health education should be designed to avoid such delay, such education should be stressed at both lay and professional levels. JOHN MARTIN, M D

**Transorbital Leucotomy** WALTER FREEMAN *Lancet*, Lond., 1948, 2 371

Fiamberti is given credit for simplifying the operation of frontal leucotomy in 1937, which operation had been introduced by Moniz one year previously. On the basis of unpublished but previously reported work the author believes that transorbital leucotomy which undercuts areas 9 and 10 on the Brodmann Chart seems to be a valid procedure.

The operation, which it is claimed can be carried out by the properly trained psychiatrist, consists of the introduction of the leucotome under the upper eyelid, through the conjunctival sac, and across the orbital vault, where, with a slight hammer tap, it is driven through the orbital plate. No damage to the globe save occasional subcleral hemorrhage has been observed. The instrument is a tool steel shaft measuring 12 cm long and 4 mm wide tapering for the

last 6 cm. to a rather fine slightly beveled point. Proper maneuvers are described which serve to sever the fibers in the lower portion of the thalamofrontal radiation. The possibility of laceration of the arteries in the depths of the fissures on either the medial or lateral surface of the frontal lobe must be born in mind. Moderate pressure is maintained over the eyelids to prevent excessive orbital hemorrhage. Circumorbital ecchymosis persists for several days. The procedure is then repeated through the opposite orbit. It is advised that the postconvulsive phase of electroshock therapy is the time of choice for the operation. Recovery from the operation is said to be very rapid.

Complications have been observed in only 3 of 100 cases. In all of these there was bleeding with severe inertia, and paralysis in one and mild hemiparesis in the others. Undesirable personality changes are minimal. One-third of the schizophrenics and more than half of the individuals treated have been discharged from the hospital.

The operation is claimed to be most effective in certain patients in whom tension is a prominent feature of the illness and who are beginning to become chronic sufferers in spite of more conservative therapies. It finds its most successful application in patients who are benefited and then have a relapse or who are being carried on maintenance shock therapy. Severe emotional dilapidation is the outstanding contraindication.

ALLAN D. CALLOW, M.D.

### PERIPHERAL NERVES

#### Clinical Assessment of Peripheral Nerve Injuries

W. R. HENDERSON *Lancet*, Lond., 1948, 2, 801

This article is principally concerned with the value of Tinel's test in peripheral nerve injuries and is based on the author's experience with 400 cases observed in prisoner-of-war hospitals in Germany from 1940 to 1945. When it is interpreted according to its original description, Tinel's test is useful in assessing the amount of regeneration after about the fourth month following injury or suture of the nerve, provided it is interpreted by comparing sensations from the lesion and the distal segment.

The test fell into disrepute probably because too much emphasis had been placed on the sole presence or absence of response from the distal segment of the injured or sutured nerve. The author stresses the importance of palpation over the lesion as well as over the distal segment to perform and interpret the test correctly. It is believed that the test can be of value in assessing the prognosis of brachial plexus injuries after a few months, such as the traction injuries observed in parachute jumpers.

On the basis of Tinel's test, the author classifies nerve injuries into four clinical groups, assuming that sufficient time has elapsed to allow the fibers to regenerate at least several inches along the distal segment of the nerve. When no regeneration occurs, tapping at the site of the lesion elicits a strong re-

sponse with no response to palpation along the distal segment. A strong indication of a neuroma with negligible regeneration distally is shown by a strong response over the site of the lesion and a feeble response over the distal segment. Partial regeneration of a nerve is the most difficult type of lesion to interpret by Tinel's test. Complete regeneration will show a strong response of tingling along the distal segment advancing at the rate of about 3 inches a month. Also included in the article is a description of tests used to exclude damage to the nerves in recent injuries.

JOHN L. BELL, M.D.

### MISCELLANEOUS

#### The Results of a Specifically Co-Ordinated Plan of Medical and Surgical Treatment of Essential Hypertension

LOYAL DAVIS, HOWARD A. LINDBERG, and N. V. TEEGER. *Ann. Surg.*, 1948, 128, 770

In 1934, Barker and Davis formulated a plan for the study of patients with essential hypertension for whom surgical therapy might be undertaken. In 1939, they reported upon their clinical and experimental experiences and attempted to make clear for others the principles upon which their work was being carried out, in the hope that eventually it would lend itself to comparison with that of other groups engaged in similar work.

The authors stress the point that before surgical procedures for hypertension can be evaluated, an agreement must be reached as to exactly which type of patient is being operated upon or should be operated upon. They studied some 700 patients with essential hypertension and attempted to classify them according to therapeutic and clinical types. Finally, they decided early to limit the surgical therapy to one of the types of essential hypertension and they chose that group for which medical treatment was inadequate and the progress of the disease appeared to be imminently fatal.

The first group of hypertension they termed the fluctuant group, the second, the plethoric, the third, menopausal hypertension, the fourth, the high diastolic type of hypertension, the fifth, arteriosclerotic hypertension, and the sixth, malignant hypertension.

Each of these particular groups are discussed and a case history is given for each group. The authors chose their surgical cases from the group of patients whom they classified as having the high diastolic type of hypertension. They further restricted their choice to those in this group who had been given an adequate and thorough trial of therapy with the thiocyanates and had proved to be resistant to this drug, that is to say, their diastolic and systolic pressures and their symptoms could not be improved by cyanate blood levels below those which produced toxic symptoms.

Another indication for the choice of patients was that they should have a labile blood pressure as evidenced by a group of pressor and depressor tests. General considerations upon which the surgical indications were based were that the patients should

stage 2 cases which present proved axillary metastases. The relative merits of preoperative and postoperative irradiation are difficult to evaluate since the statistics cited do not show the stages of the disease. However, it is stated that in 448 cases analyzed between 1930 and 1942, the survival rate with preoperative irradiation was greater than with postoperative treatment, namely, 73 per cent in the former and 53 per cent in the latter.

The over-all 5 year curability of 348 traced cases of all stages of cancer of the breast is 39 per cent, and varies from 87 per cent in stage 1 to 0 in stage 4.

FRANK B. QUEEN, M.D.

**Surgical and Radiation Treatment of Cancer of the Breast** ROLF BULL ENGELESTAD *Am J Roentg*, 1948, 60: 776

The author reports the results of a 5 to 10 year follow up study of 1,384 patients with cancer of the breast. Of these, 680 patients were followed for a period of 10 years. The plan of treatment is based on the stage of development of the disease.

Operable cancer of the breast with no clinical signs of pathologic spread is designated as stage 1. Treatment was surgical, with postoperative irradiation.

Operable cancer of the breast with clinically or histopathologically demonstrable operable metastases to the axillary and lymph nodes is defined as stage 2. Treatment was surgical, with postoperative irradiation, and ovarian irradiation with from 1,200 to 1,500 roentgens over two or three pelvic fields, followed by the administration of 100 mgm of testosterone propionate three times a week for a period of 10 weeks.

Inoperable cancer of the breast, or inoperable axillary or infraclavicular metastases or supraclavicular metastases, is defined as stage 3. Treatment in these cases was the same as that administered to patients in stage 2—roentgen irradiation, operation, and hormone therapy.

Inoperable tumor with distant metastases is defined as stage 4. These patients were treated with ovarian irradiation and testosterone injections.

Collective results including the four stages of cancer showed 520 of 1,377 patients (37.8%) to be symptom free after 5 years. The results obtained in the treatment of cancers in stages 1, 2 and 3 were found to be as follows: of 949 patients with operable and inoperable cancer, 498 (52.5%) were symptom-free after a period of 5 years.

Of the patients with stage 1 and stage 2 cancers, who were followed for 5 years, 55.6 per cent were symptom free following preoperative irradiation and radical operation, 66.7 per cent were symptom free after preoperative and postoperative irradiation plus radical operation, and 60.0 per cent were symptom-free after radical operation plus postoperative irradiation.

In the author's survey of a smaller group of patients who had been treated in later years, he observed still further improvement in results. Twenty-two patients who were operated upon, with post-

operative treatment, have been symptom free for a period of 5 years (constituting 86 per cent of patients with stage 1 and stage 2 cancers who were treated in later years). The author believes this method of treatment to be ideal for patients with stage 1 and stage 2 tumors.

The methods of radium and roentgen administration, as well as dosages, are discussed in detail.

JANE C. MACMILLAN, M.D.

## TRACHEA, LUNGS, AND PLEURA

**Rupture of Bronchus Due to External Chest Trauma, Report of 3 Cases with Recovery.** PAUL H. HOLINGER, ALBERT R. ZOISS, and KENNETH C. JOHNSTON *Laryngoscope*, 1948, 58: 817

Rupture of a bronchus is an unusual and serious complication of severe external trauma to the chest. Kinsella and Johnsrud presented a very complete review of the topic in a recent publication and were able to uncover only 38 cases in the literature. The first report of a patient surviving this type of injury was made by Krinitzki, in 1928. In this case, complete bronchial stenosis was noted as an incidental postmortem finding, the apparent result of chest trauma suffered 21 years previously. The second instance of recovery was reported in 1939 by Jones and Vinson, who were the first to establish the diagnosis clinically in a nonfatal case. Cases with recovery have since been reported with increasing frequency, testifying to the increasing awareness of the entity and also to the recent advances in the treatment of severe thoracic injuries.

Three cases with recovery are presented in detail to emphasize further the not too rare occurrence of traumatic bronchial rupture and to call attention to the complexities of treatment.

Bronchial rupture is a relatively rare complication of severe, nonpenetrating, external chest trauma. Patients who survive such major injuries are being clinically recognized with increasing frequency.

Traumatic bronchial rupture inevitably results in cicatricial bronchial stenosis. In the majority of cases this stenosis is complete.

A pathological sequela in cases with residual complete bronchial stenosis is a chronic atelectatic lung with reduction in respiratory capacity. Unique and noteworthy is the absence of complicating infection in most of these chronic atelectatic states.

Diagnosis in the intermediate and late clinical phases is dependent upon a history of severe chest trauma, the discovery of a persistent lung collapse, and the bronchoscopic and bronchographic findings of complete bronchial occlusion.

In the initial phase of bronchial rupture, treatment of the concomitant severe chest injury is the primary concern. The possibilities of early surgical repair of bronchial disruptions warrant further investigation.

In the management of old bronchial injuries one is handicapped by the lack of basic cardiopulmonary studies. Therapeutic pneumothorax and thoraco-

plasty are recommended under certain specified conditions. Resection is indicated in the rare case that develops complicating pulmonary infection.

JOHN E. KIRKPATRICK, M.D.

#### Traumatic Bronchial Rupture with Occlusion

PHILIP J. HODES, JULIAN JOHNSON, and JOSEPH P. ATKINS *Am J Roentlg*, 1948, 60 448

Bronchial tears are usually due to crushing chest injuries and are often fatal. When patients survive the injury, they may subsequently develop complete bronchial occlusion and pulmonary collapse. Thirty-two cases of bronchial tears have been recorded in the literature since 1889. Ten of these patients survived the immediate effects of injury and developed bronchial occlusion. In every instance the bronchial defect lay immediately adjacent to or within a few centimeters of the bifurcation of the trachea. Bronchial tears are attributed to two factors: (1) compression of the bronchus between the elastic chest wall and the rigid spine, and (2) abnormally high air pressures within the bronchus at the time of the impact, due to the inadvertent closing off of the larynx by the victim as he tries to protect himself from the onrushing blow.

The patients usually exhibit shock, dyspnea, anoxia, interstitial emphysema, and cough. Roentgenograms immediately after injury may reveal fractured ribs, interstitial emphysema, pneumothorax, pulmonary compression, and mediastinal shift. Therapy at this stage must be directed toward relieving the above signs and symptoms. If the patient survives, bronchial occlusion then begins to take place. Usually there exists a period of days or weeks between the date of injury and the time of complete bronchial occlusion by cicatrix formation. Bronchograms reveal a cup-shaped pouch at the site of occlusion. Therapeutic measures at this stage have included pneumothorax, occasionally helpful, and pneumonectomy, usually very helpful. Thoracoplasty has not been used to date. It is of interest that these collapsed lungs, removed at operation, show no evidence of infection in contrast to the usual atelectatic lung.

The authors report the case of a 36 year old man who had been violently injured and who developed complete bronchial occlusion of the right main stem bronchus with total collapse some 4 months after injury. A pneumonectomy was performed and the patient was completely relieved of his symptom of severe dyspnea.

JESSE E. THOMPSON, M.D.

#### Arteriovenous Fistula of the Lung Treated by Ligation of the Pulmonary Artery

GEORGE B. PACKARD and JAMES J. WARING *Arch Surg*, 1948, 56 725

The presence of arteriovenous fistula in the lung has been recognized clinically only during the past few years. The steadily increasing number of cases reported suggests that it is much more common than supposed. The stereotyped syndrome of cyanosis, clubbing of the nails, and polycythemia, without

abnormality of the heart, is accompanied by roentgenographic observations which are practically diagnostic.

The possible relationship of this condition to hereditary hemorrhagic telangiectasia is indicated, and the incidence of multiple lesions is emphasized.

Consideration is given to the distinctive features of the pulmonary circulation as compared with the systemic circulation, which may permit some variations in the treatment of pulmonary arteriovenous fistula as compared with treatment of fistula in the systemic circulation. Apparently arterial connection between the pulmonary artery and bronchial artery branches is hardly to be compared with the free collateral circulation existing in the systemic circulation.

Report is made of one of the early cases in which the condition was recognized and one of the early cases in which there was surgical treatment. It is known that many more cases, in which the condition has since been recognized and treated, are in the process of being reported. As far as we know, this is the only case in which the condition was treated, and, to date, beneficially, by simple ligation of the pulmonary artery.

JOHN J. MALONEY, M.D.

#### The Problem of the Solitary Lung Tumors

DONALD BRIAN EFFLER, BRIAN BLADES, and EDWARD MARKS *Surgery*, 1948, 24 917

Mass roentgenography has resulted in the discovery of an occasional solitary shadow, or spot, on an otherwise normal lung field. The diagnosis and management of these asymptomatic lesions may constitute a very real problem. In the past, observation has been the accepted procedure in the management of these patients. This has resulted in the assumption that the majority of these lesions were probably benign, otherwise the patient would have re-established contact with the physician.

With the continued improvement in surgical and anesthesia techniques, a definite changed attitude has been evolved. The authors review 24 cases in which a round pulmonary asymptomatic lesion was discovered through routine examination. Operation was advised for each of the 24 patients, at least for the purpose of biopsy. All consented and were subjected to thoracotomy. All of the lesions were considered benign neoplasms preoperatively. However, 15 per cent of the tumors proved to be malignant neoplasms after adequate tissue studies were performed. It is believed that this in itself justifies surgical exploration of every solitary tumor of the lung, even though the patient is symptom free and the lesion has every indication of being benign.

STEPHEN A. ZIEMAN, M.D.

#### Bronchial Carcinoma

R. C. BROCK *Brit M J*, 1948, 2 737

The improvement in operability of bronchial carcinoma is due largely to the fact that patients are seen early, rather than to improvement in the surgical technique. Operative technique is now largely

standardized Further improvement in curability is dependent upon earlier recognition of the signs and symptoms

The clinical features leading to the diagnosis of bronchial carcinoma are (1) an unexplained cough, (2) stained sputum, and (3) a vague deterioration of health, especially in elderly patients The most important step in early diagnosis is to think of the disease This is true particularly since lung carcinoma is a comparatively newcomer, and doctors trained 20 or more years ago were not brought up to be cancer-of-the-lung minded

The most important confirmatory procedures are roentgenography, bronchoscopy, and cytologic examination of the sputum (Cytologic examination of the mucus obtained at bronchoscopic examination has been found to yield accurate diagnoses in as many as 60 per cent of the cases in some clinics in the United States of America) Thoracotomy is the last logical examination and should be used when needed to establish the diagnosis as well as to assess the operability

The operation recommended is block-dissection pneumonectomy In this, the pericardial sac surrounding the hilar structure is removed with the lung, with complete block dissection of all the accessible mediastinal glands from the superior thoracic inlet down to the level of the diaphragm Lobectomy may be used in properly selected cases, i e , elderly patients with a peripheral type of growth in whom the hilum appears clear

In 666 cases seen from 1941 to 1947, the average operability was 11 per cent Operability has increased to 16.5 per cent during the past 3 years

In 101 operations, of which 15 were lobectomies, the operative mortality was 18 per cent (The collected operative mortality from 7 leading clinics in the United States and England varies from 15 to 32 per cent)

The 5 year survival rate thus far is 8 per cent, with 47 patients still alive and well for periods of from under 1 to 3 years

Twenty-eight patients have died since operation, 3 of causes other than recurrence It is believed that many of these obtained great benefit from operation since a number enjoyed a useful extra life span, and in many cases death came in a kinder form than would have been the case with an untreated tumor

FRANK B. QUEEN, M.D.

## HEART AND PERICARDIUM

**Closure of Defects in Cardiac Septa** GORDON MURRAY *Ann Surg*, 1948, 128 843

The cardiac septal defects present a challenge to the surgeon Attempts at closure, at least in part, have been carried out experimentally and in clinical patients and have resulted in moderate improvement.

In about 30 animals the authors passed sutures through in the line of the interauricular septum beginning at the site of the transverse sinus behind the

aorta, and coming out posteriorly between the superior vena cava and the right pulmonary veins With two, three, or four sutures passed through in this way, pulled taut, tied together posteriorly, and then tied anteriorly, it was possible to compress the anterior to the posterior wall of the auricle in such a way as to occlude the defect completely There was also the advantage of diminishing the size of the enlarged auricles On examinations of the specimens, the anterior wall of the auricles had healed to the posterior wall in such a way as to cause complete occlusion of the defect and construction of what appeared to be another interauricular septum

This would suggest further work which might go on to produce better effects anatomically and clinically The demonstration that this can be done with safety is probably the chief feature of the present work

JOHN J. MALONEY, M.D.

**Surgery of the Heart** B. NOLAND CARTER *J Am Med Ass*, 1948, 138 1207

The author describes the surgical treatment of several cardiac conditions Surgical therapy of heart disease in cases which have heretofore been considered hopeless is changing the prognosis

Acute suppurative pericarditis Penicillin and surgical drainage offer the best prognosis for this condition Early operation is important, and the most common approach is the anterior one Drainage tubes, irrigation, or both are used Chemotherapy has been disappointing The objections to pericardial paracentesis are (1) danger of injury to the heart, and (2) inadequate drainage

Chronic constrictive pericarditis Although medical treatment is often palliative, it is never curative While the inflammatory process is active surgery is unwise Technically, few changes have been made A portion of the thickened pericardium is removed by either the extrapleural or the intrapleural approach Early diagnosis is important because of atrophy from disuse and myocardial degeneration in long-standing cases

Coronary sclerosis The production of an adequate collateral circulation is the basis of surgical treatment in these cases Some methods are (1) scarification of opposing surfaces, (2) use of irritating substances (talc, asbestos, and acriflavine), (3) use of pectoral muscle flaps, and (4) anastomosis of the aorta to the coronary sinus with a transplanted vessel Pericoronary neurectomy has been used in an attempt to relieve anginal pain The author has modified the work of Lezius in using the lung as a source of blood supply The author points out the difficulty in evaluating clinical results because of the different methods used and the limited material

Nonpenetrating wounds of the heart Damage varies from actual rupture to mild contusion Signs and symptoms are frequently masked by evident injury to the bony thorax Findings are precordial pain, tachycardia, arrhythmia, dyspnea, and roentgenologic and electrocardiographic changes Surgical intervention is indicated (1) when a small rupture

of the artery occurs with hemorrhage and cardiac compression, (2) when there is cardiac compression from blood originating from sources other than rupture of the heart, and (3) when softening and fibrosis result in the formation of an aneurysm

**Penetrating wounds of the heart** Not all patients sustaining penetrating heart wounds need be subjected to operation (wounds from ice picks, small-bladed knives, and long pins) In larger wounds, surgery is indicated Aspiration is performed in selected cases only when the operating room is prepared for surgery

**Retained foreign bodies** The recent war has focused more attention on this subject Harken has pointed out that foreign bodies measuring 1 cm or more in two dimensions should be removed surgically Surgery is performed (1) to prevent embolism, (2) to diminish the danger of bacterial endocarditis, and (3) to decrease the incidence of myocardial damage

**Patent ductus arteriosus** Surgery in this field has served to limit complications of the condition and improve the prognosis in these cases Complete division of the ductus seems to be the procedure of choice It is pointed out that the operation has a curative value in the presence of subacute bacterial endarteritis, whereas at one time this complication was considered a contraindication

**Coarctation of the aorta** The most important sign is hypertension in the upper portion of the body with hypotension in the lower Additional signs are cardiac hypertrophy, scalloping of the ribs, absence of the aortic knob, and palpable pulsating arteries on the thoracic wall Resection on the coarcted portion with end-to-end suture is the treatment of choice

**Tetralogy of Fallot** A surgical attack is made for the relief of pulmonic stenosis, although each vessel arising from the aortic arch has been utilized for anastomosis Blalock prefers the innominate subclavian artery because of the better angle it makes when anastomosed The results in patients who survive have been phenomenal Side-to-side anastomosis between the aorta and either pulmonary artery has been used

ROBERT E. FLOER, M.D.

**The Surgical treatment of Mitral Stenosis Valvuloplasty** DWIGHT E. HARKEN, LAURENCE B. ELLIS, PAUL F. WARE, and LEONA R. NORMAN *N. England J. M.*, 1948, 239-801

Numerous complex physiologic and morphologic factors are concerned in the production of symptoms in patients with mitral stenosis

A preliminary classification is presented of patients incapacitated by mitral stenosis, who may be benefited by different types of surgery group A, patients with a low fixed cardiac output—mitral valvuloplasty, group B, patients with normal cardiac output—artificial interatrial shunt, and group C, patients with uncontrollable tachycardia or with anginal pain—cardiac denervation

Five operations have been performed Mitral valvuloplasty was performed in 2 patients of group A,

with 1 death Artificial interatrial defects were produced in 2 patients of group B, with survival in each case Denervation of the heart by bilateral removal of the inferior cervical and dorsal first to fourth ganglions in 1 patient of group C was followed by improvement

These cases are now reported only to indicate the ability of such patients to withstand operation The evaluation of any long term benefits attributable to these procedures—and, indeed, of the ultimate position of surgery in mitral stenosis—must rest on objective criteria gained from hemodynamic studies carried out before and after operation Subjective selection of patients and assessment of results lead to dangerous competitive exercises in surgical techniques rather than to advances in therapy

Four principles of the surgery of mitral stenosis have been evolved the operation should be performed without dislocation of the heart from the position of optimum function, the buttonhole opening of the stenotic mitral valve should be approached from the auricular side so that the funnel directs the cutting instrument toward the leaflet margin, surgical enlargement of the stenotic orifice should be so planned that there is a minimum burden from associated regurgitation (selective insufficiency) and maximum restoration of valvular function (valvuloplasty), and in the presence of mitral obstruction or regurgitation, undue acceleration of the heart rate must be prevented—tachycardia increases pulmonary vascular pressure and is associated with attacks of pulmonary edema and other forms of "pulmonary decompensation"

An unsuccessful attempt at producing "selective insufficiency" is presented It is suggested that tachycardia was an important factor in the disastrous outcome

A case report is presented of a patient with mitral stenosis who survived following an operation designed to produce "selective insufficiency" and "valvuloplasty" of the mitral valve

The need for more extensive and more effective valvuloplastic techniques is pointed out

JOHN J. MALONEY, M.D.

**Chronic Constrictive Pericarditis A Study of 53 Cases** PAUL OGLESBY, BENJAMIN CASTLEMAN, and PAUL D. WHITE *Am J. M. Sc.*, 1948, 216-361

The case histories of 53 patients with chronic constrictive pericarditis seen at the Massachusetts General Hospital, Boston, since 1914 are analyzed with respect to the clinical picture and the long term results of surgery Exertional dyspnea was the most common symptom and was followed in incidence by swelling of the ankles and legs, abdominal swelling, and abdominal discomfort The most common physical findings were, in order of their frequency, hepatomegaly, prominence of the neck veins, ascites, peripheral edema, and signs of fluid and/or pleural thickening at the lung bases

Cardiac enlargement as determined by roentgen films was present in slightly more than 50 per cent

of the cases, and by fluoroscopy the cardiac pulsations were found to be diminished or absent in 32 of the 40 patients so studied. Evidence of unilateral or bilateral hydrothorax and calcification of the pericardium were observed in about equal numbers, in slightly over 50 per cent of the cases.

Surgical exploration with pericardiolysis and partial pericardiectomy was undertaken in 42 patients, 5 of whom were operated upon twice because of failure of the first procedure to improve their clinical status satisfactorily. One patient has been operated upon 3 times. Fifteen of the 42 patients have been essentially cured of their symptoms by operation. There is unquestionable evidence that surgery benefited 10 other patients, 8 of whom are still living, while 2 died 6 years following pericardiectomy. Satisfactory or excellent results have thus been obtained in 60 per cent of the patients coming to operation. Of the remaining 16 patients, 6 died as a result of the operative procedure itself, 5 died from complicating diseases, and 4 died from the effects of their underlying disease.

The etiology was entirely obscure in 30 cases despite the fact that sections of the pericardium were available for microscopic study in 46 of the 53 cases in the series. Tuberculous involvement of the pericardium was proved in 9 patients. Healed fibrous scarring was the usual finding which may or may not have resulted from tuberculous infection.

From the pathological study of the autopsy material it is suggested that removal of the anterior or anterolateral portions of the pericardium alone may be inadequate to release auricular and ventricular action completely. Also, the friable and sometimes calcified nature of the myocardium may explain some of the poor operative results. The possibility has also arisen that the formation of scar tissue over the defect in the pericardium resulting from the partial pericardiectomy might reproduce the same constriction of the heart that was present prior to operation. Persistence of an active inflammatory process may also explain some of the poor surgical results.

ORVILLE F. GRIMES, M.D.

#### Constrictive Pericarditis with Obstruction of the Pulmonary Veins. WALTER LAWRENCE, JR., W. I. AOMAS and DONALD E. CASSILL. *J. Thorac. Surg.*, 1948, 17: 832.

A case of chronic constrictive pericarditis followed from ineptency to termination is reported, in which the cause for failure of surgical treatment was not disclosed until postmortem examination was performed.

In early 1946 a 14-year-old boy was admitted because of abdominal swelling, ankle edema and dyspnea. The diagnostic work up led to the opinion that his malady was produced by a mediastinal mass impinging upon and obstructing the pulmonary circulation. Such a mass was demonstrated by a chest roentgenogram.

At operation, considerable evidence of pleural and mediastinal inflammatory change of a chronic sort

was encountered, but a 2 by 2.5 inch tumor, classified as a cavernous hemangioma, was removed from the mediastinum in the region of the pulmonary conus. Immediate improvement was noted when the mass was removed. This improvement was short-lived, however, the venous pressure remaining elevated. Fluid persisted in recurring in the pleural and peritoneal cavities. Cardiac movements were restricted and fluid was aspirated from the pericardium.

Approximately 1 month after the first operation a decompression of the pericardium was carried out. This sac contained considerable hemorrhagic fluid, but no adhesions were recognized within the space.

Improvement was again noted but 4 months later evidence of a constrictive pericarditis was present and an extensive decortication was performed. Little or no improvement followed this and the patient succumbed some days thereafter.

The autopsy revealed the failure of successful cardiac decompression to be due to cardiac failure induced by extreme cicatricial narrowing of the pulmonary veins.

The progressive character of an inflammatory lesion of the mediastinum nullified attempts at surgical release of cardiac constriction. The presence of a mediastinal tumor contributed to this result. Such a combination is unusual, of course, but it did permit this case of chronic constrictive pericarditis to be followed throughout its entire course. The constricting effect on the pulmonary veins was also a very unusual feature. The etiology of the inflammatory process could not be determined.

In 6 of 7 other patients with constrictive pericarditis who were treated, the results were satisfactory even though 2 required reoperation. In the seventh patient the condition was of tuberculous etiology and terminated fatally, this being the only case in which a definite etiology could be determined.

HIRSH T. LACOSTE, M.D.

#### Operation of a Stenosis of the Aortic Isthmus 6 cm in Length (Opération d'une sténose de l'isthme de l'aorte d'une longueur de 6 centimètres). J. BORREMA. *Presse méd.*, 1950, No. 39.

Congenital stenosis of the aortic isthmus presents a characteristic picture. There is marked hypertension in the aortic arch and its branches to the head and arms, causing frequent headaches and nausea. At the same time, there is hypotension and poor circulation in the lower half of the body. The patient complains of coldness in the legs, fatigue on walking, even intermittent claudication is observed. Pulvation is absent in the femoral and popliteal arteries.

The prognosis in patients not subjected to operation is poor. Most of them die during childhood or adolescence either of rupture of the aorta or heart failure or of cerebral hemorrhage. Even the majority of those who reach adulthood die before the age of 40. Because of the immobility of the aortic stenosis, the stenosis and end to end anastomosis is possible only if the stenosis does not surpass the length of 5 cm.



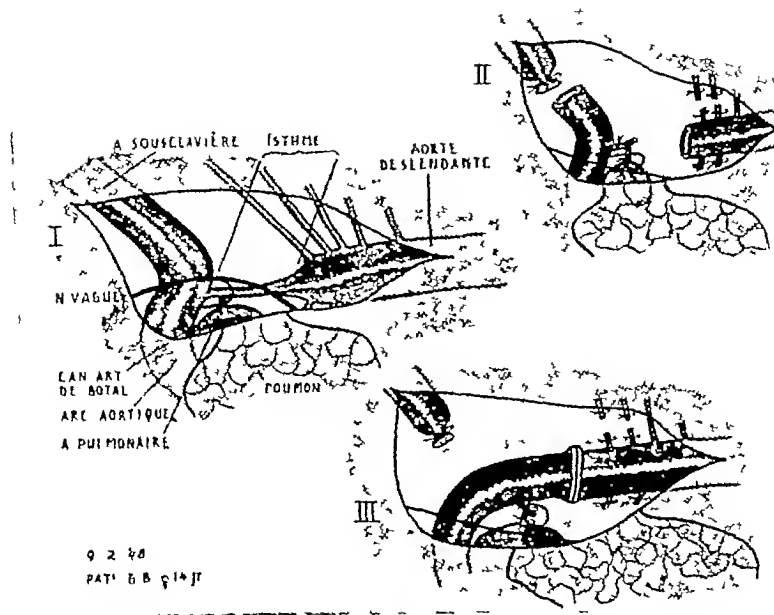


Fig 1 (Boerema)

In the first case a girl of 14 years, in whom the correct diagnosis was made soon after birth, complained of headache, nausea, chest pain, pain in the calves after walking, and dyspnea. The blood pressure in the arm was 150/105, there was no pulsation of the femoral and popliteal arteries, and the arteries of the foot could be demonstrated by oscillometric examination. Operation revealed stenosis of the isthmus of 6 centimeters' length. The left subclavian artery was very much dilated and appeared like a continuation of the aortic arch. As direct union of the aorta was impossible because of the length of the stenosis, the subclavian artery was ligated and, after resection of the stenosis, was joined to the descending aorta by end-to-end suture.

The operation was a complete success. Two weeks after surgery, the blood pressure in the arm was 135/90 and the pulse was present in the dorsalis pedis artery. The symptoms of headache, pain on walking, and the dyspnea had disappeared completely.

WERNER M. SOLMITZ, M.D.

**The Surgical Treatment and the Physiopathology of Coarctation of the Aorta.** R. J. BING, J. C. HANDELSMAN, J. A. CAMPBELL, H. E. GRISWOLD, and ALFRED BLALOCK. *Ann Surg.*, 1948, 128: 803.

Twenty-three patients with coarctation of the thoracic aorta were operated upon. Thirteen of the patients were 20 years of age or more, while 10 were younger. An anastomosis was completed in 21 cases of the 22 in which it was attempted. In 17 cases the stenosis was resected and an anastomosis of the proximal and distal ends of the aorta was performed. In 4 cases in which the proximal segment of the aorta

was too short for end-to-end suture, the left subclavian artery was used to by-pass the stenosis. There were 3 deaths in the series, including 1 in a child who had multiple congenital defects which had been recognized preoperatively.

Physiologic investigations disclosed no significant deviation of the cardiac output from normal. Blood flow through the arm, which was elevated before operation, fell during surgery. The blood flow through the leg rose postoperatively. Hypertension in the upper part of the body and hypotension in the legs were observed preoperatively. After operation, these pressures tended to equalize. Analysis of the physiologic data indicated no generalized elevation of peripheral vascular resistance. It is probable, therefore, that the hypertension in coarctation of the aorta is not attributable to a renal pressor mechanism, but is due to the resistance of the stenosis and collaterals.

JOHN J. MALONEY, M.D.

## ESOPHAGUS AND MEDIASTINUM

**Benign Stricture of the Esophagus.** EDWARD B. BENEDICT and RICHARD H. SWEET. *Gastroenterology*, 1948, 11: 618.

In an attempt to standardize the treatment of benign stricture of the esophagus, the authors have reviewed 60 cases of stricture. Clinically, all of the cases presented varying degrees of esophagitis, and many of the strictures were associated with other conditions, such as hiatus hernia, esophageal ulcer, and duodenal ulcer.

Once the differential diagnosis is established by roentgenography and biopsy examination has ruled





Fig 1 (Nissen) Sketch of the operative procedure. The denuded portion of the esophagus is covered by a pedicled flap of the upper segment of the lower lobe of the left lung

out carcinoma of the esophagus (which is equally common in the older age group as is stricture) bougienage with dietary treatment was found to give satisfactory results in more than 60 per cent of the cases. Only if repeated bougienage fails is surgery indicated in the patient who is a good risk. Because of the inflammatory nature of the disease and the length of the stricture, plastic repair is difficult and unpromising. In most cases, therefore, the operation of choice is resection. JANE C. MACMILLAN, M.D.

**Bridging of Esophageal Defect by Pedicled Flap of Lung Tissue** RUDOLPH NISSEN *Ann Surg*, 1949, 129: 142

Grafts of lung tissue have been widely used for reinforcing sutures of the bronchial stump following lobectomy and pneumonectomy. In lobectomy, which is performed for benign lesions as a rule, preference is given to a pedicled flap. In pneumonectomy in which the high level of bronchus dissection does not permit preservation of a pedicled flap, Churchill was successful in securing bronchial closure with a free graft of lung tissue taken from the periphery of the excised lung.

A case history is given in detail in which a leiomyoma of the thoracic esophagus was removed and a pedicled flap of lung tissue was used to protect the critical area in exactly the same way as omental grafts are used in abdominal surgery. The illustrations show the technique of the procedure.

JOHN J. MALONEY, M.D.

**Carcinoma of the Superior Mediastinal Segment of the Esophagus** RICHARD H. SWEET *Surgery*, 1948, 24: 929

Up to the present time no satisfactory technique for the removal of a lesion located in the upper fourth

of the thoracic portion of the esophagus has been developed. Recently a modification of the technique used for the removal of tumors in the midthoracic segment of the esophagus has been proposed. Now, a growth situated in the superior mediastinal segment can be resected and a primary esophagogastric anastomosis with the short proximal esophageal stump can be made in the neck.

The technique involves dissection of the esophagus and mobilization of the stomach as the first phase of the procedure. The dissection is begun in the region of the tumor after the mediastinal pleura is incised above the aortic arch behind the left subclavian artery. If the tumor-bearing portion of the esophagus can be freed sufficiently to make it possible to perform a resection, the operation is continued by completing the dissection of the entire length of the esophagus within the thorax. The mobilization of the stomach is then accomplished and the integrity of the vascular arches along the lesser curvatures is preserved at all cost. The stomach is drawn into the left thoracic cavity behind the hilum of the lung and lateral to the aortic arch. Fixation is accomplished by a series of interrupted silk sutures. The diaphragm is sutured to the stomach just above the pylorus and the diaphragmatic incision is then closed.

The intracervical esophagogastric anastomosis is then accomplished as a second step in the procedure. The esophagus is pulled up from the mediastinum and out in front of the carotid sheath. The fundus of the stomach is brought forward medial to the apex of the lung and pulled up into the lower portion of the neck (Figs. 1 and 2).

Here the anastomosis is done with careful approximation of the mucosa to mucosa and muscle edge to muscle.

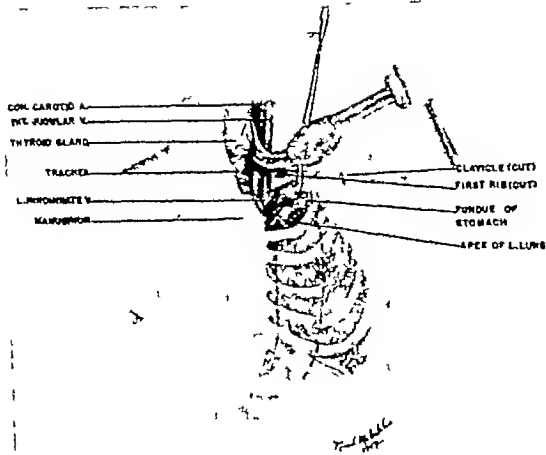


Fig 1 (Sweet) Drawing to illustrate the method of bringing the fundus of the stomach from the apex of the left pleural cavity into the neck through an opening produced by resecting the medial half of the clavicle and of the first rib

The author reports a case, giving a detailed description of the method employed. The result was most encouraging. The patient was able to swallow normally and to eat a normal diet.

From the standpoint of long time survival, it is conceded that only the accumulation of experience and the use of the procedure in a large group of patients will prove its value. The probability of local recurrence is great because of the fact that the dissection must of necessity be carried out close to the diseased area. This fault, however, is characteristic of all resections of the esophagus except those near the cardia. It is contended that the relief from dysphagia and the assurance of the comfort of normal eating are benefits which can be expected in the majority of patients and make the procedure well worth the risk.

STEPHEN A. ZIEMAN, M.D.

**Traumatic Chylothorax** ROBERT R. BALDRIDGE and ROBERT V. LEWIS *Ann Surg*, 1948, 128: 1056

The actual mechanism of the development of chylothorax following injury to the thoracic duct is not clear, since anatomically the duct is extrapleural in position and chylothorax is an accumulation of chyle in the pleural cavity. Some believe that chyle can escape into the pleural cavity through an uninjured pleural layer, while others believe that a perforation of the pleura is always present, though unrecognized. Retropleural accumulations of chyle have been reported, and it is probable that the usual delay which occurs between injury and the development of chylothorax represents the time required for erosion of the contiguous pleura, and perforation of an enlarging chyloma into the pleural cavity.

Traumatic chylothorax is more common on the right than on the left side, except in cases of penetrat-

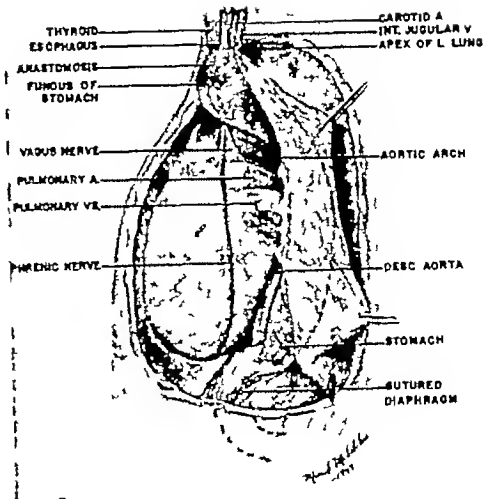


Fig 2 (Sweet) Drawing to show the relations of the stomach to the thoracic viscera and the structures in the base of the neck. Note (1) The stomach passes behind the hilum of the lung and extends forward in the apex of the left pleural cavity medial to the lung, (2) at the completion of the operation the anastomosis is on the posterior surface of the fundus of the stomach and lies anterior to the carotid artery and jugular vein.

ing injuries. As a general rule, injuries low in the thorax result in right chylothorax and high injuries in left chylothorax.

The immediate effects of chylothorax are mechanical in nature: (1) a time interval of 2 to 10 days, (2) sudden dyspnea, (3) shock, (4) rapid relief after thoracentesis, and (5) reaccumulation of fluid and recurrence of symptoms.

The secondary effects result from persistent loss of fluid, protein, fat, and lymphocytes: (1) loss of weight, (2) dehydration, (3) reduction in serum protein and body protein, (4) reduction in blood and tissue fat, (5) disappearance of lymphocytes and eosinophiles from the circulating blood, (6) inanition, oliguria, thirst, and (7) death.

The patient may live for a few days to a few months, depending upon the extent of the injury and the complications of the original trauma. The mortality rate approximates 50 per cent.

The accepted treatment of chylothorax has as its aims: (1) reduction of the volume of chyle, and the prevention of respiratory and vascular collapse from intrapleural pressure, (2) maintenance of nutrition, and (3) measures designed to favor healing of the duct, but none of the measures hitherto used is eminently successful.

It has been abundantly demonstrated that the integrity of the thoracic duct is not essential to life. When a patient with an injured duct presents a progressive downhill course, therefore, and conservative methods fail, surgical ligation of the duct would appear to be the only logical therapeutic procedure.

A case of injury of the cisterna chyli during sympathectomy for hypertension, with cure of the resulting chylothorax by ligation of the thoracic duct, the cisterna chyli, and all of its main afferent trunks, is described. Lymphaticovenous anastomoses within the abdomen are adequate for the return flow of lymph and chyle following obliteration of the cisterna chyli and the lower thoracic duct.

When indicated, ligation of the thoracic duct or cisterna chyli, or both, is feasible, and may in some cases be a life saving procedure.

SAMUEL KAHN, M D

### MISCELLANEOUS

#### Strangulating Diaphragmatic Hernia of the Liver

SAMUEL A. WOLFSON and ALFRED GOLDMAN *Surgery*, 1948, 24: 846

A case of congenital, strangulated, diaphragmatic hernia of the liver with surgical cure is reported. This case included a unique symptomatology of attacks of nausea, vomiting, and epigastric pain described as "cloudlike" with radiation to both lower, lateral thoracic areas. A "doorstep" feeling on bending forward was a prominent feature of the symptomatology. These symptoms probably have a causal relationship to the strangulation of the herniated liver, and with the surgical reduction of the hernia the patient experienced both a complete and lasting cure.

When a mass is demonstrated roentgenologically in the pericardiophrenic sulcus, herniation of the liver should be considered as well as the more common lesions. If abdominal symptoms of the type described are present, it is reasonable to suspect strangulation of the herniated liver, and exploratory thoracotomy should be advised.

JOHN J. MALONEY, M D

#### Thoracoabdominal Approach for Portacaval Anastomosis

VICTOR P. SATINSKY *Ann Surg*, 1948, 128: 938

The work of Whipple, Blakemore, and Lord has established portacaval shunt as an effective means of treating portal hypertension in properly selected cases. In general, a portacaval anastomosis is more desirable than a splenorenal anastomosis because of the larger size of the shunt in the former. In many cases, however, splenorenal anastomoses have been done because of the technical difficulties encountered in performing the portacaval shunt.

A new right-sided transthoracic, thoracoabdominal approach is described in which either the eighth or the ninth rib is resected, the diaphragm divided, the abdomen opened, and the liver dislocated into the right hemithorax. Access to the structures in the gastrohepatic omentum and to the hilum of the liver is simplified, enabling a high ligation of the branches of the portal vein from its lateral aspect and thus affording a longer segment of vein for anastomosis to the vena cava. Exposure is wide and all structures are presented more superficially than when the patient is on his back. Postoperative ileus is reduced to a minimum and little chance for postoperative incisional hernia exists.

Experiments on 6 dogs were carried out as a preliminary step, and a 45 year old male patient with cirrhosis of the liver then had a portacaval anastomosis successfully performed by this approach, using a one layer Blalock type of intima-to-intima suture with No. 5-0 braided silk. Heparin was not used postoperatively.

The suggestion is made that this route be used in the performance of reconstructive surgery of the common duct in cases in which the injury is close to the hilum of the liver, and for operations on the right adrenal gland.

JESSE E. THOMPSON, M D

# SURGERY OF THE ABDOMEN

## ABDOMINAL WALL AND PERITONEUM

**Abdominal Wound Closure in the Substandard Patient** MILTON W DURHAM and JOEL W BAKER  
*Bull. Mason Clinic, 1947, 1: 4*

A new technique of abdominal wound closure is described which has been found to be especially beneficial in certain groups of patients, including (1) those with disturbed healing capacity (as attested by a lowered serum protein value or a reversal of the A-G ratio), anemia, or reduced blood volume and reduced vitamin values, (2) those with wounds which are actually or potentially infected, and (3) those with wounds made through previous incision scars. Chronically debilitated patients, those with malignancy, weight loss, and impaired hepatic or renal function, patients with peptic ulcer (particularly those with obstruction), and all those with intestinal anastomoses, including gastric and colon resections, require special attention to wound closure, to forestall disruption or postoperative hernia.

Particular advantages of the technique include the minimal reaction to the steel sutures which allows them to remain a considerable length of time with negligible skin reaction, and broad splinting of the wound which allows immobilization of the part but early ambulation of the patient. Closure of abdominal wounds of the type described was performed in 100 consecutive cases following, for the greater part, colon and gastric resections, without wound disruption or postoperative hernia. As a rule the technique is accomplished on paramedian rectus retracting incisions with the peritoneum and posterior rectus sheath in the upper abdomen, or the peritoneum alone in the lower abdomen, with a running suture of 0 or 00 chromic catgut, since a continuous suture results in a smoother intra-abdominal wound and allows less space between sutures through which a hernia might develop.

The remaining closure is carried out as shown in Figure 1, with No. 30 steel sutures which are allowed to remain in place 21 days, and up to 35 days on occasion, according to the degree of healing. The final result with the sutures tied and demonstrating a strong wound support is shown in Figure 2. The sutures are easily removed by cutting the steel on the side opposite the knot next to the skin and pulling the knot with a hemostat.

**The Costal Arch Resection: A Substitute for the Transthoracic Approach to Upper Abdominal Pathology** L P GAMBEE and ANTHONY INGALA  
*West J. Surg., 1948, 56: 605*

The authors believe that requisite exposure of viscera lying high in the abdomen can be obtained via an abdominal incision without extension into the thorax. The incision which has been developed and offered to supplant the combined abdominothoracic

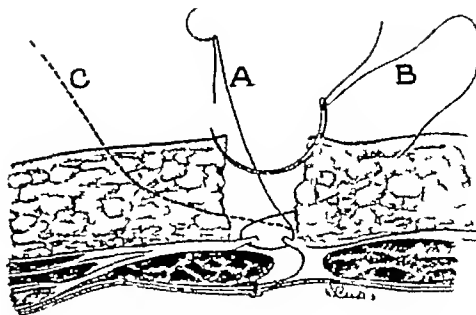


Fig 1

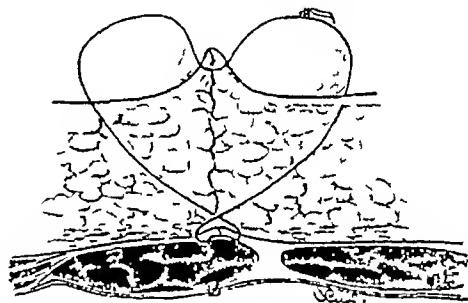


Fig 2

Fig 1 (Durham, Baker) Strand A sutured through the anterior rectus sheath with Mayo needle 0.5 cm from the edge of the rectus sheath; strand B sutured through skin from 2.5 to 3.0 cm from the skin edge, then matted back through both skin margins 0.3 cm from the incisional margin with large curved cutting needle and back through the skin margin to become strand C. The sutures are placed 1 cm apart and then tied over rolls of gauze 2.5 cm in diameter and the same length as the incision.

Fig 2 Cross section of the incision after suture is snugly tied over the roll of gauze. A thin gauze dressing is then placed over the wound and the wound is sealed with vertical strips of wide adhesive tape.

approach is one transecting the recti and augmented by its extension over the costal arch and excision of the arch. The incision is physiological in that motor innervation is preserved and that the incision parallels the lines of abdominal stress. Exposure has been consistently abundant and has expedited the accomplishment of the primary surgical objective, thereby offsetting the added minutes consumed in opening and closing this incision. Closure has been completed easily without tension, with the patient slightly jack-knifed. Healing has been most satisfactory and postoperative complications few.

JOHN J MALONEY, M D

## GASTROINTESTINAL TRACT

**Intraperitoneal Injury of Hollow Viscera Due to Nonpenetrating Wounds** CHARLES A. REIF-SCHNEIDER and ERWIN R. JENNINGS *South M J* 1948, 41 888

Intra-abdominal trauma presents one of the most difficult problems with which a surgeon has to deal. Injuries to the hollow viscera may be caused by penetrating wounds or may be due to nonpenetrating injuries from blunt force. Of the two, the latter variety offers more difficult problems in diagnosis. The trauma to the hollow viscus may act in different ways. A severe blow may rupture any portion of the gastrointestinal tract. If the intestines are ruptured, the tear is most likely to occur near the ligament of Treitz or near the ileocecal junction. The intestine may be torn from its mesentery, may be crushed between the abdominal wall and the spinal column, or may be punctured by a spicule of bone from a fracture of the pelvis.

When a patient with a suspected intra-abdominal injury is admitted to the hospital, he should be watched very carefully. If possible an accurate history should be obtained, especially of the time of the accident, and the character and force of the blow. He should be carefully examined, and his pulse, temperature, respiration, and blood pressure should be recorded every 15 minutes. A specimen of urine should be obtained. If he cannot void he should be catheterized. The urine should be examined for macroscopic and microscopic blood. A rectal examination should also be made. He should be typed immediately for transfusion. If possible a flat x-ray plate of the abdomen should be made, as air under the diaphragm may clinch the diagnosis. A blood count and hematocrit determination should be made. The degree of rigidity of the abdominal muscles should be carefully noted, as well as the percussion note, to determine whether or not there is any free fluid in the peritoneal cavity.

If the pulse rate increases and the blood pressure falls, it usually means active hemorrhage and immediate laparotomy is justified. If the patient gives a history of injury to his abdomen, he should be kept under observation for at least 6 hours. This is just as important as the period of observation given to head injuries. A patient should not be discharged from the accident department while still complaining of abdominal pain.

Nonpenetrating rupture of the stomach is rather uncommon. There are no distinctive symptoms or signs of gastric rupture. Excruciating pain is present if the gastric contents are spilled into the peritoneal cavity. This is accompanied by marked tenderness and boardlike rigidity of the upper abdomen. Nausea and vomiting are usually present. The vomitus may or may not contain blood. Symptoms of shock appear early. A flat roentgenogram of the abdomen may show air under the diaphragm.

Rupture of the small intestines due to a nonpenetrating wound is usually single, but it may be

multiple. It is most likely to occur at or near one of the fixed points, such as the ligament of Treitz or the ileocecal junction.

Early diagnosis is of great importance. If the operation is delayed more than 6 hours the patient's chance of recovery is greatly decreased. If 12 or more hours have elapsed between the accident and the operation, the prognosis is very bad. If the operation is delayed 24 hours or more, the result is usually fatal.

The patient should be treated for shock with plasma, given intravenously. He should be immediately typed for transfusion. The choice of anesthetic is most important. Spinal anesthesia is contraindicated. If the injury is complicated by intrathoracic trauma, the anesthetic setup must be adequate.

The abdomen is usually opened through a right rectus incision. If free blood is found in the peritoneal cavity, the site of injury should be quickly located and the hemorrhage controlled. It should be noted whether any gastric or intestinal contents are mixed with the blood. The spleen and liver should be quickly examined for laceration.

Local suture, instead of an anastomosing operation or resection, should always be done when possible. If a wound in the intestines is repaired, the line of suture should be transverse to the long axis so as to diminish the chance of constriction of the lumen.

It is a known fact that mortality is greatly increased in resection. According to Bailey, resection should be done only (1) when a section of the intestine has been destroyed, (2) when there are several large perforations within a short distance of one another, and (3) when injuries affecting the mesentery and its vessel endanger the circulation of the intestines.

The existence of traumatic appendicitis is still extremely controversial. In order to make a definite diagnosis of traumatic appendicitis, it would be necessary to find evidence of trauma of the appendix following a blow of the abdomen, such as laceration or hemorrhage of the walls of the appendix or of the mesentery of the appendix. McCarthy and Magrath, of Philadelphia, reported 2 cases of traumatic appendicitis. In 1 case the appendix and appendical mesentery were detached from the cecum. In the other the appendix was detached at its base.

In 1939, Connell, of Denver, in answer to a questionnaire, tabulated 49,604 cases of acute appendicitis. In this series there was a history of trauma in 11 cases only. In 1 case a pin was found in the appendix, in another there was intussusception without internal violence. If these 2 were eliminated, the remaining 9 cases would give a percentage of 0.0018 in which trauma was mentioned as an etiologic factor.

Rupture of the large intestines due to a blunt blow is rather rare. The large bowel may be ruptured by a sharp fragment of bone from a fracture of the pelvis or may be torn when air is forced into the rectum by a hose.

A full bladder extends above the symphysis pubis and may be injured by a blow to the lower abdomen. Fracture of the pelvis is not infrequently complicated by a rupture of the bladder. The rupture may be extraperitoneal or intraperitoneal, the latter condition being much more serious. If the intraperitoneal rupture is not recognized and operation is not performed early, a fulminating peritonitis is found. If the rupture is extraperitoneal, marked urinary extravasation may take place.

Physiologic salt solution should be given with great care until the peritonitis is well controlled and normal gastrointestinal function has returned. The administration of salt results in the collection of the sodium at the sites of trauma in the body, which are principally the operative site and the bowel wall. This results in edema at the operative site, and large collections of fluid within the bowel lumen. An excess of saline in the body is exaggerated by the stimulated adrenal glands and results in the retention of sodium. Sodium excess is also accentuated by the usual partial disturbance of kidney efficiency. It must be remembered that blood and plasma contain salt equaling approximately 9 gm per liter. Thus, adequate daily salt intake, usually considered between 4 and 9 gm, is administered in these agents. Further salt, if needed, may be given.

The use of antibiotics in a diffuse peritonitis due to a perforated viscus is directed toward control of the infectious process often caused by many different organisms which are present.

JOHN E. KIRKPATRICK, M.D.

**Gastric Ulcer. A Study of 600 Cases.** FRANCES H. SMITH and SARA M. JORDAN. *Gastroenterology*, 1948, 11: 575.

The authors review 600 cases of gastric ulcer, 59 of which were found to be malignant histologically, 12 ulcers were found to be malignant clinically but were not operated upon. They divide these cases into 3 categories: (1) malignant ulcers, (2) benign ulcers which were operated upon, and (3) benign ulcers which were not operated upon, and then they compare the findings in the benign and malignant groups.

The incidence of malignant ulcers was found to be 9.8 per cent, or 59 cases, these were proved histologically. Of these, 54.7 per cent were operated upon within 2 months from the time they were first seen at the Lahey Clinic. Refusal of operation and delayed hospitalization (and the lack of x-ray evidence in 1 case) accounted for delay in operation of from 2 to 4 months. Of 5 patients on whom operation was delayed from 4 to 6 months, 1 did not return for 4 months and 4 had persistence or recurrence of symptoms although the roentgen signs had disappeared. The 10 patients operated upon later than 6 months had had medical treatment in or out of the hospital and were operated upon because of recurrence. Of the 59 ulcers found to be malignant, 33 were resectable. The survival chart for these cases is shown in the following table.

TABLE I — 600 CASES OF GASTRIC ULCER

Analysis of 44 Operated Malignant Ulcers  
Survival Period of 33 Resectable Cases

Duration	Cases	
	Number	Per cent
2 years postoperatively	19	57.5
5 years postoperatively*	5	15.1

\*1 patient was alive and well nine years after operation for lymphosarcoma.

There were 211 cases of benign gastric ulcers in which operation was done. Three patients were subjected to total gastrectomy and 208 to partial gastrectomy. Table II shows a summary of the indications for operation in these cases.

It should be noted that while some of these patients underwent resection at intervals varying from 2 months to 11.5 years after coming to the Clinic, 66.8 per cent of them were operated on within 2 months after they were first seen at the Lahey Clinic. Of the 211 operated on, 10 died before leaving the hospital, 5, or 2.4 per cent, may be considered to have died as the direct result of the operation, including bronchopneumonia in 1932, peritonitis in 1933, pulmonary embolus in 1935 and 1945, and cachexia in 1936. Table III is an analysis of the postoperative results for 5 years after gastric resection for benign ulcer in 211 cases.

The medically managed ulcers, or those not treated surgically, make up the third category and include 332 patients. There were 2 patients with malignant ulcer (proved by postmortem examination 6 and 23 years after the patients were first seen at the Lahey Clinic), 41 patients could not be followed up, and there were 15 deaths among the 104 cases followed up for less than 2 years. Four of these 15 deaths were due to hemorrhage and 11 were due to other nonrelated coexisting conditions. The cases of recurrence were studied and the recurrences were

TABLE II — 600 CASES OF GASTRIC ULCER

Analysis of 211 Operated Benign Ulcers  
Indications for Operation

	Cases
Diagnosis of carcinoma	15
Diagnosis of probable carcinoma	74
Recurrence	70
Obstruction	17
Hemorrhage	3
Intractability	9
Failure to heal	21
Polyp	1
Planned cholecystectomy (large ulcer incidental finding)	1

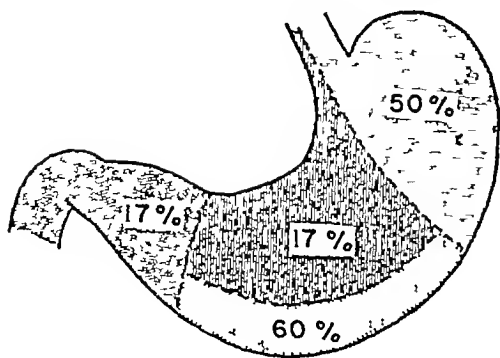


Fig 1 (Smith, Jordan) The incidence of malignancy in various locations

attributed largely to dietary indiscretions, and emotional upset or worry

In comparing the malignant and benign groups it was found that anacidity occurred twice as commonly in the former as in the latter group, but it was observed that hyperacidity is not incompatible with gastric malignancy. Marked weight loss occurs in a much greater percentage of the benign cases than of the malignant ones. The incidence of hemorrhage and obstruction is similar in the two groups, and perforation occurred twice as often in the benign as in the malignant ulcers. The number of cases of coexisting cholelithiasis approximate an incidence identical with that in the general population. The finding of an hourglass stomach in patients with gastric ulcer is interesting because of the preponderance in the malignant group. X-ray deformity of the duodenum is comparable in the benign and ma-

TABLE III — 600 CASES OF GASTRIC ULCER

Analysis of Postoperative Symptoms and Signs in 211 Benign Operated Cases

Symptoms and Signs	Duration of Follow Up					
	Less than 2 years		2 to 5 years		5 years and over	
	Total no	Per cent	Total no	Per cent	Total no	Per cent
Dumping syndrome	6	8.6	3	5.9	2	4.3
Nausea and/or vomiting	10	14.3	4	7.8	3	6.5
Heartburn	5	7.1	3	5.9		4.3
Postprandial fullness	4	5.7	6	11.7	2	4.3
Fatigue and weakness	5	7.1	4	7.8	2	4.3
Failure to gain weight	8	11.4	5	9.8	10	21.7
Anemia*	3	4.3	10	19.3	9	19.5
Acid present	4	5.7	6	11.7	2	4.3
Total cases followed	70		51		46	

\*Hypochromic or normochromic mild in all cases

lignant groups. Symptoms were similar in both types, except that the patients with benign ulcer tended to have more night pain, and nausea in greater incidence, than those with malignant ulcers.

Gastroscopy was found not at all helpful for diagnosis in 25 per cent of the cases, and in 4.3 per cent of 93 cases a false negative or "benign" impression was obtained on visualization. This is partially accounted for by the high occurrence rate of malignant lesions in spots blind to gastroscopy, as shown on the accompanying diagram.

It should be noted that while the usually estimated incidence of malignant degeneration of an ulcer is 10 per cent, there were only 2 cases in this series known to have become malignant. Assuming that the 4 (follow-up) deaths in the same group were due to cancerous change, the maximum incidence of malignant degeneration was only 5.4 per cent in this series. Even this compares favorably with the hospital mortality of 4.7 per cent and the operative mortality of 2.4 per cent.

There were 20 cases (constituting 3.3 per cent of the total) in which the patient was mistakenly treated for a benign ulcer, and when he was operated upon for recurrence of symptoms a malignancy was found. It is not proved that these ulcers did not degenerate into malignancies during medical treatment, as they well may have done. It is the feeling of the authors that this may have happened in this group in which surgical treatment was delayed. The resection of all recurrent ulcers is advocated even though the resection of some benign ulcers will result.

The criteria of healing ulcers are discussed and evaluated in this paper as follows: the progress of healing (as judged by means of x rays), the subsidence of the symptoms, and the disappearance of occult blood in the stools, which should all be observed in 3 or 4 weeks, and be complete in from 6 to 8 weeks. Unless the patient follows the medical regimen, and the healing signs are satisfactory, it is believed safer to resect the ulcer early.

JANE C. MACMILLAN, M.D.

Subcardiac Gastric Ulcer (*L'ulcera gastrica subcardiale*) A. CIMINATA *Gior ital chir*, 1948 4 443

According to the author, who has performed about 1,500 operations on the stomach, 15 per cent of stomach ulcers occur in the subcardiac area. In these cases he doubts the rationale of doing a gastric resection when a simple gastroenterostomy, with its lower mortality, may be sufficient.

In subcardiac ulcer the advisability of doing a gastric resection depends on the amount of gastric tissue available to insure satisfactory suturing. Therefore the extension of a subcardiac ulcer to the esophagus prohibits a resection. When the ulcer involves the posterior wall of the stomach and penetrates the pancreas, the information as to the amount of gastric tissue available for suturing is obtained by passing the ulcer. When the author is unable to do so, he follows the advice of Finsterlin, i.e., he

performs a gastrostomy, inserts the finger in the stomach, and proceeds to explore the stomach up to the esophagus, thus also obtaining information as to the size of the ulcer

He advises that enterostats be discarded when a gastric resection is done, a suggestion made first by Tansini in 1923, he stresses the meticulous ligation of the submucous vessels to prevent dehiscence of the sutures and advises ligation of the gastric artery where it courses downward to prevent ischemia of the critical part of the resection. By following this technique he lost only 1 case among the 35 resections he performed for subcardiac ulcer because of dehiscence of the sutures

The step type of resection is the best one in these cases because it allows resection of the small curvature up to the cardia and removal of the pyloric end which is the ulcer-genetic factor

JOSEPH M. A. PAPE, M.D.

**Gastrojejunal Ulceration** A. G. R. LOWDON *Edinburgh M. J.*, 1948, 55 533

Gastrojejunal ulceration is of peculiar interest and importance for several reasons. It is a man-made disease, a failure of the surgical treatment of ulcer, moreover, it is a serious failure because it is frequently a more troublesome and dangerous condition to the patient than the original complaint. It carries with it the risk of the usual complications of peptic ulcer—hemorrhage and perforation—and, in addition, other complications equally as serious, if not more so. The surgical treatment of gastrojejunal ulcer, often imperative, is difficult and dangerous.

If cases are carefully selected as suitable for the operation of gastroenterostomy, the incidence of gastrojejunal ulcer should be less than 3 per cent. If gastroenterostomy is performed for all cases of duodenal ulcer, irrespective of sex, age, or the degree of stenosis or hyperacidity, the incidence of gastrojejunal ulcer will be 20 per cent or more. The incidence of gastrojejunal ulcer after partial gastrectomy is under 2 per cent.

Preventive treatment of gastrojejunal ulcer must consist primarily in the careful selection of cases for the operation of gastrojejunostomy. It is probably wise to avoid the operation in any patient under 45 years of age unless there are contraindications to the more formidable procedure of partial gastrectomy, and to confine its use to patients in whom the peptic ulcer is associated with some degree of pyloric stenosis and a normal or low acid curve.

Partial gastrectomy has been proved by experience to be a satisfactory treatment of gastrojejunal ulceration. In practice it produces a high percentage of cures. The operative mortality of partial gastrectomy for anastomotic ulcer has, however, been unfortunately high.

Vagotomy is now under trial as an alternative method of reducing the hydrochloric acid secretion. The immediate results of the operation are very gratifying, there is complete relief of ulcer pain and a marked fall in acidity. It is still too early to judge

the lasting value of the procedure, but it can, on present evidence, be regarded as the treatment of choice for anastomotic ulcer in elderly or bad risk patients and in all cases of recurrent ulcer after partial gastrectomy.

There are a number of important complications associated with gastrojejunal ulceration. An abscess may develop in the anterior abdominal wall, but this is now rarely seen because the anterior anastomosis is seldom performed. Free perforation into the peritoneal cavity is comparatively common, it occurred in 18 of the 67 patients. It may occur repeatedly. Perforation is usually to be taken as an indication to treat the patient by gastrectomy as soon as he has recovered sufficiently from the primary operation for closure.

Hemorrhage from a gastrojejunal ulcer presents considerable difficulty both in diagnosis and in treatment. The diagnostic problem is to decide whether the hemorrhage is from a stomal ulcer or from a recrudescence of the primary ulcer. Fortunately, hemorrhage from a secondary ulcer is seldom so severe or persistent as it may be when a posterior duodenal ulcer erodes a branch of the gastroduodenal artery.

Gastrojejunal fistula is one of the most difficult problems that can confront an abdominal surgeon. The symptoms are very characteristic—diarrhea, vomiting of fecal material, belching of foul gas, and progressive wasting. Pain is frequently absent, or slight.

CHARLES BARON, M.D.

**Partial Gastrectomy for Peptic Ulcer** H. W. PORTER *Edinburgh M. J.*, 1948, 55 549

While the final answer to the treatment of chronic peptic ulceration will almost certainly be found in the sphere of the physician, there is at present a considerable proportion of patients who can obtain no permanent alleviation of symptoms from medical treatment, and the majority of these can be greatly benefited, if not completely relieved, by the surgeon.

The disadvantages of partial gastrectomy may be tabulated under the following headings: the operative mortality, anastomotic ulcer, inability to return to normal diet, postoperative dumping syndrome, anemia, inability to return to former employment.

An analysis was made of 118 unselected cases (87 duodenal, 20 gastric, and 11 stomal ulcers).

The indications for operation were repeated perforations (38 cases), hemorrhage (17 cases), and failure to respond to medical treatment (63 cases). Patients who failed to respond were those who had had more than one adequate course of medical treatment in the hospital and were not benefited, or had had a recurrence in spite of adherence to medical treatment after discharge, and (b) people who were unable to continue adequate medical treatment due either to economic factors or low intelligence.

There were 4 deaths, all of which occurred in patients in the 50 to 60 year age group, which may be an argument for instituting surgical treatment at an earlier date.



The postoperative complications were pulmonary atelectasis in 22 patients, hemorrhage in 7, pulmonary embolus in 1, pneumothorax in 1, obstruction at the stoma in 1, and bowel obstruction in 1, leakage from the duodenal stump did not occur in any of the cases. Several factors contributed to a satisfactory recovery. Prophylactically, they were (a) the abolition of constricting abdominal binders and dressings, (b) early rising to encourage abdominal breathing, (c) the avoidance of indiscriminate use of gastric suction, (d) encouragement to cough, which not only entails reassuring the patient regarding the ability of his wound to stand the strain of coughing, but may also necessitate personal supervision to make sure that he does cough, (e) the avoidance of respiratory depressant drugs as far as possible, especially morphia (the use of procaine intravenously may prove to be a suitable substitute), (f) the avoidance of postoperative dehydration. In the treatment of collapse, should it occur the use of penicillin has proved invaluable.

It has been possible to follow up all patients who were operated upon. Three patients have died since their discharge. In 1 of these a gastrojejunal fistula developed, in 1, an acute lobar pneumonia developed 6 months later, the third patient had two attacks of acute obstructive jaundice 4 months later and after exploration, which revealed no stone, the jaundice cleared up, but the patient had a flare up of quiescent pulmonary tuberculosis which proved fatal. All of the remaining patients are alive and well. All but 2 of these have returned to their former employment (84 per cent of these returned in 3 months or under, and 24 per cent returned in 6 weeks or under). Several among the 24 per cent were able to undertake heavy manual work.

Many authors believe that gastrectomy is but one step in the treatment of peptic ulcer, and that it is necessary for patients to continue on a strict ulcer regime after operation. This may be due in part to the fact that the majority of patients who have undergone a large or full length anastomosis cannot eat a full meal. It has been shown that the gastric remnant remains small for a long period after operation—18 months or more—and that after eating there is gross jejunal bulging. One cannot help feeling that any major operative procedure directed at curing the patient must be regarded as a failure unless he can consume a full normal diet and lead a normal life. In this series, no case followed up roentgenologically showed gross jejunal bulging and all showed dilatation of the gastric remnant to 3 or 4 times its original size within 6 weeks of operation. This has enabled 99 per cent of patients to return to a full diet—normal in quantity and quality—within a period of 6 weeks. It is obvious that the psychological effect of being able to eat anything and everything is very great. Finally, the answer to the last question in the follow-up. Would you advise a close relative to have this operation under similar circumstances? Approximately 99 per cent of the operative

(CHARLES HARRIS, M.D.)

### "Palliative Gastrectomy" in Cases of Duodenal Ulcer

IRVING SPARK, *Ann. Surg.* 1945, 62, 9

The author uses the term "palliative gastrectomy" to describe the operative procedure for duodenal ulcer when the ulcer is left in situ but the procedure is otherwise similar to a Billroth II operation. It is the procedure which is more commonly described in the American literature under the term of the Finster exclusion operation. The article is based on a comparison of the results of 83 "palliative gastrectomies" with those of 102 radical Billroth II resections with complete removal of the ulcer, the two series comprising all of the cases of duodenal ulcer operated on in the years from 1936 to 1945 with a follow up of at least 1 year.

"Palliative gastrectomy" was performed on all patients with an ulcer penetrating into the pancreas when injury to the pancreas or the gall ducts might be entailed by radical operation. The author emphasizes that a palliative resection must be systematically planned and that when it is resorted to in an emergency after radical excision has proved impossible, irreparable damage to the blood supply of the pylorus has usually taken place which will result in serious and often fatal leakage from the pyloric stump. In performing this operation the author excises the mucosa of the pyloric stump and invaginates the remaining tissue, taking care to be sufficiently proximal to the pylorus to allow easy invagination.

The comparison of the results in these two large series is of great interest. The mortality for palliative resections was 2 per cent and for the radical operation 5.5 per cent. In the follow up 91 per cent of the patients who had had a "palliative resection" had a satisfactory result, while 80 per cent of those on whom the complete operation with excision of the ulcer had been performed had satisfactory results. In studying the patients postoperatively the author found no significant difference in the production of acid in the two groups, nor was there any difference in the incidence or severity of postoperative dyspeptic symptoms. In both groups some patients had in addition, an enteronastomosis, but no difference in the postoperative course could be found.

The author thus concludes that there is no significant difference between the effects of the two methods of operation, and as the palliative resection in many cases has a lower mortality it should be widely used.

(J. J. THOMAS, JR., M.D.)

### Gastric Polyps

LEO J. HARTZ, LEONIDEX S. SHAM, and GEORGE MILLS, *Gastroenterology* 1944, 11, 69

The authors present 6 cases of gastric polyps. The highest incidence occurred in the middle age groups, 70 per cent of the patients being between 40 and 50 years of age. Of the 6 patients 75 per cent were males and 25 per cent were females.

Gastric cancer may develop in the polypoid gastric mucosal wrappings, but there is no evidence

## SURGERY OF THE ABDOMEN

findings, often reveals some type of polypoid growth. These growths have, at times, no definite characteristic criteria as to their malignant or benign nature. Most of them, regardless of the later proved diagnosis, had no free acidity on the test meal, and most of them had a normal mucosa, so that deviation from the normal in such patients is without diagnostic significance. A safe method for dealing with polyps of the stomach, therefore, appears to be surgical removal of the lesions.

SAMUEL KAHN, M.D.

### End Results in the Treatment of Cancer of the Stomach

GEORGE T. PACK and GORDON MCNEER  
*Surgery*, 1948, 24: 769

Gastric cancer is the most common and one of the most rapidly fatal of all cancers. Nevertheless, the hope for cure is a very definite one and is becoming greater as the years go by. The 5 year cure rate for 795 patients treated from 1912 through 1941 was 3.4 per cent. Of 75 patients surviving gastrectomy, 26, or 34.7 per cent, lived 5 years without recurrence.

If more gastric cancers are to be recognized in their early curable stage, strict attention must be paid to the earliest symptoms which are:

- 1 Simple indigestion in any person of middle or later life

- 2 The ulcer syndrome appearing for the first time in a person past 40 years of age. Until proved otherwise, this patient should be considered as having cancer of the stomach.

- 3 Secondary anemia without known cause

- 4 An awareness that all is just not right, or "stomach consciousness." Probably this is the earliest symptom of gastric cancer.

When any of these symptoms occur, GI series and fluoroscopy by a competent radiologist must be done. Only by these means will more gastric cancer be recognized in the early curable stage.

An analysis of 795 patients suffering from gastric cancer and treated in the Memorial Hospital for Cancer and Allied Diseases, New York, from 1912 through 1941, shows a steady increase in operability and resectability, and a steady decrease in operative mortality despite the fact that formerly palliative operations were common while now curative resections are the trend.

The operability of cancer of the stomach has increased steadily through successive 5 year periods, from 51.8 per cent to the present 82.7 per cent, and the resectability (of all cases) from 2.9 per cent to 39.8 per cent, while the operative mortality has decreased from 62.5 per cent to 21.7 per cent. The decrease in mortality has occurred despite the fact that during the past 5 years 42.8 per cent of all gastric resections for cancer were of a major character, i.e., total gastrectomy or transthoracic cardectomy. In 92 subtotal gastrectomies the operative mortality was but 9.8 per cent.

Other factors which influence the end results are:

**Duration of symptoms.** The average duration of preoperative symptoms in 66 patients operated on between 1931 and 1941 was 9.7 months. The dura-

Period	Total cases	Operable cases per cent	Resectable			Operative mortality per cent
			Number	Operable cases per cent	Total per cent	
1916-1930	272	51.8	8	5.7	2.9	62
1931-1936	245	60.8	19	12.8	7.7	31
1937-1941	278	73.7	76	35.6	26.2	19
1942-1946	405	82.7	161	48.1	39.8	21

tion of symptoms for those surviving less than years and those surviving more than 5 years following operation was approximately the same, i.e., 10 months and 9.3 months, respectively.

**The gross pathological type of cancer.** The 5 year survival without recurrence following resection of the various gross types was 22.7 per cent for the annular, 25 per cent for the infiltrating, 26.3 per cent for the polypoid, 33.9 per cent for the ulcerative and 100 per cent for carcinoma *in situ*. Thus antral carcinomas are the most fatal type, and carcinoma *in situ* is the least fatal.

**The presence of metastases in the regional lymph nodes.** The influence of metastases to the regional lymph nodes on 5 year survival was shown by a 22 per cent 5 year survival when metastases were present and a 42.8 per cent 5 year survival when they were absent.

Stated differently, of the patients who survived or more years, 69.2 per cent had no lymph node metastases, while among those who had metastases the 5 year survival rate was but 30.8 per cent.

**Serosal penetration.** Fifty per cent of 16 patients having this complication had a 5 year cure, even though in 6 metastatic cancer was present in the regional lymph nodes.

**The microscopic grade.** Five year cures were obtained among the various microscopic grades of malignancy as follows: grade 1, 100 per cent; grade 2, 41.7 per cent; grade 3, 30 per cent; and grade 4, 16.7 per cent. Thus, grade 1 cancer is highly curable and grade 4 is far from hopeless.

Gelatinous or mucinous types of cancer have poor prognosis, probably because the mucin together with the cancer cells permeates the subserosal lymphatics early, and results in diffuse peritoneal carcinosis. Only 2 (21%) of 9 patients with such a cancer lived 5 years after resection, although in 7 there were no metastases in the perigastric lymph nodes.

FRANK B. QUEEN, M.D.

### Physiological Aspects of Vagotomy

J. E. THOM and S. A. KOMAROV *Gastroenterology*, 1948, 14: 413

The authors point out that the striking physiological aspects of vagotomy on experimental animals have aroused the curiosity of investigators for at least the past 300 years. However, the effects of complete severance of the vagus nerves on gastro-

testinal functions were not adequately observed until Pavlov devised a method for preventing the early death of the experimental animal, which regularly followed vagotomy done through a cervical incision. When the vagus nerves were cut in the neck the animals generally died of asphyxia or aspiration pneumonia, or they starved to death because of disturbances in the swallowing mechanism. By using dogs with a gastric fistula and cutting one of the vagus nerves below the level of the recurrent laryngeal nerve, Pavlov and others learned to circumvent many of the original difficulties.

In animals prepared by Pavlov's technique it was found that gastric digestion was inadequate to cope with the ordinary nutritional requirements of an animal on a normal diet. Food stagnated in the esophagus and stomach, and special precautions were necessary to prevent death of the animal. It was the rule in the Pavlov laboratory that only those animals which failed to secrete acid when sham-fed were considered to have had their gastric vagus fibers completely severed. In 1896 Pavlov, considering his studies and those reported in the literature of the time, concluded that the consequence of complete vagotomy which was most dangerous to life was the impairment of the digestive processes including disturbances of the gastrointestinal motility and the secretory function of the stomach, pancreas, and possibly the intestine. He also emphasized the extreme vulnerability of the intestine.

The authors point out that the exact relation of the vagus nerves to gastrointestinal function is one of the more obscure problems of physiology. At times the vagus nerves appear to initiate functions as do true motor or secretory nerves. At other times they appear merely to augment or inhibit response to local stimuli. Following vagotomy the loss of tonic activity appears to be of major importance in the deterioration of function that follows vagotomy. Although no specific function is lost, the muscle appears to be relaxed and flabby and does not react with normal vigor to such local stimuli as distention of the stomach wall. Doubtless, also, the gland cells are affected in a similar way, but because of the nature of their function the changes are less easily characterized. Not only is the cephalic phase of secretion absent because of loss of vagal innervation but responses to the local stimuli normally producing the gastric and intestinal phases may be feeble or altogether absent.

The authors stress the fact that complete vagotomy in experimental animals regularly causes nutritional disturbances severe enough to cause death of the animal. These changes are characterized by hypomotility of the stomach and hyposecretory function.

The authors review the evidence, both experimental and clinical, and they believe that transthoracic or transabdominal vagotomy is seldom complete and that apparent discrepancies in experimental results can be explained by the differences in the completeness of the vagotomy. They also suggest that

the relative harmlessness of this operation in man is due specifically to its incompleteness. Any attempts to accomplish a more nearly complete vagotomy in human subjects is thought to be unwise. The guaranteed severance of all vagal fibers may lead to quite unfavorable results.

EDWARD F. LEWISON, M.D.

**Gastrointestinal Motility Following Vagotomy and the Use of Urecholine for the Control of Certain Undesirable Phenomena.** THOMAS E. MACHELLA and STANLEY H. LORBER. *Gastroenterology*, 1948, 11, 426.

Changes in gastrointestinal motility may be due to alterations in either the extrinsic or intrinsic innervation. The extrinsic innervation consists of the sympathetic and the parasympathetic systems. The intrinsic innervation consists of at least two plexuses, Auerbach's and Meissner's. The vagus nerves supply parasympathetic innervation to the alimentary tract down to and including the proximal half or third of the transverse colon.

The authors briefly review the experimental and clinical evidence for the alterations in gastrointestinal physiology associated with vagus section, and report (1) cardiospasm, (2) gastric dilatation, hypotonus, and delayed emptying time, and (3) changes in intestinal motility.

This study is based upon 24 patients who have been subjected to vagotomy and upon 2 others who had their vagi interrupted together with resection of the fundus of the stomach and the lower esophagus for a high ulcer. Ten of these patients had no ancillary operative procedure other than vagotomy, while 16 had some form of anastomosis prior to, or simultaneous with, vagotomy.

In studying the effects of vagotomy upon gastrointestinal motility the most common motor disturbance observed by these investigators was gastric retention, and absent or diminished antral peristalsis. The time required for barium to move from the duodenum to the cecum was delayed probably as a result of poor emptying of the stomach.

In one patient, dynamic ileus was noted, and in another, dilatation of the entire small intestine. Motility disturbances secondary to an obstructing duodenal ulcer, to obstruction at or near the site of a gastroenterostomy stoma, or to obstruction of the esophagus at the operative site was observed. Such mechanical obstructive factors are to be kept in mind when symptoms of retention or obstruction are observed following vagotomy. No significant changes in the motility of the colon were noted by the authors. Spontaneous gastric emptying, sufficient to afford relief from symptoms of retention, occurred in all patients in whom the retention was secondary to vagotomy alone, after intervals varying from 2 to 12 months.

The authors discuss their experience in using urecholine for the treatment of postvagotomy complications and emphasize the little known fact that absorption from the small intestine must occur if

oral administration is to be effective Their routine in using the drug is outlined

EDWARD F LEWISON, M D

**New Observations on the Oral Opaque Enema of the Small Intestine** (Nuove osservazioni sul clisma opaco transbuccale del tenue) ANTONIO LURÀ. *Arch ital mal app diger*, 1948, 14 386

The term "oral opaque enema of the small intestine" is applied by the author to the introduction of an opaque medium through a duodenal tube for the purpose of visualization of the small intestine

The method allows visualization of the entire small intestine and sometimes also a portion of the large intestine The advance of the opaque column can be studied

The method is valuable for the detection of a neoplasm of the small intestine It is superior to oral administration of an opaque medium because the customary method may yield unsatisfactory results in the presence of a pylorospasm or a partial pyloric obstruction Also, in the presence of vomiting, direct introduction of a barium suspension into the duodenum is obviously preferable to ingestion of the opaque medium A vicious circle following gastroenterostomy can be visualized

JOSEPH K NARAT, M D

**A Contribution to the Study of the Arterial Circulation at the Angle of the Duodenum, Jejunum, and the First Intestinal Loop** (Contributo allo studio della circolazione arteriosa dell'angolo duodenale e della prima ansa intestinale) G OMAGNA and S NEGRETTO *Chirurgia*, 1948, 3 280

The authors studied the arterial circulation in the region of the ligament of Treitz by injecting the superior mesenteric artery at its origin in 20 cadavers They describe a branch known as the artery of the duodenojejunal angle which arises from the inferior pancreaticoduodenal artery or from one of its branches Rarely, it arises from the first intestinal artery This artery which is small in caliber often constitutes the only blood supply to the first loop of the jejunum Even when there is an anastomosis with the first intestinal branch the superior portion has fewer collateral vessels than the inferior portion This causes a deficiency of secondary arches to the superior portion of the first jejunal loop

The authors wish to stress the value of this finding when gastric surgery is to be done, especially when a gastroenterostomy for marginal ulcer is broken down, and end to end anastomosis of the first part of the jejunum is necessary As one proceeds distally the blood supply becomes better and better For this reason they recommend that in performing an ordinary gastroenterostomy the jejunal loop should be at least from 7 to 10 cm in length

The authors also describe the terminal branches of the vasa recta and the marginal arch of Drummond They emphasize that the intestine should be opened along its free margin or antemesenteric border in order to conserve the blood supply equally on both

sides when a gastrojejunal anastomosis is accomplished This also makes for better hemostasis When it is necessary to divide the intestine this should be done at right angles to the long axis of the bowel because the terminal branches follow a perpendicular course and do not anastomose very freely The section may be oblique, with the mesenteric side longer than the antemesenteric side, but never shorter

LUCIAN J FRONZUTI, M D

**Intussusception in Childhood** ROBERT E GROSS and PAUL F WARE *N England J M*, 1948, 239 645

This report covers the diagnosis, treatment, and results of therapy in 610 cases of intussusception, including 372 cases reported by Ladd and Gross in 1934

Emphasis is placed upon early diagnosis The authors' statistics show an increase in earlier diagnoses and a lowered mortality for the late cases in the period from 1934 to 1947 as compared to the earlier series

The etiology remains obscure, mechanical factors (diverticuli, polyps) having been found in only 5.4 per cent of the entire series

Diagnosis is relatively simple in 9 of 10 cases and can be made on the basis of the sudden onset of paroxysmal pain, vomiting, gross or occult blood in the stool (10 or 12 hours after onset of the pain), and a palpable abdominal mass Rectal examination with bimanual palpation of the abdomen will increase the number of cases in which an intra-abdominal mass can be felt When doubt remains a barium enema will confirm the diagnosis in most instances since in from 90 to 95 per cent the colon is involved as the receiving segment of the intestinal tract

In general, the authors do not feel that reduction by hydrostatic pressure should be attempted because of the delay caused by the procedure, and the possibility of missing a specific mechanical cause or leaving a small bowel or ileoileocolic intussusception incompletely reduced

Rapid preparation of the child for surgery is accomplished with glucose, plasma, or blood, as indicated, and a right rectus muscle incision is used The intussusception is reduced by taxis rather than by traction and the viability of the intestine is determined by improvement of color or the occurrence of peristalsis in the involved segment

If the intussusception is irreducible, or the viability of the bowel in doubt, resection must be done In addition, when dealing with a very ill patient, resection should be done without any attempt at reduction since the authors believe reduction has a deleterious effect on the patient which may be fatal under these circumstances

The authors favor the aseptic, Mikulicz resection because of the low mortality (23 per cent) in their series as compared with the mortality when primary anastomoses (83 per cent) or open enterostomies (77 per cent) were done

Postoperatively, gastric suction and fluid therapy are used and fluids are given as tolerated after 24 hours. If resection has been done, the patient must be very carefully followed up for a longer time and parenteral fluids used to control plasma levels of chloride, protein, and carbon dioxide combining power. From 1946 to 1947 the over-all mortality was 2.7 per cent. With the Mikulicz resection they have had only 1 death in 11 resections in the last 9 years.

JOHN H. KAY, M.D.

**Anastomosis of the Ileum to the Lower Part of the Rectum and Anus. A Report on Experiences with Ileorectostomy and Ileoproctostomy, with Special Reference to Polyposis.** R. RUSSELL. *BEST Arch Surg*, 1948, 57: 276.

This article is a report of the author's experiences with anastomosis of the terminal ileum to the lower 4 inches of the rectum and directly to the anus. In this series the operation was done in 5 cases of polyposis with associated malignant degeneration of the rectum and in an additional 4 cases of advanced carcinoma of the rectum without polyposis.

The chief indications for anastomosing the terminal aspect of the ileum to the lower part of the rectum or anus are polyposis of the colon and the rectum when carcinoma has developed in the rectum, and the patient's desire to avoid an ileostomy. At the present time the author does not believe the ileorectostomy or ileoproctostomy should be attempted in routine cases of rectal carcinoma in order to preserve the sphincter mechanism or when it is impossible to bring the sigmoid and rectum into apposition. From the complications which appeared in these cases it would appear that a colostomy should be chosen in preference to attempting to preserve the sphincter mechanism by side-tracking the colon and hooking the terminal ileum to the lower part of the rectum or anus until further refinements of techniques have been developed.

It appears that the best operation in the present series is a telescoping procedure whereby a rectal tube is forced into the ileum and the tube is drawn out through the anus. Interrupted sutures complete the anastomosis. This can be accomplished entirely from within the abdomen or by a combined method of abdominal dissection and posterior anastomosis. Because of the incidence of rather excessive posterior drainage or development of fistula, establishment of posterior drainage of the presacral space is indicated.

Considerable effort must be directed toward decreasing the frequency of bowel movements during the postoperative period. This includes the energetic use of paregoric and milk of bismuth and tannic acid products. A low residue constipating diet is of assistance. After several weeks bowel movement frequency usually stabilizes itself at about 3 to 6 stools during the 24 hours unless a complicating stubborn posterior fistula or stricture develops. This complication results in almost constant posterior drainage.

Hypoproteinemia is rather pronounced during the early weeks postoperatively, but a normal level usu-

ally establishes itself after some 3 to 4 weeks, provided efforts toward a high protein intake are made. When the distal part of the ileum is anastomosed to the terminal part of the rectum or anus it becomes dilated, the wall hypertrophies, and the absorptive function and storage capacity apparently increase.

HAROLD LAUFMAN, M.D.

**Anemia Following Resection of the Intestine.** J. D. MARTIN, JR., ROY L. ROBERTSON, and EDWARD W. DENNIS. *Surgery*, 1948, 24: 819.

Anemia following intestinal resection may be of three types. A normochromic normocytic anemia may occur immediately after operation and is due to blood loss. A secondary hypochromic anemia may occur as a result of nutritional disturbances. A macrocytic hyperchromic anemia may occur as a result of the deficient production or absorption of the erythrocyte maturing factor.

Two cases in which anemia developed following extensive resection of the intestine are discussed. The condition of both patients improved dramatically on folic acid therapy. From a review of the literature it appeared that in both of these patients the anemia was due to faulty or absent absorption or production of substances that ordinarily combat macrocytosis and hyperchromia, namely, the anti-pernicious anemia factor and vitamin B.

In an attempt to produce a hyperchromic macrocytic anemia in adult dogs, massive resections of the small intestine were performed. Of 12 animals used, only 4 survived a sufficient length of time for study. In these a characteristic sequence of events was observed. At first hemoconcentration occurred because of dehydration from diarrhea and low fluid intake. After adequate fluid intake was resumed approximately normal counts were obtained. However, from 3 to 4 weeks after operation the red cell count and hemoglobin began to drop progressively to low levels. Reticulocytes were extremely rare or absent. Changes in volume and color index were not constant, and no definite trend toward macrocytosis could be established. No response was noted to folic acid therapy, in contrast to the response seen in human beings, and this suggests that the more severe anemia produced in the animal is not entirely due to the same causes as that seen in the clinical cases.

EDWARD W. GIBBS, M.D.

**Evaluation of Conservative Resection with End-to-End Anastomosis for Carcinoma of the Rectum and Lower Sigmoid Colon.** JESSIE GRAY. *Arch Surg*, 1948, 57: 361.

The author's opening paragraph states succinctly the purpose of her report: "This paper is not a crusade for resection of the rectum with restoration of continuity. It is an honest endeavor to assess the place of conservative resection, if any, in the operative therapy of rectal carcinoma. Certain facts are presented, and certain conclusions are drawn. Facts cannot be questioned, but conclusions should be critically assessed."

Seventy-four cases of conservative resection with end-to-end anastomosis for carcinoma of the rectum and rectosigmoid region are reviewed. The operative mortality among these patients was 4 per cent. The expected relationship of survival to stage of the disease was confirmed. Eighty per cent of patients in the group with stage I carcinoma were alive and well, 52 to 59 per cent of those in the groups with stages II and III carcinomas have survived, and only 25 per cent of patients in the group with stage IV carcinomas were alive and well at the time of writing.

The expected relationship of survival to gland involvement was confirmed. Fifty-seven per cent of patients without secondary involvement in glands were alive and well, while only 39 per cent of those with gland involvement have survived.

Results of conservative resection are found to be related to the anatomic level of the tumor in the bowel. Only 17 per cent of the patients whose growths arose below the bottom of the pouch of Douglas have survived. The percentage survival of patients with carcinomas at other levels is found to depend on the stage of the disease and on gland involvement of the tumor. The highest percentage of good results is obtained in growths of upper rectal level. This is attributed to the relative avascularity of this portion of the bowel with resultant slower growth and spread of carcinomas arising at this level.

Unless a carcinoma is definitely polypoid in type and freely movable, resection with preservation of the anal canal should not be undertaken when the growth is readily within reach of the examining finger per rectum.

The development of local recurrence of disease is found to have no special relationship to the stage of disease or gland involvement, but a distinct relationship to anatomic level of the tumor in the bowel. Forty-three per cent of the local recurrences have occurred among the patients with carcinomas below the peritoneum, which comprise only 16 per cent of the entire series.

If conservative resection had been reserved for patients whose carcinomas were above the peritoneum, only 3 per cent would have had recurrences which might conceivably have been avoided by total extirpation of the rectum.

Eighty per cent of patients operated on within the 5 years prior to writing were alive and well as compared with only 42 per cent of those with resection done more than 5 years previously. Evidence is brought forth to support the belief that this is due, in a large part, to improved management in recent years. A higher percentage of 5 year cures is to be expected in the future, particularly if conservative resection is reserved for tumors above the peritoneum.

All of the deaths in the entire series were analyzed as to cause, survival time, and debatability in reference to the type of operation performed. Among 62 patients with growths above the peritoneum, conservative resection resulted in only 2 deaths which,

because of the level stage and gland involvement of the carcinomas, might conceivably have been prevented by abdominoperineal resection.

Analyses of results in this series indicate that since the results above the bottom of the pouch of Douglas are only 3 per cent less favorable than those which might be obtained by total extirpation of the rectum, the obviation of a permanent colostomy warrants this 3 per cent increase of risk of failure to cure the patient when the carcinoma occurs above the peritoneum.

HAROLD LAUFMAN, M D

### The Surgery of Complications of Ulcerative Colitis

L. KRAEER FERGUSON and LLOYD W. STEVENS  
*Gastroenterology*, 1948, 11: 640

Delay in surgical intervention in ulcerative colitis is frequently justified on the basis of a forbidding mortality, and the belief that ileostomy dooms the individual to a life of restricted activity. These are misconceptions. The surgical mortality of ileostomy is currently less than 5 per cent, and the mortality for colectomy is even less. The handicap of an ileostomy has also been eliminated to a great extent. With the Koenig-Rutzen type of ileostomy bag, the average patient is able to assume fairly normal economic and social activity. Procrastination may cause death from ulcerative colitis.

Perforation, uncontrolled hemorrhage, and obstruction occur after diversion of the fecal stream as well as in the actively functioning colon. Ileostomy offers no insurance against their appearance. It has been said that these patients are too sick to be operated on. In reality, they are too sick not to be operated on. Emergency colectomy is feasible in the treatment of certain cases of perforation and uncontrolled hemorrhage.

Colectomy is indicated also in the presence of long standing irreversible mucosal changes, polyposis, granulomatous masses, and obstructive lesions. In the presence of these lesions, it should not be delayed for long periods of time.

Any colon which has been defunctionalized as a result of ileostomy should be observed periodically. If no indication for colectomy is found, barium enemas and sigmoidoscopic studies should be made from time to time, to discover early evidence of complications. Only in this way can the threat of rapidly metastasizing tumor be removed.

SAMUEL KAHN, M D

### Rectal Stricture of Lymphogranuloma Venereum

LESTER BREIDENBACH and LOUIS R. SLATTERY  
*Ann Surg*, 1948, 128: 1079

Reports of the experiences of many other surgeons are discussed in the present article, and 18 new cases of rectal stricture of lymphogranuloma venereum are presented in outline form. The ages of the patients varied from 20 to 40 years, with colored females predominating. The typical patient is a poorly nourished, exhausted, colored female. The abdomen shows varying degrees of distention, crampy pains and intractable diarrhea are usually

present, secondary anemia is often associated with slight leucocytosis, plasma proteins are low and the albumin-globulin ratio may be reversed, the Frei test is always positive

The first step in the treatment of patients is to restore them to their normal physiologic condition. To accomplish this, a completely defunctioning colostomy is performed, usually in from 5 to 7 days after admission. The second step is removal of the local focus, which is performed 1 to 6 months later. The operative procedure is described. An inverted "Y" incision is made over the end of the sacrum and around the anus, the lower portion is turned down. The local focus is completely excised, the proximal sigmoid or colon is brought down to the distal segment, and an anastomosis is performed. In the authors' cases, the result of this procedure seemed satisfactory. The third stage of the operation is closure of the colostomy, which is performed, usually, in 4 to 6 weeks following the resection, when the anastomosis and posterior wall are well healed.

All patients who submitted to the completed operation have been restored to normal health. There were no fatalities among the 18 patients subjected to resection. Sphincter control has been attained in all cases.

RICHARD J. BENNETT, JR., M.D.

#### Streptomycin and Surgery in Anorectal Tuberculosis E. RANSOM KOONTZ *Surg Clin N America*, 1948, 28: 1643

A series of 27 cases of anorectal tuberculosis is reported. The patients were treated with streptomycin with and without definitive surgery. Streptomycin therapy supplemental to surgical incision or excision was carried out in 19 cases, and healing occurred in 100 per cent of the cases. In these cases streptomycin was used as an adjunct to recognized proctologic surgical procedures, and meticulous post-operative treatment was not neglected. There were 8 patients who received streptomycin alone. Of this group, healing was obtained in 4 patients while some improvement occurred in the others.

In selected cases in which surgery is contraindicated or deemed inadvisable, streptomycin therapy alone may be utilized with some promise of success but the results will not be as gratifying as when surgery and streptomycin are combined. Streptomycin therapy makes possible in certain cases the performance of a less extensive surgical procedure than formerly would have been justified. It also enables the surgeon to institute surgical treatment of anorectal tuberculosis at an earlier stage in the hospitalization and treatment of the patient with pulmonary tuberculosis and serves as a protection against spread and exacerbation of the pulmonary disease during surgical treatment.

The author believes that streptomycin therapy supplemental to surgery definitely shortens the post-operative period required for healing and prevents recurrence. There was no recurrence in his patients which he treated in this manner.

JOHN L. LINDQUIST, M.D.

#### Carcinoma of the Anal Canal J. L. ROUX-BERGER and A. ENNUYER *Am J Roentg*, 1948, 60: 807

The authors present an argument in favor of radiotherapy for carcinoma of the anal canal. All lesions in this series were of epithelial origin and therefore considerably more radiosensitive than adenocarcinoma of the rectum. There were 18 five year cures in a series of 51 cases, or a 35 per cent 5 year curability rate.

The authors consider radiation to be the only treatment which gives a chance of avoiding permanent colostomy. However, a comparison of radiotherapeutic and surgical results is impossible for want of a sufficient number of 5 year statistics. The number of failures following radiotherapy is still large, but the authors believe that if the treatment were carried out earlier, when the lesions were still small, the number of cures would be greatly increased. In 11 patients in whom the primary lesion did not extend beyond the limits of the anal canal, 7 were cured.

The authors have abandoned radium implantation in favor of contact roentgen therapy for small lesions and supervoltage roentgen therapy for larger lesions extending outside the anal canal. An evaluation of the correctness of this change cannot be made at this time.

It is the authors' contention that the hope of preserving a normal anus, the results which they have obtained, and the technical improvements which are at present in operation, justify the use of radiation as the primary treatment for carcinoma of the anus. If this method of treatment fails, surgical removal can be carried out, provided the previous radiotherapy has not made operation impossible.

HAROLD LAUFMAN, M.D.

#### LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

##### The Nervous Hypergenesis of Cholecystitis (L'hy- pergénése nerveuse des cholécystites) L. CORNILL, H. GASTAUT, J. CHARPIN, and H. PAYAN *Presse méd*, 1948, No. 57: 669

These authors call attention to the frequent occurrence of areas of hyperplasia of the nervous tissue in the adventitia of the gall bladder wall found on microscopic section of surgically removed gall bladders. These areas are comparable in histologic structure to the so-called amputation neuromas. They seem in no way related to the neurofibromatosis of Recklinghausen and would appear to be in some way a result of preceding severe inflammatory changes in the gall bladder wall.

EDWARD W. GIBBS, M.D.

##### Postcholecystectomy Symptoms Due to Cystic Duct Remnant CHARLES BRUCE MORTON, II *Surgery*, 1948, 24: 779

Symptoms referable to the biliary tract following cholecystectomy may have a varied etiology. Stones in the ducts, strictures or angulations of the duct, cholangitis, hepatitis, and pancreatitis are some of the etiologic agents.



The author wishes to emphasize that the remnant of the cystic duct left at the time of cholecystectomy may be the cause for persisting or recurring symptoms. He reports 7 personal cases in which operation revealed a cystic duct remnant to be apparently the sole cause of postcholecystectomy symptoms. He therefore concludes that meticulous care should be exercised at the time of cholecystectomy to remove the entire cystic duct. F J LESEMAN, JR., M D

**Late Results of Cholecystectomy The Factors Involved in Failures and in Recurrences Personal Experience of the Clinic at Naples** (I risultati lontani della colecistectomia fattori di insuccesso e di recidiva. La esperienza della nostra clinica) LUIGI IMPERATI *Gior ital chir*, 1948, 4, 547

This is the second communication concerned with the analysis of the causes of failure in surgery of the gall bladder. The first appeared in the previous issue (August number) of this journal. The material reported in this second communication consists of 118 patients who underwent the original operation and 36 who had previously been operated upon in the author's clinic or elsewhere. The follow-up technique consisted of personal visits of the patient or of answers to a questionnaire. This study could be carried out only in 36 instances because of the exigencies of war, however, the patients reporting presented various types of lesions and the follow-up was conducted at varying periods of time following the clinic treatment, and therefore the findings are regarded as closely illustrative.

In the group of original operations a careful distinction is made between the lithiasic cases and the a-lithiasic gall bladder. In the former the results were regarded as satisfactory in 88.5 per cent of the cases, as mediocre in 8.5 per cent, and as negative in 3 per cent. In the a-lithiasic group the results were regarded as satisfactory in 21.4 per cent, as mediocre in 48.8 per cent and as negative in 29.8 per cent. Of course, the percentage of failures in this material is rather high, but it is ascribed to the greater willingness of those who still suffer, or again suffer, pain and disability to reply to the rather long and involved questionnaire.

As regards the results obtained in the 36 patients who were relaparotomized for continued or recurrent suffering following the original cholecystectomy, such information as is available indicates that the results were satisfactory in 6 cases of repair of a laparocoele, in 3 cases of intestinal occlusive symptoms in which excision of the adhesions was done, in 2 cases of ulcus duodenale following excision and gastroenterostomy, and in 2 cases of gynecological conditions (1 case of cystic ovary and 1 of fibroids of the uterus). The results were satisfactory in about 50 per cent of the 3 cases of chronic adhesions and 10 cases of the acute and chronic appendicitis syndrome.

As regards the treatment, the experiences here encountered lead to the conclusion that the treatment of calculous cholecystitis is strictly surgical,

and the earlier surgery is instituted, the better. Although the author does not maintain that the treatment for the noncalculous, or a-lithiasic, syndromes is never surgical, yet in the clinic at Naples operation in these cases is becoming ever more rare. He believes that every resource of physical and laboratory examinations, and of all conservative therapy should be exhausted before these patients, as well as patients with postcholecystectomy syndromes, are sent to the operating room.

Special emphasis is placed by the author on the diagnostic advantages to be gained by cholangiography carried out during the laparotomy itself and the therapeutic help to be expected in the nonoperative cases from duodenal drainage.

JOHN W BRENNAN, M D

**The Silent Gallstone a 10 to 20 Year Follow-Up Study of 112 Cases** MANDRED W COMFORT, HOWARD K. GRAY, and JAMES M WILSON *Ann Surg*, 1948, 128, 931

The problem of the silent gallstone has become an increasingly frequent and an increasingly important one. Several pertinent questions are being asked concerning the frequency of occurrence and the advice which should be given the patient who has silent gallstones. Questions also arise concerning whether the patient should be told to undergo cholecystectomy or to await the development of dyspepsia or colic before submitting to surgical treatment, and whether he should be urged to undergo cholecystectomy after the first attack of colic or after several attacks have occurred.

The frequency with which the silent gallstone occurs in the general population is not known.

In the hope of supplying some of the data necessary for decision regarding treatment of the silent gallstone, a long-term follow-up study of all cases in which gallstones were found incidentally during the course of some other abdominal operation at the Mayo Clinic was carried out. The records of 998 such cases occurring from 1925 through 1934 were reviewed and 112 cases were considered suitable for study. The average age of the 112 patients was 48.2 years when the gallstones were discovered.

Although the data compiled do not give conclusive information about the risk of nonoperative and operative treatment of the silent gallstone, they are noteworthy on this basis: the patient with silent gallstone may be told that he has about an even chance that symptoms will develop, that he has about one chance in five that painful seizures will develop and a small chance that jaundice will develop within 10 to 20 years. In addition, he should be told that the risk of surgical intervention at the best is about 0.5 per cent when cholecystectomy is performed before complications develop, that the risk will increase to about 3 per cent if he defers surgical intervention until complications develop, or old age and physical debilities appear, but that the increase in risk is counterbalanced by the fact that if he defers surgical intervention he may never re-



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quire operation. It is not possible on the basis of information now available to tell the patient whether the risk is greater or smaller if operation is performed while the gallstones are silent than if it is postponed until symptoms develop. Certainly, the mortality rate will be low regardless of the choice made.

Cholecystectomy may be advised but need not be urged if the patient prefers to accept the chance of experiencing painful seizures or the increased risk of surgical treatment in the event the complication of calculous disease of the biliary tract appears.

**Reflux into Wirsung's Canal in Course of Cholangiography** *Dystonia of Wirsung's Canal* (Le reflux dans le canal de Wirsung au cours des cholangiographies *Dystonie du canal de Wirsung*) P. MALLET-GUY, E. GUILLET, and L. DURAND *Lyon chir*, 1948, 43 653

Cholangiographic studies were done by the authors on 800 patients. Of the 2,826 films, 1,329 were taken preoperatively and 947 after the operation. In 173 cases, or 21.6 per cent of the entire material, a reflux of the opaque material into the main pancreatic duct was noticed. In 65 cases the opaque medium was introduced into the gall bladder, in 100 cases directly into the common duct, and in 8 cases into both.

An analysis of the technical factors and the clinical observations showed that no reflux occurred in patients with intact biliary and pancreatic systems. A reflux of the opaque medium into Wirsung's duct was recorded in 12 patients with mechanical obstruction of Vater's papilla, in 53 with a hypertonic sphincter of Oddi, in 36 with a hypotonic sphincter of Oddi, in 40 with chronic pancreatitis without disturbance of sphincter function, in 2 with acute pancreatitis, and in 30 with various pathologic conditions of the biliary system, among them 19 with attacks of jaundice.

The authors mention several sources of diagnostic errors. A reflux may be simulated by images of osseous structures or of the duodenum, or by duplication of the shadow of the common duct caused by respiratory movements. Conversely, difficulties in visualizing a reflux may be caused by a filiform duct of Wirsung or by the location of this duct behind the common duct.

The type of dystonia of Oddi's sphincter can be determined by manometric measurements.

The phenomenon of the reflux disappears after elimination of the dystonia, namely, splanchicectomy for hypotonus, and infiltration of the vagus nerve, sphincterotomy, or medical treatment (administration of beta-phenylisopropylamine sulphate or inhalation of amyl nitrite) for hypertonus.

The authors introduce a concept of dystonia of the main pancreatic duct which in turn may produce pancreatic lesions. They advance the hypothesis of a painful functional syndrome of the pancreas, comparable with a similar condition of the biliary tract. Such a syndrome may be responsible for the symptomatology of the dystonia of the sphincter of Oddi. The existence of a reflux into Wirsung's duct in the presence of acute or chronic pancreatitis without

demonstrable lesions or functional disturbances of the sphincter of Oddi constitutes a physiopathologic problem that awaits elucidation.

JOSEPH K. NARAT, M.D.

**Traumatic Rupture of the Choledochus Associated with an Acute Hemorrhagic Pancreatitis and a Bile Peritonitis** N. FREDERICK HICKEN and VERNON L. STEVENSON *Ann Surg*, 1948, 128 1178

The authors present the case history of a 7 year old white boy who was injured by compression of the upper abdomen. The boy was treated immediately and dismissed. Four days later he was readmitted to the hospital because of nausea, vomiting, dehydration, and increased jaundice. His temperature was 104.8 degrees F. Emergency treatment was given, and after 4 days of intensive preoperative preparation, the abdomen was opened. At this time 2,300 c.c. of normal appearing bile were aspirated from the abdominal cavity, and 2,100 c.c. of bile were aspirated from the lesser omental cavity. In order to localize the tear in the common bile duct, 50 c.c. of a 70 per cent diodrast were injected into the collapsed gall bladder, and a cholangiogram was taken. The bile system was visualized, and it was considered that the edematous pancreas had occluded the opening into the duodenum, since none of the medium passed through the ampulla of Vater. A tear was visualized on the posteromedial wall of the common bile duct. A traumatic pancreatitis was the complicating factor. A cholecystostomy was used to decompress the common duct while the obstructive pancreatitis was subsiding.

Supportive therapy was administered. Subsequent cholangiograms showed that the tear in the common duct had healed and, finally, that once again the bile was flowing normally into the duodenum. The drain was then removed. A period of 10 months has elapsed since the injury, and the results have been satisfactory. A total of 8,900 c.c. of bile was aspirated from the abdominal cavity.

RICHARD J. BENNETT, JR., M.D.

**Choledochus Cyst Associated with Congenital Atresia of the Bile Ducts** CHARLES B. RIPSTEIN and G. GAVIN MILLER *Ann Surg*, 1948, 128 1173

The case of a female infant, age 4 months, is presented. The child had been jaundiced from the time of birth. At operation, a cyst of the common duct was found. This was associated with a congenital atresia of the bile ducts. The condition in this patient may have been due to abnormality in the development of the bile ducts.

RICHARD J. BENNETT, JR., M.D.

**Postoperative Biliary Dyskinesia Due to Neuroma of the Cystic Duct** (Disquiescia biliar post operatoria por neuroma del cistico) JUAN LEVY BOLA and DERES *Bol. Soc. San. Pol. nac.*, 1948, 4 470

For several years a woman of 26 years had suffered from painful crises in the right hypochondrium and flank accompanied by frequent vomiting and a bitter

taste. She had been subjected to appendectomy and salpingectomy on the right side, but her symptoms persisted and she was finally seen by the author, who made the diagnosis of biliary dyskinesia due to atony of the gall bladder and recommended cholecystectomy.

At operation the gall bladder was removed and a separate ligation of the artery and cystic duct was performed, this was followed by choledochotomy and the introduction of a T-tube. The choledochus was of normal size and was surrounded by an abundant nerve plexus. Recovery was uneventful. The woman remained well for 14 months and then began to have slow digestion accompanied by nausea and occasional vomiting and 6 months later her symptoms were as bad as before the operation. The biliary dyssynergia was evidently of neurogenic origin. At operation the choledochus was exposed and a small tumor, about 1 cm in diameter, was found to be adhering to it at the site of implantation of the cystic duct, it was freed with a scissors and removed. Recovery was prompt and the patient has remained well. The specimen presented a small cavity corresponding to the obliterated canal, and its wall was thickened by proliferation of fibrosclerous tissue, section of the wall revealed massive enlargement of the neuromatous nerve endings.

For a number of years the author has performed direct cholecystectomy from the fundus to the cystic duct after placing a temporary hemostatic ligature on the pedicle. Now he incises the peritoneal fold which covers the cystic duct at its junction with the choledochus, dissects as far as possible the nerve filaments that pass from the choledochus to the cystic duct and resects them, he also dissects, if possible, the cystic artery, ligates and cuts it, and then proceeds as usual. If the inflammatory edema or the obesity of the patient does not allow correct performance of this step, he frees the gall bladder from the fundus to the cystic duct after placing the temporary hemostatic ligature, and then cleans the cystic duct of all tissue that surrounds it, and ligates the duct. When the temporary ligature is removed, it is easy to catch the cystic artery and to ligate it if it has not been previously tied off while the gall bladder was freed.

RICHARD KEMEL, M D

**Recurrent Acute Pancreatitis. Observations on the Etiology and Surgical Treatment.** HENRY DOUBILET and JOHN H. MULHOLLAND. *Ann Surg*, 1948, 128: 609.

The case histories of 21 patients exhibiting attacks of acute recurrent pancreatitis are recorded and analyzed with respect to the value of the surgical division of the sphincter of Oddi. The rationale of such treatment is twofold: it is dependent (1) upon an anatomic variation in the entrance of the main pancreatic duct into the duodenum which creates a common biliary-pancreatic passageway that permits bile to flow into the pancreas, and (2) upon the contention of Archibald that spasm of the sphincter of Oddi produces a bile diverting mechanism.

Studies on human patients with proved acute recurrent pancreatitis substantiate the contention that when a common passageway exists, spasm of the sphincter will produce the disease and sectioning of the sphincter will relieve it. It is well known that morphine, by producing spasm of the duodenal wall, increases the resistance of the sphincter to the flow of bile. Also the application of N/10 hydrochloric acid to the papilla of Vater will produce spasm of the sphincter of Oddi. After section of the sphincter muscle, the hydrochloric acid effect on the papilla is abolished. The sphincter can no longer become spastic and biliary reflux under pressure is prevented. However, the morphine effect on the duodenal wall persists. Thus, reflux of the duodenal contents into the biliary tract is prevented even though the sphincter has been sectioned.

The actual sectioning of the sphincter is a somewhat exacting procedure. The papilla is difficult to find and when the muscle is in spasm the orifice may be extremely small. The best approach is through the common bile duct. The duodenum may be opened over an instrument or over a probe. The muscle is then cut over the probe for about 1 cm in the anterior free or intraluminal portion of the duct. The retraction of the sphincter muscle fibers prevents healing or regeneration of the muscle.

ORVILLE F. GRIMES, M D

**The Operative Diagnosis of Duodenal Pancreatic Indurations.** (Diagnostico operatorio de las induraciones del duodeno-pancreas). LORENZO H. MARTARENA. *Bol Inst clin quir*, B. Air, 1948, 24: 91.

It is believed that because of the advancement in diagnosis and treatment of lesions of the head of the pancreas, a new anatomic entity, the duodeno-pancreas, should be taken into account. This is true particularly as this section has its own neurovascular individuality and its own pathologic anatomy.

Because obstructions from tumors are similar in their effect to obstructions from inflammatory processes, understanding of the duodenopancreas segment will prevent needless surgery, such as pancreatotomy, for a simple inflammatory condition. Diagnosis of this type of obstruction is facilitated by the routine palpation of the head of the pancreas. The surgeon will become familiar with the normal consistency of the structure, and as a result a silent lesion will not be overlooked.

When necessary, surgical exploration should be resorted to unhesitatingly. Exploration of the duodenopancreatic area for obstruction is easily accomplished by sectioning of the duodenal pancreatic ligament, diagnostic puncture of the obstruction, biopsy of the pancreas, biopsy of the gangliopancreatic area, biopsy of the hepatic metastasis, or exploratory duodenectomy.

Pancreatic obstruction may be classified into definite pancreatic or duodenopancreatic obstruction, or obstruction in the region of the ampulla of Vater.

It is stated that in patients with symptoms of biliary lithiasis without jaundice and in those pre-

senting cholelithiasis with a nodular obstruction in the head of the pancreas, the diagnosis of chronic pancreatitis secondary to lithiasis is justified

On the other hand, in patients with the same symptoms plus jaundice who present stones in the gall bladder or in the choledochal ducts with obstruction in the head of the pancreas, and who on choledochectomy reveal that the pancreatic obstruction is not of calculous origin and the obstruction is not from the choledochus, the condition is without a doubt secondary pancreatitis

However, in patients with painless jaundice, a tumor in the biliary or pancreatic ducts, despite normal appearance of these ducts (whether they be dilated or not), and an obstruction in the duodeno-pancreas area, the diagnosis of cancer is correct

STEPHEN A. ZIEMAN, M D

**Pancreatolithiasis** (La litiasi pancreatica) MARCELLO INNOCENTI *Ann ital chir*, 1948, 25 413

Among 20,000 surgical patients operated upon in Florence, stones in the pancreas were found only in 1, a man of 45 years. In addition to this case the author reports another in which the diagnosis was established clinically and roentgenologically. The patient, a 52 year old woman, was not operated on

The first patient was admitted with complaints of pain in the epigastrium and in the left upper quadrant of the abdomen of a few years' duration. The x-ray findings suggested the presence of a duodenal ulcer, in addition to it, a shadow with irregular outlines was visualized to the right and to the left of the vertebral column at the height of the stomach. The operation failed to demonstrate any lesion of the stomach or duodenum but a circumscribed induration was palpated in the body of the pancreas. A stone 1.75 cm in diameter was extracted. A post-operative roentgenogram disclosed a few more shadows in the region of the pancreas. The patient developed cachexia and expired 4 months after the operation. The stone contained carbonates and calcium but no oxalates or phosphorus, and gave a positive xanthoprotein reaction. Although stones in the pancreas may accompany arteriosclerosis, neoplasms, or syphilis, inflammatory processes propagated by contiguity or reaching the pancreas through the blood or lymph stream play the most important role in the production of stones.

The author collected from the literature 74 cases of stones in the pancreas. In the majority of cases the stones are multiple and consist of calcium phosphate (80%), calcium carbonate (17%), and organic matter (3%). A latent and a painful form, with or without intermittent jaundice, may be differentiated. A transient or persistent glycosuria is found in many instances. The examination of feces usually reveals a disturbance of the function of the pancreas. If a generalized lithiasis or so-called petrification of the pancreas is found in roentgenograms, a conservative treatment is the method of choice. Otherwise the stones should be removed surgically.

JOSEPH K. NARAT, M D

**Splenomegaly, Splenic Arteriovenous Anastomosis, and Banti's Disease** (Splenomegalia, anastomosi arteriovenose spleniche e malattia di Banti) PIETRO FRANCESCHINI *Sperimentale*, 1948, 99 1

In 1939 the author first described the existence of arteriovenous anastomosis in a spleen removed from a patient with Banti's disease. He thus established that the sinus apparatus is not the only communication between the arterial and venous system. The arteriovenous anastomosis allows for direct and rapid emptying of the arterial blood into the larger veins. This is the method which causes reduction of the size of the spleen when adrenalin is administered to the patient.

The author thus concludes that Banti's disease is caused by an irreversible disturbance in the functional cycle of the splenic sinuses, which results in a progressive enlargement of the spleen. This disorder is not relieved by ligation of the splenic artery and, hence, splenectomy remains the procedure of choice in the treatment of Banti's disease.

LUCIAN J. FRONDUTI, M D

**On Splenectomy, with Special Reference to Indications** H. ABRAHAMSEN and N. B. KRARUP *Acta med scand*, 1948, 131 Supp 213, p 9

This study of 45 splenectomized patients shows that the diagnoses considered to be indications for splenectomy are not always well defined pathologically but often cover more or less vague collective notions. In each case the primary diagnosis, the findings at operation, and the postoperative course of the disease have been studied in an attempt to clarify the diagnostic problems and indications for splenectomy. Uncertainty is especially conspicuous in the case of the diagnosis of Banti's disease.

There were 16 splenectomies based on the supposition that the patients presented Banti's disease. When a later examination took place only 4 of the group were alive, of these, 3 had been materially benefited, while the condition of 1 was unchanged. There were 4 deaths immediately after the operation, and 7 patients died from 3 months to 25 years after operation. A revision of the diagnoses on the basis of the postmortem findings and later examination leads to the conclusion that it would be most expedient not to use the diagnosis of Banti's disease in clinical work at all. In cases of splenomegaly with or without anemia the primary diagnostic task must be an attempt to reveal any specific disorder underlying the splenomegaly (leucosis, nonleukemic myeloid splenomegaly, lymphogranulomatosis, reticuloendotheliosis, Gaucher's disease, tumor, tuberculosis, or syphilis). If found, splenectomy will almost always be contraindicated. It will also be almost always contraindicated in the presence of liver cirrhosis. Splenectomy will be indicated for cryptogenic splenomegaly without liver involvement and for thrombosis of the splenic vein.

There were 12 patients splenectomized for hemolytic jaundice, in half of whom a hereditary factor was established. Splenectomy appeared to be the

treatment of choice in subacute and chronic cases, and was the treatment of necessity in acute, critical cases

A review of 6 cases of splenectomy for chronic essential thrombopenia showed that the effect of splenectomy was immediately good in all cases and of lasting benefit in all but 1 case

There were 4 patients operated on because of splenomegaly, the splenic enlargement affording the indication for operation, and 7 patients operated on because of ruptured spleen

JOHN L. LINDQUIST, M D

**Splenectomy in Brucella Infection** (La splenectomia nella infezione brucellare) GIUSEPPE GIUNCHI  
*Polisimico, sez med*, 1948, 55 125

In 1 case of brucellosis resistant to vaccinothérapie, penicillin and sulfonamides were administered, but a cure was obtained by splenectomy. The weight of the removed spleen was 960 gm. The organ contained multiple hemorrhagic infarcts. Hepatomegaly and bilirubinemia subsided after the operation. Periodic clinical, bacteriologic, and serologic examinations during the first postoperative year failed to disclose any evidence of brucella infection.

In the second case complications in the form of a grave anemia, left orchitis, and painful limitation of motions of the left hip were present. The failure of conservative treatment suggested a more radical procedure. In view of the grave condition of the patient, instead of splenectomy a ligation of the splenic artery was performed. A large amount of hemorrhagic fluid was encountered in the peritoneal cavity. Within the first 10 postoperative days 18 more liters of similar fluid were withdrawn by paracentesis, repeated 3 times. Three years after the operation the patient was in perfect health.

In selected cases such operative procedures may supplement or replace the treatment of brucellosis with streptomycin alone or in combination with sulfonamides.

JOSEPH K. NARAT, M D

### MISCELLANEOUS

**The Traumatic Condition of the Abdomen** ARTHUR R. METZ, RAYMOND HOUSEHOLDER, and GERRIT DANGREMOND *Am J Surg*, 1948, 76 368

Injuries to the intra-abdominal organs are not uncommon and usually are serious. Their successful management depends on early, accurate diagnosis followed by immediate intelligent treatment. An understanding of the anatomy of the abdominal area and the mechanism of injury, and a thorough routine of examination are essential in caring for the patient who has sustained trauma to the abdomen.

Distended organs are more liable to injury than empty ones, consequently, abdominal injuries are more likely to produce damage to the hollow viscera when sustained soon after the ingestion of food.

The most common causes of abdominal trauma are as follows: (1) direct violence, such as a blow to the abdomen by some blunt object, as a piece of wood or

a tool that the individual may be handling, (2) indirect violence as a fall from a height of a few feet or more, the impact of landing producing the injury, (3) nonpenetrating wounds, for example, squeezing injuries from pressure between moving objects, and (4) penetrating wounds such as from a stab or gunshot.

Success in managing cases of traumatic injuries to the abdomen may well depend on the primary examination of the patient and the recorded findings by the first attending physician. A thorough examination routine is helpful and should be combined with the taking of an accurate history concerning the injury.

An accurate history and description of the mechanism of the accident should be obtained to determine the amount of violence, distance of the fall, or any other facts that may be of value in determining the possible severity of the injury. The patient's reaction immediately following the accident should be ascertained—whether he noticed a sudden, sharp pain, whether he had to sit down or stop work for a short period of time, or whether loss of consciousness occurred immediately. Did the patient vomit and, if so, was blood present in the vomitus? Does the patient remember the details of the accident? This information may have an important bearing in helping to determine the extent of injury and in arriving at a diagnosis. In addition, it may be valuable for future reference as stories of accidents frequently change after time has elapsed.

When the patient is first seen, particular attention should be given to, and a record made of, the degree of shock, the volume and rate of the pulse, the blood pressure, temperature, and respiration. A blood count and urinalysis should be made. This gives the physician a basis for the status of the blood so that changes may be noted on frequent repeated counts. The presence or absence of blood in the urine is to be noted. It may be necessary to catheterize the patient to obtain a specimen.

The physical examination must be comprehensive. Roentgen films showing the entire abdomen, including the pelvis and lower chest, should be made.

The management and treatment of traumatic injuries of the several organs of the abdomen are presented in considerable detail.

Patients operated upon within the first 6 hours after a severe injury have better chances of recovery than those in whom surgery is delayed beyond the 6 hour period. In case of doubt it is safer to explore the abdomen than to delay surgical treatment too long as it may jeopardize the life of the patient.

JOHN E. KIRKPATRICK, M D

**Two Cases of Enterogenous Cysts** SVEN RÖKAEUS  
*Acta obst gyn scand*, 1948, 28 113

The author reports 2 cases of enterogenous cysts, one from the Kronprinsessan Lovisa's Hospital for Children in Stockholm. One of the patients, a 25 year old woman, had a rectal cyst with symptoms not definitely related to the cyst. The other patient was a 6 weeks old boy without symptoms. Both of the



# GYNECOLOGY

## UTERUS

**The Problem of the Presence of Sensitive Corpuscles of the Uterus** (Sulla questione della presenza dei corpuscoli sensitivi dell'utero) NICOLA DAMIANI *Quad clin ostet gin*, 1948, 3 356

Keiffer described the presence of sensitive corpuscles in the myometrium and mucosa of the uterus. He enumerated 19 types in the myometrium and 2 or 3 in the mucosa. He also described a neuromuscular type of corpuscles as the most common one found near the cervix and in the proximity of the blood vessels.

The author failed to find any such structures in his histological studies and states that such sensitive corpuscles are the walls of arteries which have been cut obliquely, and that, physiologically, uterine sensation is so poor that it contradicts the existence of so many sensitive corpuscles.

JOSEPH M. A. PAPE, M.D.

**Radiologic Diagnosis of Uterine Cancer** (Diagnóstico radiológico del cáncer uterino) GONZALO ELIZONDO MARTEL *Arch cubanos cancerol*, 1948, 7 127

In 1,665 intrauterine hystero-grams for cancer there were no accidents. The uterus was filled gradually by the spot roentgen technique and the luteal phase was chosen as the best time of the menstrual cycle for good diagnostic results.

The diagnosis is based upon uterine tonicity and contractility. In the premenopausal phase while follicular function is active a tumor is revealed by an increase in contractility similar to that seen when a foreign body is in the uterus. In large infiltrating tumors, contractility is not observed, but a globose relaxation of the entire organ may be seen. In the postmenopausal stage the uterus appears dormant under the filling and distends without resistance.

The presence of filling defects may be detected by direct semiologic studies. At first the deformity appears small, fixed, and irregular in outline. This disappears as the uterus balloons out. In carcinoma there is no erasure of these features.

Hystero-grams are considered of absolute value in the localization of a lesion but only of relative help in diagnosis. They are particularly useful in obtaining information concerning uterine depth, location for the biopsy, and differentiation between intrauterine and extrauterine tumors.

STEPHEN A. ZIEMAN, M.D.

## ADNEXAL AND PERIUTERINE CONDITIONS

**The Significance of Cystic Enlargement of the Ovary with Respect to Treatment** IRVING L. FRANK *Md Clin N America*, 1948, 32 1611

The author discusses cystic enlargement of the ovary and states that these cystic collections arise

either by the obstructive accumulation of the secretions of normal cells, or from the secretions of liquefaction necrosis of neoplastic cells. Most cystic enlargements of the ovary are due to perversions of the follicle apparatus and are physiologic variants. They are usually 5 cm or less in diameter and are classified as "non-neoplastic" or "physiologic" cysts of the ovary.

On gross examination it is seen that the ovarian enlargement is due to the presence of many cysts varying from buckshot to cherrystones in size, scattered through the parenchyma, and usually occurring bilaterally.

Microscopically, congestion, edema, and fibrosis of the stroma, and "cirrhosis" of the ovarian tunic is found.

The author states that the most common causes of cystic enlargement are (1) inflammation—usually acute bacterial inflammation, (2) mechanical factors, such as ovarian prolapse with passive congestion and edema, and (3) hormonal imbalance.

The differential diagnosis between non-neoplastic cysts and true cystomas is difficult, but in general non-neoplastic cysts are usually bilateral, many decrease in size with time, do not usually exceed 5 cm in diameter, and produce minor menstrual disorders, while neoplastic cysts are usually unilateral, enlarge constantly, and do not affect the menstrual cycle.

Two rather constant symptoms are produced by the non-neoplastic cysts: bilateral deep and boring lower abdominal pain with radiation to the thighs and back, and menstrual disorders.

Treatment is varied, but, in general, observation with repeated pelvic examinations is all that is required, correction of uterine displacements and improvement of the pelvic circulation with pessaries and postural exercises, and the control of pelvic infection may be of value in many cases. Hormone therapy utilizing large doses of stilbestrol, as advocated by Karnaky, or testosterone may be considered.

In general, surgery is not indicated in the treatment of the non-neoplastic cysts and should be considered only when the ovarian dysfunction is profound and the structural ovarian changes are definite.

J. ROBERT WILLSON, M.D.

**A Report of 2 Cases of Tumor of the Internal Theca of the Ovary** (Relation de deux cas de tumeurs de la thèque interne de l'ovaire) L. GRÉCOIRE *Bruzelles mtd*, 1948, 28 2227

Two patients had been subjected to total hysterectomy. The first, aged 57, had a uterine fibroma and a thecoma of the right ovary; the second, aged 61, had a uterus too large for her age, a fibroma of the left ovary, and a calcifying and degenerating (hyaline) thecoma of the right ovary. Both had more frequent bouts of hot flushes after the opera-



tion than before it, and the breasts of the first patient were decidedly enlarged for some time.

The 2 cases represent the 2 principal forms of thecoma: the cystic variety described by some authors being probably a sort of follicular or luteinic cyst. When the epithelioid zones are very important (first case), recalling the thecal tissue of the corpus luteum, the differential diagnosis from the insular and sarcomatoid form of tumor of the granulosa may offer some difficulty. The argyrophile reticulum exists only in tumors of the theca, in addition, the tumors of the granulosa present, here and there, zones of epithelial follicles with Call-Exner corpuscles. The fibrous form (second case) differs from ordinary fibroma by the presence of masses of epithelioid cells, by lipid overload of the cells, especially cholesterol, and by its hormonal action.

According to Greenhill's 1947 Year Book of Obstetrics and Gynecology, about 100 cases have been reported up till now. About 70 per cent occur after the menopause, mostly between the ages of 50 and 60. There has been no case before puberty and no coexistence with pregnancy. The youngest patient was 12 years of age, the oldest 92. The symptoms of hyperfolliculinemia are manifested by reactions of the receptor organs, especially the uterus, with more or less functional disturbances. Of 50 uteri of which the mucosa was studied, 38 were hyperplastic (32 after the menopause), 3 normal, 2 atrophic, 5 malignantly adenomatous, and 2 pregravidic (these should be classed as luteomas). Of 52 described uteri, 24 had a fibromyoma, 17 revealed diffuse hypertrophy of the myometrium and 5 adenomyosis, while 7 were normal and 4 subnormal. Mammary congestion has been noted in some cases, among them being 1 patient at the age of 92. Functional disturbances varied and were sometimes absent, hemorrhagic metropathy during sexual life, and cyclic or irregular bleeding after the menopause (73 per cent of the cases). There may be glandulocystic hyperplasia without hemorrhages as in the second case. Removal of the tumor has caused menopausal disturbances in patients who were far beyond the menopausal age. Only 3 of 82 cases have presented a malignant evolution. The metastases also have a hormonal action. Bilaterality of a solid tumor of the ovary suggests a malignant nature.

Treatment is essentially surgical and conservative in young women. In case of solid tumor, the other ovary should always be explored. The radioensitivity of thecomas seems to be low.

RICHARD KEMEL, M.D.

**Disgerminoma of the Ovary** (*Fl disgerminoma ovarii*) J. M. BIRNBAUM. *Per. esp. obst.*, 1948, 5: 200.

The cellular elements of disgerminoma of the ovary are found in the testes and ovaries. This tumor has many synonyms. It is usually assumed that the structure of the organ has been invaded. It is a solid homogeneous tumor, frequently bilateral in occurrence. As it is histologically malignant it grows rapidly as a rule and once it breaks through

its capsule it invades all of the adjacent pelvic structures.

Fortunately, this tumor is rare. It occurs most often in young persons and histologic examination is necessary to determine its nature.

Treatment is surgical followed by roentgenotherapy.  
STEPHEN A. ZIMAN, M.D.

**Primary Carcinoma of the Fallopian Tube** A Clinical and Pathologic Study with Personal Contributions (Il carcinoma primitivo della salpinge uterina. Contributo personale e studio clinico ed anatomopatologico) G. VALLI. *Ginecol. ital.*, Torino, 1948, 14: 383.

After reviewing about 500 articles, the author writes a comprehensive monograph embracing all the aspects of primary carcinoma of the fallopian tube. His opinions are based on a personal case and a detailed study of 51 acceptable cases derived from the literature.

It was found that this tumor occurs once in 10,000 gynecological patients, which is rare enough so that many gynecologists never see one. It is often confused with secondary carcinoma of the tube, which occurs 10 times more frequently than the primary type. Pain, vaginal discharge, and pelvic tumor are the most constant symptoms, but none of these is pathognomonic. The pain is usually colicky, sometimes violent, localized in the lower abdomen and occasionally radiating to one of the thighs. The discharge may be of any type and is in no way diagnostic, except that microscopic examination may reveal malignant cells, which, however, would not locate the lesion in the tube. The mass is rarely noticed by the patient, but is felt by the surgeon during pelvic examination. It may be tender and usually unilateral. Frequently it is disguised by a coexisting inflammatory process. At operation the carcinoma is usually overlooked because of associated fibroid or inflammatory masses. Pathologic examination generally reveals the tumor not to be of a high grade malignancy, but there is an exceptionally early infiltration of contiguous structures, possibly caused by expulsion of the cells from the narrow tube. The prognosis is grave, only an occasional patient survives 5 years.

The treatment of choice is panhysterectomy, preferably with direction of the pelvic lymphatics. Unfortunately this is rarely done because the diagnosis is not made until the routine microscopic sections are examined. It is recommended that surgeons make a more careful examination of the diseased tissues at the operating table, and order frozen sections when in doubt.

One of the author's records consisted only of a pathologic report on the clinical record and patient had been lost during the war. The record was that of a 38-year-old nulliparous female who gave a past history of untreated active genital tuberculosis, carrier of a ulcerated foot 10 years previously, and uterine myoma for hysterectomy 10 months previously. The menstrual symptoms and

physical findings consisted of intermittent, colicky, abdominal pain in the left lower quadrant radiating to the thigh, yellow, watery vaginal discharge not related to the episodes of pain, and bilateral tender tumefactions of the adnexa, interpreted by the examiner to be pelvic inflammatory disease. At operation there were found bilateral hydrosalpinx and numerous inflammatory pelvic adhesions. The specimen seemingly corroborated the clinical impression and led the operator to remove only the tubes. The pathologic report revealed a primary carcinoma of the left fallopian tube. Histologically the tumor was primarily glandular with papillary and alveolar aspects and was considered to be of high grade malignancy. At the time of writing, 2 years after the laparotomy, the patient was gravely ill from abdominal metastases, notwithstanding massive doses of deep roentgen therapy.

N. CHRISTIAN MEYER, M.D.

### EXTERNAL GENITALIA

Two Cases of Vaginal Atresia Observed in Duplex Anomalies of the Genitalia. KEIJO SOIVA. *Ann. chir. gyn. fenn.*, 1948, 37: 276.

The author observes that imperforation of one side of a double vagina is comparatively rare. Divergent opinions have been expressed as to the frequency of duplication of the genitalia. The literature on this subject is reviewed briefly by the author. One writer has found only 3 cases among 19,000 patients, whereas another found 10 such malformations among 7,400 patients.

There has been much controversy as to the causes of atresia in genital passages. In the earlier literature, they were unanimously considered to be of a congenital nature. In the opinion of more recent investigators, all imperforations found in otherwise normally developed genitalia are secondary phenomena, that is, cicatrices that appeared after birth due to inflammatory processes. This is also considered the cause of imperforation, at least in the majority of double anomalies of the genitalia. It is observed by the author that other more recent writers reviewed do not entirely exclude acquired atresia, although they believe that the majority of imperforations in double genital passages are congenital. The formation of cicatrices causing imperforation may develop after serious inflammations of the vagina, which in children can be due to gonorrhea, but which have sometimes been observed also in connection with scarlet fever, diphtheria, or pneumonia, or as a consequence of puerperal fever or febrile abortion.

After a brief presentation of the symptoms of vaginal atresia, the author discusses the diagnosis. Operative treatment alone is of help in these cases of vaginal atresia. The extent of the intervention must be carefully considered for each individual case. If there is an accumulation of blood or collection of pus confined to the vagina, only the removal of the septum dividing the vagina is done. If, on the other

hand, the accumulation of blood and pus extends or is believed to extend into the uterine cavity or into the fallopian tubes, a removal of the uterus and of the tube is generally advocated. Sometimes total extirpation of the uterus is necessary.

The author presents in detail 2 cases in which atresia was found in one of the double vaginas. In one of the cases, that of a girl of 15, the operation revealed a double uterus and an accumulation of blood in the left vagina, uterus, and fallopian tubes which had developed together with congenital atresia of the left vagina. The left uterus with its adnexa was removed and the hematocolpos directed into the right vagina. In the second case, a girl 9 years of age was found to have 2 narrow vaginas divided by a thin septum, in the upper part of which there was an imperforation with a collection of pus. The septum was removed. No portio uteri was found at the end of the vagina, nor was the uterus palpable in the internal examination.

HERBERT F. THURSTON, M.D.

### MISCELLANEOUS

Newer Concepts of Menstruation. IRWIN H. KAISER. *Am. J. Obst.*, 1948, 56: 1037.

Bleeding is the most conspicuous feature of the menstrual process. Because of this, a large part of the laboratory and clinical study of menstruation has been directed toward the blood vessels of the endometrium. An explanation of the cyclic uterine bleeding as a consequence of alterations in the coiled arteries of the endometrium has gained widespread acceptance.

There are two basic interpretations of menstruation. A mechanical concept is based on the observation that the coiled arterioles increase rapidly in complexity and extent as the secretory phase of the cycle progresses. This increasing complexity reaches a point at which it impedes the flow of blood to the endometrium and produces ischemia, which then sets off the chain reaction of menstruation. A pharmacodynamic concept stems from the observation that prolonged periods of vasoconstriction are invariable precursors of other menstrual changes. The growth and differentiation of the coiled arterioles render them sensitive to the action of vasoconstrictor substances. These then produce vasoconstriction, ischemia, and menstruation. Both concepts assume that continued growth of a complex, coiled arteriole is a necessary precursor of menstruation. Such hypotheses often bypass or contradict the earlier work on hormone withdrawal as the common precursor of menstrual flow.

The erroneous conclusions based on this faulty vascular hypothesis of menstruation are demonstrated by the recent observations of arteriovenous anastomoses in human endometrium, the presence of relatively vast areas of coiled arteries during early pregnancy with the absence of bleeding, the occurrence of bleeding during an anovulatory cycle when the arteriolar bed is much simpler than that of true

menstruation, and the presence of menstruation in New World monkeys in the absence of coiled arteries

The current explanation of menstruation, based upon alterations of the coiled arterioles, fails to account for much that is known about the menstrual process. It appears that the coiled arteriole is of principal importance primarily in the process of implantation of the embryo. JOHN R. WOLFF, M D

**Preliminary Results of Streptomycin Therapy in Tuberculosis of the Peritoneal Cavity and of the Adnexa in the Female** (Primi risultati della terapia streptomycinica nella tubercolosi peritoneale—annessiale) EUCLIDE FORLINT *Quad clin ostet gni*, 1948, 3 424

Four cases of tuberculosis of the female genitalia, 2 of which were verified by laparotomy, were treated by the local and parenteral administration of streptomycin, accompanied by general medical therapy (rest and ultraviolet irradiation therapy, and the administration of vitamins A and D, and calcium thiosulfate). In 2 instances the drug was administered into the residual ascitic fluid after part had been withdrawn, in the others the administration was entirely parenteral or by injection into the masses of adnexal tissues through the vaginal fornix. The dosages were never more than from 250 to 500 mgm per day.

In every case, after treatment of a few days to a few weeks the ascites disappeared, the abdomen became flaccid and painless, and the adnexal masses entirely disappeared. These patients were followed up for as long as 5 months after treatment, the fever had ceased and in every instance there seemed to be complete cure.

The author admits that his cases are few, that the tubercle bacillus was not demonstrated in any of the material withdrawn, and that the general therapeutic measures, including pretherapeutic laparotomy in 1 case, may have helped in the cure, and, finally, that complete cure was not proved in any of these patients, nevertheless, he believes that the results procured are sufficiently encouraging to indicate that the authorities should put streptomycin at the disposal of the gynecologist, as well as of the phthisiologist for purposes of trial in genital tuberculosis of the female. JOHN W. BRENNAN, M D

**Observations on the Delay Period in the Diagnosis of Pelvic Cancer** JOHN Y. HOWSON *Med Clin N America*, 1948, 32 1573

The author has reviewed 1,000 cases of pelvic cancer obtained from the files of the Committee for the Study of Pelvic Cancer in Philadelphia. In an analysis of the delay period it was found that there was a definite physician delay in 276, and a patient delay in 437 of the 1,000 cases. The greatest delay occurred in carcinoma of the vulva (27 months), and the shortest delay occurred in carcinoma of the cervix (from 7 to 8 months). The greatest factors in the physician delay were incorrect diagnosis and failure to examine the patient in the presence of pelvic

symptoms. The reasons offered for the failure to examine the symptomatic patients were presence of active vaginal bleeding, indiscriminate use of medication, failure to examine at first office visit, patient unprepared for pelvic examination, symptoms indicative of the menopause, and patient visited in the home.

In the examined case the delay was due to incomplete examination, incorrect diagnosis, or to wrong treatment following the making of the correct diagnosis.

The author concludes by stating that the early diagnosis of cancer can be facilitated only if the physician becomes more cancer conscious, and (1) examines all patients with pelvic complaints, (2) urges periodic examination of women over 40, (3) withholds treatment of pelvic complaints until diagnosis is made, (4) does pelvic examination at first office visit, (5) does complete examination, including use of the speculum, (6) examines patients who are actively bleeding, (7) refuses to treat patients who refuse examination, (8) studies suspicious cancer lesions relentlessly, (9) institutes proper therapy in the presence of known cancer, and (10) arranges for specific clinic or specialist care of cancer patients. J. ROBERT WILLSON, M D

**Biological Significance of Protein Concentration and the Changes Occurring in Gynecologic Laparotomies** (Importanza e significato biologico del patrimonio proteico dell'organismo e suo comportamento nelle laparotomizzate ginecologiche) MICHELE GIARDINELLI and CAMILLO ROSSO *Ginecologia*, Tor., 1948, 14 340

Determinations of proteins according to Phillips, and the Van Slyke method, of hematocrit values and of hemoglobin were made by the authors in 20 patients before and after laparotomies for obstetric or gynecologic conditions. All operations were performed under ether anesthesia.

The first 2 days after the operation the protein content of the blood serum, the hematocrit values, and the amount of hemoglobin rose. This increase undoubtedly was attributable to hemoconcentration.

Later on the hematocrit values and the amount of hemoglobin returned to their normal levels while hypoproteinemia was recorded in the majority of cases. As a rule, normal protein levels were reached toward the end of the first postoperative week.

During the pregnancy, especially in its terminal stages, the hematocrit values were found to be relatively low because of gestation hydrops.

Intravenous injections of protein hydrolysates proved very valuable in combating hypoproteinemia. JOSEPH K. NARAT, M D

**On Sterility in Finnish Women with Special Reference to Its Causes and Prognosis** ALLAN VEHILÄ and KARI *Acta obst gyn scand*, 1948, 28 Supp 5

In the introduction of this treatise the author defines sterility as meaning that no impregnation has occurred. Infertility denotes that fecundation of the

ovum has taken place but that its regular development has been interfered with. Theoretically, these definitions are exact, but in practice it is often exceedingly difficult to differentiate one condition from the other. Physiological sterility is not considered in this study, nor is voluntary childlessness by contraceptive practices. Of pathological sterility there are different forms. If conception does not take place in spite of regular married life continued for several years, the term primary sterility is used. Sterility is considered secondary when, after one or more pregnancies, a woman loses her capacity for conception. The object of the present study is to examine the causes and the prognosis of sterility on the basis of the material collected from Finland.

In this investigation, the author used the term "primarily sterile marriage" to denote a marriage which has lasted at least 3 years without the occurrence of conception. A marriage is considered "secondarily sterile" if at least 4 years have elapsed since the end of the last pregnancy.

It is not possible to divide sterility into two distinct elements, namely, that due to the male, and that due to the female factor. Therefore, although the principal object of the present investigation is to deal with the causes and prognosis of sterility in women, it also touches some questions associated with male sterility.

The methods of examination are discussed by the author. When treatment was begun the average age of the patients in the present series was 32.2 years—those with primary sterility, 31.7 years and those with secondary sterility, 33.1 years. The average period for which married women with primary sterility had remained childless was 6.3 years. The average time elapsed from the end of the last pregnancy was 6.4 years in the case of the secondarily sterile married women. The average duration of sterility in all of the cases was 6.3 years. More than half of the patients with primary sterility had passed the optimal period of fertility when they were married. Breipohl expressed the opinion that a late menarche and irregularities at the first menses are likely to be of importance for the evaluation of fertility. He regarded the sixteenth year of life as the critical age of menarche in this respect. In the series reported herewith, the author observed that the prognosis of sterility seemed less favorable as the menarche was delayed. This decline, however, was so slight that there was a statistical difference only between the cases belonging to the earliest and the latest group.

By way of presenting the etiology of sterility, the author gives a tabulation in which the present series is divided into 6 main groups. The first of these, in which the vaginal factors were responsible, represented 1.6 per cent of the whole series. The group resulting from uterine factors amounted to 4.3 per cent. The tubal factors represented 45.4 per cent, endometriosis 8.5 per cent, and genital insufficiency, 20.5 per cent. The miscellaneous and unknown factors were represented by the sixth group which amounted to 10.7 per cent of the whole series.

The second of the two main objects of the present study was to investigate the prognosis of sterility. For this purpose, questionnaires were sent to such patients of the present series as were not under constant supervision. This method supplied information on the subsequent condition of 1,417 patients over a period of from 3 months to about 10 years. There was no information available on 273 cases, or 16.2 per cent, of the cases. As a result of this questionnaire, it was learned that 25.6 per cent of all the patients had become pregnant. It is significant that all of the patients revealed a less favorable prognosis as the age at which treatment was started increased. The most marked fall in the present series occurred at 3 years, which suggests that it is well to begin the treatment of sterility before the limit of 3 years, especially if the patient is elderly.

In the final summary the author notes that the object of the investigation herewith reported was to study the etiology and prognosis of sterility in Finnish women. The study was based on a series of 1,690 cases of sterility, 1,095 of which were primary and 595 secondary.

The sperm of the husband was examined in 821 cases, in 113 of which (13.7 per cent) azoospermia was revealed. These 113 were excluded from the series when female sterility was considered. Physical examination alone was carried out in 473 cases, hysterosalpingography in addition to it in 614 cases, insufflation in 164 cases, hysterosalpingography and laparotomy in 207 cases, and laparotomy in 232 cases.

The patients came up for observation at the average age of 32.2 years. The average duration of sterility was 6.3 years. In the present series, contraception did not seem to affect notably the duration of sterility. In cases of primary sterility, the patients' average age at menarche, 14.7 years, corresponded to the results of investigations recently carried out in Finland regarding the age at the menarche. The prognosis of sterility seems to show only a slight decline as the age of menarche increases. Of the patients with primary sterility, 15.7 per cent showed cyclical lability and 6.9 per cent cyclical debility. In the cyclically labile, the prognosis of sterility did not differ from that of the whole series, while in the cyclically debile the prognosis was worse.

The series was divided into 6 main etiological groups. Vaginal factors figured in 27 cases, or 1.6 per cent, of the series, and uterine sterility in 73 cases, or 4.3 per cent of the series.

In the largest etiological group, that for tubal sterility, (768 cases, or 45.4 per cent, of the whole series) examination of tubal permeability revealed tubal factors in 47.4 per cent, and physical examination alone in 40.0 per cent. Tubal sterility was considered as due to ascending infection in 37.7 per cent of the whole series. Of these cases, 3.1 per cent were due to gonorrheal infection, 10.6 per cent to infection following abortion, 5.9 per cent to infection following labor, and 18 per cent to other ascending infections. Tubal changes due to appendicitis were regarded as

responsible for sterility in 18 per cent of the whole series. In the present series genital or peritoneal tuberculosis appeared as a factor leading to sterility in 12 per cent. "Salpingitis isthmica nodosa" was considered responsible for sterility in at least 13 per cent of the series. Other cases of tubal sterility, which could not be placed into any of these groups, constituted 34 per cent of the whole series.

Endometriosis externa intraperitonealis was the probable cause of sterility in 85 per cent of the present series (143 cases). The surgically treated cases of endometriosis constituted 255 per cent of all the laparotomies. Intramural and isthmic tubal occlusions, possibly due to endometriosis tubae, appeared to be relatively rare in patients suffering from endometriosis, for only 8 of the 56 salpingographically examined patients with endometriosis externa showed such occlusions.

Genital insufficiency was considered responsible for sterility in 295 per cent (498 patients) of the whole series, in 355 per cent of the patients with primary sterility and 183 per cent of those with secondary sterility. In 725 per cent of cases in this group (361 patients with primary sterility) primary genital insufficiency was considered present. The incidence of genital infantilism and that of genital hypoplasia seemed to be roughly equal. Secondary genital insufficiency was considered responsible for sterility in 221 per cent (1 patient with primary and 109 patients with secondary sterility) of this group. In the remaining 54 per cent (27 patients with primary sterility) this subgrouping was not found to be feasible.

The last etiological group, in which the sterility was due to miscellaneous and unknown factors,

constituted 107 per cent (181 patients) of the whole series. In this group, the 44 cases of posterior parametritis are worthy of mention.

Of all the patients in the present series, 256 per cent (432) became pregnant. The corresponding figure for the group with primary sterility was 256 per cent, and for those with secondary sterility, 255 per cent. In 254 per cent of those who became pregnant, treatment had lasted 2 years or more before pregnancy began. It was not until treatment had lasted more than 5 years that there was a marked fall in the favorable prognosis. This showed a steady decline as the age increased at which the patients were admitted for treatment. This decline as associated with the lengthening of the period of sterility was most clearly seen at the 3 year limit.

Treatment in the two first etiological groups, (vaginal and uterine sterility) resulted in pregnancy in 457 per cent of the patients. In the group associated with tubal sterility, 132 per cent of the patients became pregnant, while 23 per cent of the patients with unilateral occlusion or impaired tubal patency, and 51 per cent of those with bilateral occlusion, became pregnant.

Of the patients with endometriosis, 329 per cent became pregnant. The prognosis in the secondarily sterile patients seemed to be better than that of the primarily sterile patients. In the group of patients with genital insufficiency, 311 per cent became pregnant.

Pregnancies occurred in 464 per cent of the women with sterility due to miscellaneous and unknown factors. Of the 44 patients with posterior parametritis, 26 became pregnant after treatment.

HERBERT F. THURSTON, M.D.

# OBSTETRICS

## PREGNANCY AND ITS COMPLICATIONS

**An Ultimate Resort in the Diagnosis of Pregnancy**  
SVEN SJÖSTEDT *Acta obst gyn scand*, 1948, 28  
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At laparotomy the gynecologist is occasionally confronted with an enlarged uterus which may be pregnant when prior to surgery there was no reason to suspect pregnancy. When this situation arises the surgeon (1) may close the abdomen and verify the diagnosis, (2) inspect the ovaries, looking specifically for a corpus luteum of pregnancy, (3) roentgenograph the mass at the time of surgery, (4) aspirate the uterine mass with a needle, or (5), as advocated, make an exploratory incision in the uterus.

Five cases of uterine exploration through a small incision were reported by Hellsten in 1917. In 1 case a cystic myoma was diagnosed, in 2 instances pregnancy, in 1 case hydatidiform mole, and in the last case the findings were misinterpreted and a pregnant uterus was removed.

The author reports on 3 diagnoses in which uterine incision was carried out. In the first case pregnancy was diagnosed after the exploratory incision was made. Subsequent pregnancy tests and roentgenograms did not verify this diagnosis and laparotomy revealed a myoma undergoing cystic degeneration. In the second case pregnancy could not be verified and, at laparotomy with a uterine incision, placental tissue was found. The uterus was sutured and the abdomen closed, but shortly after discharge the patient was readmitted for abortion. The last case was that of a patient who on laparotomy was found to have an ovarian fibromyoma plus a uterus irregularly enlarged to the size of a 4 months' pregnancy. Uterine exploration revealed placental tissue and the uterus was closed. Five months later the patient delivered a boy weighing 4.3 kgm.

The uterine incision must be adequate, at least 5 cm. long and from 1.5 to 2 cm. deep, in the midline and on the anterior aspect of the uterus. The risks of this procedure are slight and injury to the amnion can usually be avoided. The author recommends the utilization of this procedure in troublesome and puzzling cases.

J. ROBERT WILLSON, M.D.

**Two Cases of Pregnancy in Uterus Subseptus Unicorporeus and One Case in a Double Uterus** (Dois casos de gravidez em útero subseptus unicorporeus e um em útero duplo) MARIA DOS SANTOS PINTO  
*Rev Port obst gin cir*, 1948, 1, 341

One of the rarest congenital malformations of the female genital apparatus is uterus subseptus unicorporeus. In fact, the incidence of double formations increases with the height of the genital canal, double vaginas being rare, double uteri more frequent and bicornate uteri with a single cervix still more frequent.

The first case of uterus subseptus unicorporeus was observed in a woman of 22 years admitted during the ninth month of her pregnancy. Gynecologic examination revealed two vaginal orifices, the right one being the largest, and two noncommunicating vaginas, each with an independent softened cervix. The left fornix of the right vagina and the right fornix of the left vagina were smaller than those of the opposite sides. The right vagina easily allowed bigital examination, but penetration of two fingers into the left vagina was difficult. During labor the contractions were of good quality and the fetus was unaffected. After spontaneous rupture of the membranes the fetal head was engaged, the orifices of the two cervixes presented a dilatation of two fingerbreadths and the sutures and fontanels could be felt through each cervix. Under balsoforme anesthesia the vaginal septum was incised between two clamps, an incision was made uniting the two cervixes, and the living fetus was extracted with forceps after a unilateral episiotomy had been performed. The puerperium was normal.

In the second case of uterus subseptus unicorporeus, observed in a woman of 29 years, the septum was thick at its points of implantation in the vagina and thin in its middle portion, it ran anteroposteriorly and separated the two vaginas completely. The cervixes were partly flattened out but their dimensions, as well as those of the vaginas, did not allow delivery by the vaginal route. Therefore, low cesarean section was performed. A living child was obtained and the postoperative course was uneventful.

In the case of double uterus observed in another woman of 29 years, examination revealed that the vulva was divided by an anteroposterior septum and had two hymens, of which the left one presented no opening. The septum extended from the vulva to the uterus or uteri. The fundus of the left vagina presented a very small, softened cervix with nullipara orifice, and that of the right vagina a larger, softer cervix with the characteristics of a first pregnancy. In both fundi was felt a cephalic presentation which distended them. During labor the right cervix dilated and the left remained closed, the septum was displaced to the left but offered great resistance to the insinuation of the fetal head. When the cervix was completely dilated, the head was only slightly engaged and the fetus was suffering. Under spinal anesthesia the resistance of the septum was overcome by manual dilatation and a living child was extracted by forceps and the aid of an episiotomy. After delivery it was found that the septum had been torn in its entire length and also from the border of the cervixes. Repair left one cervix at the fundus of a single vagina.

The two cervixes gave access to two uterine cavities, one of which became pregnant, while the other increased slightly in volume. During labor the second

cervix underwent a beginning of dilatation and admitted one finger. In cases of double uterus the two cavities may become pregnant, but the pregnancy is then nearly always interrupted prematurely and the ova may be expelled at intervals of several months. Pains and bleeding may be observed, the first being due to uterine distention, the second to the hypertrophied decidua formed in the empty uterine cavity. If the wall of the pregnant uterine cavity has enough musculature, the pregnancy may go to term, otherwise, it ends in abortion or premature labor. The complications which may occur during labor in case of double uterus are due to the presentation, the mobility of double uterus, the degree of elasticity and distention of the cervix and the vagina, and the degree of development of the uterine wall.

RICHARD KEMEL, M D

**Extrauterine Pregnancy Exteriorized Through a Persistent Malpighi-Gartner Canal with Expulsion of Skeletal Remnants of the Embryo**  
(Gravidanza extrauterina estrinsecatasi attraverso un persistente canale di Malpighi Gartner con l'espulsione dei resti scheletrici dell'embrione) ICILIO PARDINI *Chin ostet*, 1948, 50: 188

A rare form of extrauterine pregnancy is the infra-ligamentary type in which the ovum settles in the tube and the placenta develops on the lower wall of the tube where the villi destroy the muscular bundles and gradually reach the connective tissue of the mesosalpinx and the broad ligament so that the ovum becomes implanted secondarily in the connective tissue of the pelvis. Pardini reports the following case:

A woman of 24 years had her last regular menstruation on July 4. On October 18 she suddenly experienced severe abdominal pain in the right lower quadrant, persisting for 2 or 3 days. On November 4 she had slight sacrolumbar pain and a small loss of blood from the vagina. After a few hours she expelled a piece of fleshy substance which looked like an empty sac. Hemorrhage and pain then stopped. On November 19 she again started to lose blood, which for the first day had the characteristics of a menstruation, but then became blackish and mixed with fetid purulent material.

Examination disclosed at 15 cm. below and to the right of the urinary meatus a small opening from which issued the fetid blackish material. The uterus was of normal size and strongly displaced to the left. Through the right vaginal cul-de-sac could be felt a round mass, the size of an orange, nonmobile, in direct contact with the right side of the cervix and partially in front of it. The lower pole of the mass was in broad contact with the vaginal vault. A probe introduced into the orifice below the meatus was passed upward and slightly to the right, reaching the lower pole of the lateral mass. Vaginal palpation revealed under the mucosa a fibrous cord which ran to the right of the urethra, first upward and laterally, then straight ahead to be lost in the fornix close to and in front of the cervix. Tipodol was injected through

the orifice and the film showed that this canal communicated with the paracervical mass.

Two days later the orifice was occupied by a blackish, small foreign body which proved to be of an embryo, then other bones were easily extruded from the canalicule and many were found in the dressing during the following 4 days. The secretion then became grayish, mucous, and gradually disappeared, while the mass was reduced to the size of a pigeon's egg, but the canalicule persisted throughout the entire course.

There is no doubt that the persistence of the canalicule was due to the persistence of a Malpighi-Gartner canal. This was demonstrated by its course posterior to the urethra, its fibrous consistency, and the fact that no other organ can be present at this site during the embryonic stage and in adult life.

The death of the ovum could have occurred at different periods in the history of the case, at the time of the severe abdominal pain and at that of the expulsion of the decidua. The first would correspond to a pregnancy of 3 1/2 months, the second to one exactly 4 months. Comparison of the collected material with those of embryos in the anatomic museum of Pisa showed that they resembled more those of embryos of the fourth month, therefore, the interruption of the pregnancy must have coincided with the expulsion of the decidua.

Pardini advances the theory that the ovum is implanted in the mesosalpingeal part of the ampulla, after perforating the tubal wall, it is attracted between the leaves of the broad ligament, approached the side of the uterus so as to come in contact with the canal of Malpighi. At this point, reasons which cannot be determined but which are probably connected with defects in the blood supply, the pregnancy was interrupted and found the way to the outside to be through the canal of the Gartner duct.

RICHARD KEMEL, M D

**The High Occipital Position** (Der hohe Geraden Kopf) YNGVE MONTILL *Ann chir gyn fern* 1947, 250

One of the rarest abnormalities of position at birth is the high occipital position. In the material of the Women's Clinic of the University of Helsinki which comprised 68,584 births between 1900 and 1945, there were only 80 cases, or 0.11 per cent of this type. The percentage of such cases in the years varied from 0 to 0.30. However, there is no doubt that the percentage of such cases is actually much higher and that many cases are overlooked because of the presence of complications of labor. Among the etiologic factors the most important are the form of the pelvis, the size of the fetus, the form of its head (flat roof of the skull), probably the time of rupture of the membrane. In addition there are many incidental causes such as malposition and a number of unknown factors. In many cases several factors are present simultaneously.

Two forms of high occipital position are distinguished: the pubic, in which the back of the



head lies behind the symphysis, and the sacral, in which it lies in front of the promontorium. Most investigators accept the pubic form as more common, the proportion of 3 to 1. In the present material, the sacral form was more frequent than the pubic form, the proportion being 2 to 1 (54 sacral cases as against 26 pubic). However, since spontaneous delivery occurred more often in the pubic form, the author thinks that in reality both forms are present with equal frequency. Although labor in the pubic form was somewhat longer than in the sacral, he considers the pubic form as more advantageous, not only because spontaneous births are more frequent but also because in eventual complications a low or semi-low forceps can ordinarily be used.

The treatment of high occipital position does not actually differ from that of other positions if there is great disproportion, cesarean section is performed, otherwise, spontaneous birth is awaited. Of the 54 sacral cases, 21 (38.89 per cent) ended in spontaneous birth, 20 (37.03 per cent) in delivery by forceps, and 13 (24.08 per cent) in delivery by cesarean section. Of the 26 pubic cases, 11 (42.31 per cent) ended in spontaneous birth, 7 (16.92 per cent) in delivery by forceps, and 8 (30.77 per cent) in delivery by cesarean section.

In the sacral cases, 20 children (37.04 per cent) were born with the dorso-posterior position of the head, 19 (35.18 per cent) with the dorso-anterior position, and in the remaining 15 the position of the head was unknown. Of the 20 with the dorso-posterior position of the head, 11 (55 per cent) were born spontaneously. According to the literature, spontaneous birth of children in sacral cases occurs nearly exclusively in the dorso-anterior position of the head, i.e., the head rotates 180 degrees during birth. The position of the head was corrected in 2 cases although attempts at correction usually fail.

In spontaneous delivery of primiparas, labor was prolonged for both forms. In the pubic form it lasted 32.5 hours (31 for the first phase and 1 for the second phase), in the sacral form it lasted 29.3 hours (26 for the first phase and 3.3 for the second phase). There were no maternal deaths and only 2 (2.5 per cent) among the children.

RICHARD KEMEL, M.D.

#### Diethylstilbestrol in the Prevention and Treatment of Complications of Pregnancy

O. WATKINS  
*Smith, Am J Obst, 1948, 56: 821*

This study of the clinical evaluation of diethylstilbestrol therapy in human pregnancy is based on the analysis of 632 pregnant patients treated by 117 obstetricians according to the recommendations of the author as to the dosage schedule. These patients included ward and private patients and as to their residence represented a cross section of the United States with its varied climatic conditions, dietary variations, geographic distribution, and general obstetric care.

The basis for the use of this drug is that, in the dosage prescribed, stilbestrol has the ability to stimulate a greater production of the placental

steroid hormones and thus increase progesterone metabolism.

Therefore, stilbestrol should prove beneficial in any abnormal situation of pregnancy in which progesterone deficiency may be etiologically involved, provided the cells which secrete the steroid hormones are still capable of functioning. That progesterone deficiency might result in abortion and premature delivery has been established. It has also been shown that a progressive deficiency of the steroid hormones invariably precedes the onset of late pregnancy toxemia, eclampsia, and intrauterine death. A reciprocal relation exists between the vascular supply to the placenta and the circulating level of the steroid hormones. By combating a deficiency of estrogen and progesterone, vascular damage might be prevented, so that hormonal therapy might be of value in twin pregnancy, essential hypertension, and in the prevention of vascular complications. The use of stilbestrol for the treatment of late pregnancy toxemia, as opposed to its prophylactic use, is not advised since the vascular damage is already so advanced that the increased secretion of progesterone cannot be stimulated.

The dosage schedule is that of 5 mgm daily by mouth started during the sixth or seventh week. It is increased by 5 mgm at 2 week intervals to the fifteenth week when 25 mgm are given daily. The daily dosage is then increased by 5 mgm at weekly intervals. The drug is discontinued at the thirty-fifth week. For the prevention of late pregnancy accidents stilbestrol is started not later than between the sixteenth and nineteenth weeks. The initial dose is always the one for the particular week of pregnancy when therapy is begun.

Of 491 patients treated for bleeding between the sixth and twenty-first weeks of gestation (threatened abortion and abortion prophylaxis) 78 per cent carried to the twenty-eighth week, and 72 per cent had living babies. In 127 patients who had from 2 to 5 consecutive abortions prior to therapy the fetal salvage was 77 per cent.

For the patients with late pregnancy complications (24) this report is of a preliminary nature. The author believes that this prophylactic treatment has reduced the incidence of complications associated with deficiencies of the steroid hormones.

Only 9 patients (1.4%) reported toxic reactions such as nausea, headache, vaginal discharge, and skin rash.

JOHN R. WOLFF, M.D.

#### Acute Operative Intestinal Complications in Connection with Pregnancy

HANNES SAURAMO  
*Acta obst gyn scand, 1948, 28: 150*

From 1921 to 1947, 8 patients suffering with acute operative intestinal complications associated with pregnancy were observed at the Womens Clinics 1 and 3 at the University of Helsinki. The incidence was 0.01 per cent. The author reviewed these cases thoroughly and found that the etiological factors were strangulation plus adhesions, strangulation plus Meckel's diverticulum, strangulation plus a



# GENITOURINARY SURGERY

## ADRENAL, KIDNEY, AND URETER

**Studies on Backflow in Excretion Urography** OLLE OLSSON *Acta radiol*, Stockh, 1948, Supp 70

At an early date, anatomists observed that material injected into the ureter escaped through the vena renalis. The first mention of this phenomenon to be found in the literature seemed to be that made by Gigon in 1856. With the introduction of retrograde pyelography (1906) the anatomical reconstruction method was reproduced clinically, whereby the phenomenon won clinical significance. In reviewing the experimental work reported in the literature Olsson states that, even in retrograde pyelography, this important and interesting phenomenon peculiar to backflow has not been sufficiently investigated.

In contrast to the amount of literature on the subject of backflow manifested in retrograde pyelography, the published reports of backflow discerned in excretion urography are but scanty. In an extensive material study, greater than any previously published study, the author elucidates certain questions bearing on backflow, especially in association with excretion urography. A description of the roentgenological anatomy of different types of backflow, their development and frequency in urographic material, is given.

The clinical material consisted of 100 intravenous urographic examinations exhibiting backflow. The examination technique adopted was that suggested by Hellmer, a description of which was published in 1943.

These cases of backflow were discovered by the author while perusing 1,500 urograms chosen at random for purposes of elucidation of the frequency of backflow in his material of excretory urograms.

The only mention of the frequency of backflow in excretion urography is that made by Lindbom (1943). In a perusal of 2,600 urograms, 15 cases of backflow (1.6%) were found among 900 cases in which ureteral compression had been applied. Among the author's 998 cases in which ureteral compression had been applied, the backflow phenomenon was exhibited in 2.5 per cent. In excretion urography with ureteral compression the visualization of backflow is by no means a rare phenomenon. In 98 of 100 urographic examinations, extravasation did not occur until after the application of very careful and prolonged ureteral compression.

Of greatest interest are the type and course of individual cases of backflow. These cases fall into two distinct groups: (1) the extravasate has the form of streaks or lines extending more or less regularly and medially from the kidney towards the spine; (2) the radiopaque extravasate is localized immediately adjacent to one or more calyces, from where it spreads in the sinus renalis around the renal

pelvis and its branches, and possibly out through the hilus. This group comprises 89 of the 100 cases under discussion.

The force with which the extravasate spreads in the course of excretion urography may be in most cases but little. In some cases the active contraction of the renal pelvis may now and then be assumed. Such a contraction of the renal pelvis may give rise to an abrupt increase in the intrapelvic pressure as well as to a change in the form of the fornix calyces which become more acute. Such a change favors the development of backflow.

With a view of ascertaining to what degree the designation of the term "pyelovenous" was justified, the author by experimental examination concluded that (1) backflow appearing in the radiograms as small fornix extravasates have no connection with the circulatory system, (2) backflow of the types most commonly observed in excretion urography is limited to the sinus renalis and does not involve in "injection" of urine into the circulation, (3) under vital conditions the tendency of the extravasate to spread to the blood vessel is less than in postmortem specimens, and (4) the term "pyelovenous backflow" for the designation of small sinus extravasate is not motivated.

The author suggests that on the basis of a thorough knowledge of the roentgenological anatomy, the various types of backflow should be designated

solitary	} rupture with	little	} overflow	
multiple		medium		sinus extra-
general		profuse		vasate

The clinical significance of backflow was considered by Olsson from the viewpoint of demonstrating how particular pathological conditions have a tendency to produce backflow, and to ascertain whether clinical changes can be brought about by backflow.

Distention of the renal pelvis is a condition that is necessary for the development of backflow. The author cites the case of an expansive process associated with a kidney tumor in which backflow was present. This phenomenon may be of differential diagnostic significance in renal tuberculosis and in acute renal colic as well as in kidney tumor.

The author reported 6 cases in which large radiopaque extravasates were discernible during the course of acute urography. These patients were examined very shortly after the onset of colic and the urogram was performed during the acute attack of pain, without any preparation of the patient.

The significance of backflow in this type of case from a roentgenological point of view is purely diagnostic, but from a physiopathological point of view the condition constitutes a sign of gross decompensation between the outflow of urine and the increase in intrapelvic pressure that exists during an acute

phase of renal colic. The contrast backflow begins so early that there is reason to believe it has already existed prior to the urographic examination. From his observations the author concluded that backflow, even profuse backflow, may occur in association with acute renal colic, and this backflow may constitute an integral part of the picture clinically, physiopathologically, and diagnostically.

The most common type of backflow observed in the course of excretion urography is the small sinusal extravasate. The type of backflow in which filling of the lymph channels and venous vessels may be visualized roentgenographically is relatively rare.

Experiments have shown that no short circuit exists between urine and blood in backflow of the type most common in excretion urography. Backflow should be termed according to its roentgen-anatomical extension, for example, fornix-sinus backflow, sinus lymph channel backflow, etc. The greatest significance of backflow is its diagnostic and differential diagnostic value in conditions such as tuberculosis, renal rupture, renal tumor, and acute renal colic.

CONRAD A. KUEHN, M.D.

#### The Indications and Results of X-ray Examination in Trauma of the Kidney (Les résultats et les indications des explorations uro-radiologiques dans les traumatismes des reins) TRUC and BRINGER *J urol méd*, Par., 1948, 54, 305

The clinical diagnosis of renal contusions and, in particular, severe ones does not offer great difficulty. The symptomatic triad of the general physical condition along with the urinary and local findings are sufficiently characteristic to establish the diagnosis. But in slight traumas or those of medium severity, it is not always possible to determine with certainty if there is a renal lesion, and it is also difficult to determine the extent of the renal damage.

Urologic examination does not always provide information of value. If cystoscopic examination can be carried out, the site of the bloody urinary ejaculations can be determined. Sometimes it is impossible to do this immediately after trauma because the patient is in shock.

Roentgenological examination permits the exact evaluation of the renal trauma. The only contraindication to this procedure is the severity of the trauma and the state of shock of the patient. When the trauma involves the kidney structure, immediate surgical intervention may be necessary. All injuries of the kidney should be studied from hour to hour and a roentgenological examination should always be made.

A flat film of the kidney region will demonstrate the renal silhouette or perhaps widening of the renal shadow. There may be a deformity or absence of the psoas shadow. The absence of motility of the kidney and the excursions of the diaphragm can also be shown. Associated lesions, such as fractures of the ribs, are readily demonstrated. These findings are not pathognomonic of trauma of the kidney, but they do have clinical significance.

The flat x-ray picture sometimes reveals stones that have not previously been suspected. The author cited a case of a 250 pound man who suffered a contusion to the right kidney region. He became anuric. Examination on the third day of the anuria showed a shadow that suggested a ureteral stone. After ureteral catheterization and relief of ureteral spasm by infiltration of the renal pedicle with novocain, there was a copious diuresis. Two small ureteral stones were then evacuated.

Retrograde pyelography in renal rupture may or may not be advisable, for it may aggravate hemorrhage or produce severe secondary hemorrhage. Infection may also be introduced into the kidney, and diffusion of the contrast media through the injured kidney may carry with it infectious organisms.

From many articles and numerous observations, it has been established that precise information from intravenous pyelograms has been obtained without infection or without initiation of secondary hemorrhage.

A retrograde pyelogram furnishes exact information and at times it is superior to that of the intravenous method. By the observation of strict aseptic technique, the danger of infection in retrograde pyelography is reduced to a minimum, but the risk still exists. The second objection to retrograde pyelography is the possibility of recurrence of a severe secondary hemorrhage that may be the direct result of the examination. The author stated that while the retrograde pyelograms give valuable information in early cases of renal trauma, the results are subordinate to those obtained by intravenous urography. If the renal trauma does not necessitate surgical intervention, and if the lesion heals with cicatrization, ascending pyelography after healing takes place may give useful and definite information as to the condition of the previously injured structures. Pyelograms made at this time may be useful too from a medicolegal point of view.

The intravenous pyelogram shows the physiology of the kidney and, at the same time, the renal function. If the information given by the intravenous method is not complete, it must be supplemented by the retrograde method, but it can satisfy the urologist concerning the condition of the injured patient and at the same time give information as to the existing morphology and pathology of the kidney.

Elimination by the injured kidney of the opaque substance presents certain advantages. It does not further traumatize the kidney and does not mobilize the clots that distend the fissures, neither does it aggravate the lesion or lead to infectious accidents.

In renal trauma intravenous urography permits a determination of the extent of the kidney lesion and helps to evaluate its severity. In certain cases it gives information concerning the renal parenchyma and the urinary passages. Insufficient blood supply may cause a poor excretion of the contrast media, or even the total lack of excretion on the contused side. If this is the case, early retrograde studies are indicated when the patient is no longer in shock.

When there is a recurrence of the hemorrhage accompanied by signs of severe blood loss and the hemorrhage is progressive in character, immediate lumbotomy is indicated. This operation allows for the suture of the ruptured kidney or, if necessary, a nephrectomy may be done if the renal parenchyma is injured beyond repair.

In case of severe injury, a flat x-ray film of the kidney, ureter, and bladder should be taken and an immediate intravenous urogram made at the same time. This x-ray examination will demonstrate the absence of trauma or the extent of trauma that is present. In cases of nonelimination of the contrast media by the contused kidney, the preoperative retrograde pyelogram gives valuable information.

If the patient is not in shock, he should be closely observed (temperature, pulse, blood pressure, condition of the lumbar fossa, and blood count). Cystoscopic examination may determine which side the blood is coming from, and whether the injury is minimal or both sides are involved, early intravenous urography gives a complete picture showing the functional state of the uninjured kidney and the condition of the injured kidney as well. It is possible to make a diagnosis whether the lesion is limited to the renal parenchyma, the pelvis, or whether the capsule is involved along with the pelvis and the calyces. The author makes a retrograde pyelogram if the intravenous urograms do not show elimination by the contused kidney.

The author concludes that roentgenography of the urinary tract and venous urography are indispensable in the examination of those patients who have suffered lumbar trauma. If the intravenous urograms show only diminished elimination of the opaque media on the contused side or there exists a slight alteration of one of the calyces, the patient usually recovers without surgical intervention. If the urogram shows a perirenal hematoma on the contused side, surgical intervention should be used only if it becomes absolutely necessary, otherwise, the treatment should be conservative. If the intravenous pyelogram shows no elimination of the radiopaque substance on the contused side, retrograde pyelography may give exact information as to the condition of the kidney. Surgical intervention in this type of case may be necessary. In case of very severe hematuria with perirenal hematoma which is progressive in character, the clinical signs determine the course to follow. In cases of renal contusions that are healed by conservation of the kidney, the intravenous and retrograde pyelograms give information concerning the secretory, excretory passages, and the morphology of the kidney. This procedure will also give valuable information in medicolegal cases.

CONRAD A. KUEHN, M.D.

#### **Intravenous Urography and Retrograde Pyelography in Subcutaneous Injuries of Kidney** A. STEINBOCK *Ann. chir. gyn. fenn.*, 1948, 37, Supp. 4

Steinbock reported on the results of excretory and retrograde urographic examinations of 37 fresh cases

of, and 54 cases of old recoveries from, renal rupture. Intravenous urography may be resorted to early after injury provided the patient's general status permits it, positive findings render retrograde pyelography unnecessary. The latter may be performed in urgent cases prior to operation if operative intervention is decided upon on the basis of the clinical symptoms.

Intravenous urography is considered a harmless diagnostic procedure. It significantly establishes the existence and function of the opposite kidney, thus preventing the fatal removal of a solitary kidney. Two instances of solitary kidney were encountered among the author's 37 cases of fresh renal trauma. In 13 of these 37 cases the pyelogram was normal, filling deficiencies and intrarenal injury, each, were encountered 5 times and the contrast medium diffused perirenally 11 times. The causes of error in intravenous urography for fresh renal trauma are meteorism, blood clots in the renal pelvis, a sudden fall of the blood pressure, and shock. Shock usually contraindicates excretory urography.

Steinbock believes that retrograde pyelography requires perfect asepsis and slow injection, which may be advantageously followed fluoroscopically. He has never observed any harm from retrograde pyelography performed under aseptic conditions.

The foregoing diagnostic procedures are of great value, but are not absolutely decisive in determining the indications for operation. As a rule a fresh renal rupture seldom requires surgical intervention. Of the 37 patients only 4 were operated upon (2 nephrectomies, 1 pseudohydronephrosis incision, and 1 hydronephrosis suture were performed).

Fifty-four patients were examined several years after the occurrence of renal trauma. The pyelogram was normal in 40 of these patients, including 1 patient with rupture of the kidney and pelvis which had been sutured.

The article is concluded with a comprehensive bibliography and a short report of a case of incomplete rupture of the wall of a ureter. In the region of the ureteral tear there occurred extravasation of urine forming a large mass. In this instance excretory urography performed 3 days after the trauma failed to reveal the lesion because of the absence of renal excretion of the contrast medium on the injured side. However, retrograde urography performed 3 days later showed the site of ureteral rupture.

ROBERT TURELL, M.D.

#### **Diagnostic and Therapeutic Considerations of Horseshoe Kidney** (Riñón en herradura. Consideraciones diagnósticas y terapéuticas) A. E. GARCÍA, A. ROCCHI, J. CASAL, and A. I. GUINEA *Rev. argent. urol.*, 1948, 17, 133

Eight cases of horseshoe kidney are presented, a percentage occurrence of 4.745 over an 8 year period of urologic service at the Hospital Espanol. Four of the patients were treated surgically.

The so-called pathognomonic symptoms were observed in only 1 instance, for which reason it is be-

lieved that the classic syndrome of horseshoe kidney is less frequent in occurrence and by itself does not justify a diagnosis. Urography is considered the most important single fundamental step in diagnosis. Treatment must be based on two factors, the pathologic process in the isthmus and the associated kidney lesions.

STEPHEN A. ZIEMAN, M.D.

**Kidney Tumors** (Tumores do rim) GUERREIRO DE FARIA Hospital, Rio, 1948, 34 699

The histopathology, diagnosis, and therapy of kidney tumors are discussed by the author. Numerous photographs and photomicrograms illustrate the article. The following classification of kidney tumors is offered by the author:

- 1 Tumors of the renal parenchyma
  - a Epithelial tumors adenoma, carcinoma
  - b Tumors of the connective tissue benign, such as lipoma, fibroma, and myoma, and malignant, sarcoma
  - c Embryonal tumors benign, dermoid, malignant, dysembryoma (Wilms tumor)
  - d Tumors of the suprarenal gland hypernephroma or Grawitz tumor
- 2 Tumors of the renal pelvis
  - a Epithelial benign, papilloma, malignant, carcinoma
  - b Tumors of connective tissue benign, lipoma, fibroma, and myoma, malignant, sarcoma

The author advocates postoperative x-ray treatment, which is also indicated for palliation in cases in which a surgical procedure is contraindicated.

JOSEPH K. NARAT, M.D.

**Injury of the Vena Cava during Nephrectomy** (Blessure de la veine cave pendant la néphrectomie) A. PUIGVERT GORRO *J. urol. méd.*, Par., 1948, 54 349

Among the many accidents one sees that occur during nephrectomy, without doubt, the most dramatic is the accidental opening of the inferior vena cava by a sharp cutting instrument or laceration by traction on another vein. This serious accident fortunately is rare, one sees it chiefly on extirpation of the right kidney. The author stated that twice he has been the actor in this dramatic event.

The first case of operative injury to the vena cava was reported by Lucke in 1880 (a nephrectomy for sarcoma, through a transperitoneal approach). Lucke was able to place ligatures on the lateral wall of the vena cava and he packed a tamponade into the lumbar fossa. The patient died on the fourth day of uremia. The autopsy showed that the wound of the vena cava was an opening about a centimeter in length, and that it had been occluded by compression since the ligatures of catgut that he had thought to be in place over the opening in the vein were fixed in the vicinity without occlusion of the vessel.

In 1892 Schede for the first time performed a lateral suture of the inferior vena cava with success, but his patient died of cancer 15 days after operation.

In 1893 Marconi, assistant to Professor Bottini, published the report of a case in which the inferior

vena cava was sectioned, and in spite of this healing of the vein below the origin of the renal vein was obtained. Bottini marked a step in the history of venous surgery, for he proved experimentally that animals could survive following total ligation of the inferior vena cava at a level that was compatible with life.

Houzel in 1901 performed the first voluntary ligation of the vena cava during the course of nephrectomy. It was then learned that patients could survive this serious accident of ligation of the inferior vena cava.

While some authors obtain success by tamponage of the injured veins, others place hemostats to occlude the opening. A few surgeons practice lateral ligation of the vessel wall while others ligate the vein. However, most of these cases are handled by lateral suture of the vena cava.

While opening of the vena cava is usually accidental, in some cases—as that of Zoege von Manteuffel—the vein was deliberately opened. The author audaciously opened the vein about 10 cm. to extract an extension of the neoplastic growth that had its origin in the kidney. He sutured the wall of the vena cava and the patient recovered.

Opening of the vena cava is usually accidental and occurs during the enucleation of an enlarged kidney with marked perirenal and perihilar adhesions. It is on freeing these adhesions and dissecting the hilar glands in order to facilitate the dissection that openings into the vena cava or the renal vein, as it emerges from the vena cava, are produced.

In some cases the injury is produced by tearing an enlarged kidney or by tearing the pedicle when traction is put on a large pedicle to elevate the kidney. Some injuries occur during clamping of the pedicle, and in other cases there is so much stretching of the elastic wall of the vena cava with subsequent slipping of the ligature that the vena cava is opened.

In the author's first case, that of a calculous right kidney that was bound down by dense adhesions producing a block of fibrosclerotic tissue, he encountered great difficulty in freeing the pedicle. Preliminary liberation of the ureter from the lumbar fossa was attempted in order to approach the vascular pedicle. During this manipulation of the kidney, the vena cava was torn. A lateral opening 1 cm. in length was made. The bleeding was very severe and the operative field was immediately inundated with blood. A large pack was maintained for several minutes, and when the pack was being removed the hole in the lateral wall of the vessel was seen and two clamps were placed on the wall so as to form a V. In this way, he obtained hemostasis. Then the kidney was removed. Because of the elasticity of the vena cava and the small size of the hole, the lateral wall was sutured below the two previously placed hemostats.

In the second case the patient had a large congenital hydronephrosis. Following the manipulation and freeing of this large sac that was adherent to the lateral border of the vena cava, the wall of the vessel was opened and a gush of venous blood occurred.

The accident was extremely hazardous, and instantly the operative field was inundated with blood. Compression by a gauze pack was established. When the gauze pack was slowly raised, the surgeon saw the longitudinal hole in the vena cava which was immediately closed by two hemostats. Because of the good result obtained by ligation in the previous case, it was thought advisable to close the rent. This was possible after a first vain attempt was made. He protected the suture line with a gauze pack and proceeded with the extirpation of the kidney. The patient had an uneventful convalescence as if the accident had not occurred. Catgut ligatures were used in both cases.

When injury to the vena cava is controlled by clamping, lateral ligation, suture of the vein, or tamponade, the level of the injury is not of importance. But when the vena cava must be ligated to control hemorrhage, the ligation must be placed below the opposite renal vein, for the great anastomosis of the efferent system of perirenal veins, the reno-azygos-lumbar venous system, provides the return circulation of the remaining kidney. The experience of many surgeons has shown that death occurs when the ligation is placed above the renal veins of the remaining kidney. On the contrary, when the ligation is placed below the renal veins of the remaining kidney, this procedure is well tolerated, and the circulation is re-established by the azygos veins, by the extrarachidic system of veins, by the venous anastomosis of the abdominal wall as well as by the spermatic or ovarian veins.

Lumbar packing has been used with success in some cases. Colombino removed a tamponade 6 days after the operation and obtained healing. Many authors believe that clamping of the vena cava and packing are the methods of choice when lateral ligation of the wound is impossible.

Cabot utilized a hemostatic clamp in 1 case and left it in place for 7 days. Gayt considered that subsequent thrombosis occurred with the same frequency when the hemostatic clamp was correctly placed, as when the suture method was used.

Pasteau considered that suture for the repair of injury to the vena cava was the best procedure. He considered packing an uncertain method of hemostatic control. Clamping of the venous wound was a rapid and usually easy procedure if the clamps were well placed. From his experience Pasteau believed that the clamps should be left in place for 4 days following surgery, and when this was done he obtained excellent results. In spite of the opinion held by Pasteau, some authors do not fully agree with him, but they believe that clamping of the opening in the vena cava is rather a method of necessity imposed by the attenuating circumstances.

In summary, the author uses gauze packing with pressure against the opening in the inferior vena cava from 5 to 7 minutes. By carefully removing the pack, the tear in the lateral wall of the vein may be seen quickly and clamps without teeth can be applied. He advises that clamps be applied in a V

position, then the injury can be repaired with either fine intestinal type catgut or linen sutures. It is prudent to leave a gauze wick in contact with the venous opening to provide a means of controlling the return of the blood flow or as a hemostatic tamponade.

CONRAD A. KUEHN, M.D.

**Ureterointestinal Implantation and Total Cystectomy for Cancer** (L'implantation urétéro-intestinale et la cystectomie totale pour cancer) HENRI GODARD. *J. urol. méd.*, Par., 1948, 54, 313.

In the past years ureterointestinal implantation has benefited by numerous improvements, the work of the American surgeons, Coffey, Higgins, Hinman, Poth, Mayo, and others.

In spite of undisputed progress, the technique of operation is not completely standardized since there are at least three modifications of the Coffey method in addition to other techniques published in the literature from abroad.

The choice of operation for cancer of the bladder is made after evaluating the patient's general health, the local pathology, and the personal preference of the surgeon.

The opponents of ureterointestinal implantation base their opinion upon the hazards of surgical intervention (peritonitis and ileus) and the renal complications of postoperative suppurative (pyelonephritis and pyelonephrosis). However, urologic surgeons believe that there will be a decrease in the frequency of these complications as the problem receives further study.

The author cites the opinion of Kirwin (*Surg. Gyn. Obst.*, 1938, 66, 998) who suggested partial cystectomy with destruction of the tumor by electrocoagulation with or without radium implantation as the treatment of choice in bladder cancer. After his experience with 3 cases, the author concluded that this method was not a satisfactory one, "for how can one accomplish the destruction of the tumor by partial cystectomy or by electrocoagulation without exposing the patient to the great risk of recurrence?"

Some good results have been obtained with x-ray and radium therapy. However, radiation therapy is difficult to administer in the proper dosage. It tends to accentuate the cystitis and in itself is not without danger.

Contact radiotherapy too has produced some good results. Darget and Duvergy treated 3 patients with large bladder tumors by contact radiation in doses of from 8,000 to 16,000 roentgen units with good results, lasting from 6 to 13 months.

If similar results are published, one might be inclined to consider this method of treatment for all tumors of the bladder. Actually, however, it is difficult to evaluate this method because it is not easily administered. It may be the method to use when it is impossible to do a total cystectomy. The author reviewed the work of Higgins (*Surg. Gyn. Obst.*, 1938, 66, 549) on total cystectomy and transplantation of the ureters into the intestines for cancer of the bladder. Higgins concluded that total cystectomy with

intestinal transplantation of the ureters is advisable for cancer at the base of the bladder, large tumors, multiple tumors, recurrent tumors, and, in particular, for those patients whose general health is good and those whose urograms show favorable function of the upper urinary tract. These patients must be without pulmonary and lymphatic metastases, however.

On the basis of his own experience and a review of the literature Godard concludes that total cystectomy for vesical cancer can be performed if the ureters are not dilated, but if they are, the ureters can be transplanted into the skin, otherwise, they can be transplanted into the intestine. In J. P. Robert's technique (Paris, 1943), the bladder is opened, the lesion is examined, and, by extraperitoneal approach, the ureters are brought to the skin. The mortality from this procedure was 15 per cent with frequency survivals of 5 to 10 years.

If the patient does not wish to accept this disagreeable infirmity of ureterocutaneous implantation, the other alternative must be ureterointestinal anastomosis.

With improved surgical technique, the gravity of this operation, it is hoped, will be diminished and the operation will not have to be abandoned.

In spite of considerable extension the tumors are frequently surgically removable.

The author then reviews the operative technique of ureterointestinal anastomosis as described by Hinman, Brenizer, Jewett, and Flocks. He concludes that the numerous techniques of anastomosis justify further research and perfection of operative methods in order to lower the number of postoperative infections.

Godard describes his method of total cystectomy and ureterointestinal implantation. The operation is divided into two stages. The first operation consists of a right colostomy with the formation of an artificial anus. Under local anesthesia a right subhepatic colostomy is done. The posterior portions of the cecum are maintained in order to facilitate closure of the cecum at a later date. A glass tube is placed into the colostomy in order to permit lavage of the colon and also to provide an outlet for the fecal stream. This procedure then allows for frequent colonic lavages and diversion of the fecal stream prior to ureterointestinal anastomosis. Godard believes this procedure reduces the infectious complications of the operation.

In about 10 days the second stage of the operation is performed. This consists of ureterointestinal implantation. The technique is much the same as that of Coffey. He uses a metal guide or a mandrin that is fastened to the end of the ureteral catheter to facilitate the passage of the catheter through the mucosa of the bowel. The trocar at the end of the catheter is picked up by inserting a resectoscope into the rectum, then the catheter is pulled through the rectum until the proper adjustment has been made. The catheter is then fastened in a trough, as in the Coffey II technique, while the distal end of the

catheter is brought out through the rectum. The same procedure is carried out on the opposite ureter. The total cystectomy is performed according to the usual technique. In the female the author removes en bloc the uterus, top of the vagina, and the bladder. The colostomy is then closed 3 to 4 months later.

In summary, the author concludes that, in spite of the dangers of the operation that cannot be completely overcome by our technique, ureterointestinal anastomosis remains the treatment of choice for cancer of the bladder and vesical exstrophy. He proposes a preliminary operation to deviate the fecal stream which improves the immediate postoperative prognosis and to a certain extent avoids renal infection until cicatrization and sphincterization of the ureters can take place. In the choice between contact radiotherapy and total cystectomy, a great deal of clinical judgment is required, but with the increasing progress of physical therapy (contact therapy, beta therapy, and injectable radioactive substances), it is possible that operative techniques will form only a minor part of treatment of vesical cancer.

CONRAD A. KUEHN, M.D.

## BLADDER, URETHRA, AND PENIS

**An Attempt at Classification of the Tumors of the Bladder** (Ensayo de clasificación de los tumores de vejiga) ARMANDO TRABUCCO *Rev. argent. urol.*, 1947, 16, 409

Tumors of the bladder may be divided basically into monoblastomas, or tumors which are thought to originate from one only of the germ layers of the embryo, and polyblastomas. The latter are rare, being made up almost exclusively of the teratomas (benign), or adult tissue polyblastomas, and dyscembryomas (malignant), or poorly differentiated tissue polyblastomas.

The monoblastomas are in turn classifiable into epithelial tumors and connective tissue (conjunctival) tumors. Each of these two categories may be again subdivided into homotypical monoblastomas, or tumors whose tissues conserve the anatomical likeness and other kinship to the parent tissue of the bladder from which they originate, and the heterotypical monoblastomas which vary in characteristics from any of the normal bladder tissues.

The homotypical, epithelial monoblastomas are, of course, composed of the various types of pavement-celled and glandular types of epithelioma, both benign and malignant. Here under the pavement-celled tumors are the papillary and infiltrating carcinomas of the bladder, and under the glandular type are the adenomas and adenocarcinomas (mucoid, colloid). The heterotypical epitheliomas include the spinous celled epithelioma, the chorioepithelioma, the cylindroma, the alantoid or alantoid tissue epithelioma, and the endometrioma, both adenomatous and carcinomatous.

The heterotypical, conjunctival monoblastomas are the histiocytic conjunctival monoblastomas, such

as the fibromas and the fibroplastic sarcomas, the muscular tissue conjunctival monoblastomas, such as the leiomyomas and the leiomyosarcomas, the vascular tissue conjunctival monoblastomas (angiomas, hyperplastic angiomas, angiosarcomas, hemorrhagic angiomas of Kaposi, endotheliomas, endothelial sarcomas, lymphomas, lymphosarcomas), and they are tentatively allowed to include the so-called neural (?) tumors (neuromas, gliomas, neurosarcomas)

The remaining tumors of the bladder are finally grouped into the class of heterotypical conjunctival monoblastomas. These are the melanomas, the rhabdomyomas and rhabdomyosarcomas, the osteomas and chondromas, the lipomas and liposarcomas, and the myxomas and myxosarcomas.

The polyblastomas are, of course, an extremely complex class of neoplasms and no attempt is made to subclassify them.

JOHN W. BRENNAN, M.D.

**The Diagnosis and Therapeutic Indications in Tumors of the Bladder** (Diagnostico e indicazioni terapeuticas en los tumores de vejiga) ARMANDO TRABUCCO and CONSTANCE COMOTTO *Rev argent urol* 1947, 16 399

In discussing the clinical symptoms, and cystoscopic and roentgenologic findings of value in determining the type and degree of malignancy, and consequently the methods of therapeutic procedure to be instituted, the authors divide the findings to be evaluated into six general categories. The first is devoted to the palpation of the empty bladder, the second to the type of vesical hemorrhage, the third to the cystoscopic findings in the tumor and the peritumoral zones, the fourth to the curability (or otherwise) of the inflammatory processes when they are present concomitantly with the tumor, the fifth to the roentgenographic images discernible with cysto-roentgenography, and the sixth to the general condition of the patient.

Palpation will disclose any inflammatory processes and tumorous infiltrations of the bladder walls. The inflammatory processes are prone to manifest themselves as pericystic adhesions, and, if extensive and tough, suggest malignancy of the tumor process and inoperability. Induration of the bladder wall also suggests a malignant character of the new growth, but pliability and resilience of the wall suggest benignity and curability by endovesical means.

When the hematuria is inconstant, not occurring very frequently and being easily affected by treatment, the tumor is benign, when the bleeding begins suddenly and is capricious and intractable the neoplastic process is apt to be malignant.

When the cystoscope reveals an intracystic growth, be it pedunculated (benign) or sessile (malignant), which is surrounded by a normal appearing, non-inflamed, noncongested, mucosa, the entire process is apt to be benign. When the peritumoral reaction is marked it indicates that the growth is extremely malignant and no time can be lost with conservative measures. The entire inside of the bladder can be

seen with the cystoscope and a general inflammatory appearance will speak for malignancy. The exact extent of the new growth will be revealed by the cystoscope, and its unilocular or multilocular character suggests malignancy.

The frequency of urination during the day and night, which is not influenced by general measures, chemotherapy, or the local treatment of the bladder, as one would expect in simple bacterial inflammation, is a grave sign. The pollakiuria, painful micturition and stranguria may be produced either by the infiltration and irritation of the nerve centers of the bladder wall, or by a general infiltration of the whole or greater part of the wall, which renders the organ inflexible and of small capacity. These symptoms become especially pronounced when the growth invades the region of the bladder neck and trigone.

All roentgenographic procedures should be preceded by a simple roentgen exposure, without contrast medium, to reveal any foreign bodies or calcareous deposits. The filming with contrast methods includes, of course, descending pyelography, which in cases of bladder tumors is invaluable for determining the length of the intramural portion of the ureter and thus the amount of periureteral neoplastic infiltration, as well as the retrograde filling of the vessel through the cystoscope or catheter with contrast medium or gas. The normal bladder wall gives a very thin line on the roentgenogram and any thickening or irregularity of contour indicates both the malignant character and the extent of infiltration of the tumor. Of course, the unilocular or multilocular character can be seen on roentgenoscopy, the pedunculated masses will appear as central shadow defects, accompanied perhaps by a lighter band indicating the peduncle. Roentgenologic examination when used in conjunction with other methods will always help in the determination of the grade of operability and curability of the tumor.

The general condition of the patient is not discussed at length since it is usually good until the cancerous process is far advanced, when metastases or profuse hemorrhages lead to the cachexia typical of cancer, without the prospect of any cure whatever.

JOHN W. BRENNAN, M.D.

**The Relation of Transitional Cell Buds, Golgi Apparatus, and Mitochondria to Carcinoma of the Bladder** ALBERT E. BOTHE and DAVID S. CRISTOL. *Am J Roentg*, 1948, 60 535

These authors simplify the classification of bladder tumors into pedunculated and nonpedunculated (or flat) types. Tumors of the first type are papillary, tumors of the second type are infiltrating. The small papillary growth, pedunculated and low grade, is best treated by transurethral fulguration followed by periodic cystoscopic re-examination. Up to the present time transurethral fulguration with insertion of one radon seed at the site of the pedicle has not been evaluated, the results of irradiating the recurrent growths from previously fulgurated tumors in this group also remain to be evaluated. In cases in



which multiple papillary growths of relatively low grade are found, extensive fulguration down to the muscle through a cystostomy, followed by radon seed implantation, seems to be the best method of management. Frequent re-examinations of the bladder should be performed. In cases in which flat infiltrating tumors are present, the extent of the infiltration should be determined by means of pneumocystography and bimanual examination of the bladder under anesthesia. The results of segmental and total cystectomy remain to be evaluated.

The authors studied the distribution and arrangement of transitional cells, and a cytological study was made of the Golgi apparatus and mitochondria found in malignant and nonmalignant cells of the bladder mucosa. The submucosal epithelial buds in the transitional cell-covered tissues of the bladder, described by von Brunn in 1893, appear to be susceptible to growth activity. The early changes in bladder tumors which first involve the submucosal epithelial supporting tissue are inflammatory in type. These changes are followed by proliferation of the basal layer which eventually becomes papillary or infiltrating. The anatomical distribution of these cell nests may be closely associated with bladder tumors, the multiplicity of the epithelial buds in the renal pelvis, ureters, and bladder is in accord with, and very suggestive of, the source of subsequently developing tumors, and the latter probably develop from these epithelial cell nests. If this (unproved) hypothesis is true, how may these immature imperfectly differentiated cell nests be rendered inactive or unsuceptible to growth? On the basis of 5 case histories, the authors believe that roentgen therapy may change these epithelial cells so that the tissue is less susceptible to carcinogenic irritation.

In vesical epithelial cells the Golgi apparatus usually lies in the cytoplasm distal to the nucleus (between the nucleus and free surface). In 15 specimens of bladder tumor there was a reversal of the Golgi apparatus, they were present away from the nucleus membrane and were increased in size. In some, the mitochondria showed an increase in number and a decrease in size, in others, the reverse was true.

The authors conclude that if the tissues susceptible to activation by carcinogenic agents are the immature buds, irradiation of the urinary tract postoperatively (areas covered by transitional epithelium) may arrest or prevent the activation of cell buds.

DAVID ROSENBLUM, M D

**Our Initiation into the Field of Total Cystectomy**  
(Nuestra iniciación con la cistectomía total) FRANK A HUGHES *Rev argent urol*, 1947, 16 345

Six patients were cystectomized by the author in Montevideo, Uruguay, during the past year. The operation was attempted for infiltrating malignant tumor located in the neck and trigone of the urinary bladder. Three of the patients died within a short period following the operation—2 from complications ascribable to the operation itself, and 1 from extension of the neoplastic condition. Three are still liv-

ing, 2 of these after a year and 1 after only a few months following the operation but in excellent general condition. The operation was attempted in each case for the alleviation of suffering and for intractable bleeding. However, the intention in each case was the total removal of the neoplastic mass.

The actual removal of the bladder and prostate gland has proved less troublesome than the preliminary implantation of the ureters into the sigmoid. In the first patient the attempt at ureterosigmoidostomy failed and the implantation of the ureter was made into the skin. A second attempt by the technique of Jewett (*J Urol*, Balt, 1939, 49 34) also failed and resulted in the loss of the patient. In the subsequent cases this method of implantation was abandoned in favor of the classical technique of Coffey I. This technique was carried out extraperitoneally in 3 cases and intraperitoneally in 2. The implantation of the left ureter was carried out through the left paracolic space in 2 instances with failure of drainage of this ureter and loss of the left kidney function in each case. In subsequent patients the implantation of the left ureter was accomplished into the medial aspect of the sigmoid intraperitoneally by passing the ureter through the mesosigmoid. The 1 living patient in whom this technique was used showed no noticeable loss of renal function.

The ultimate fate of these living patients is, of course, problematical, however, the operation is believed to be a logical one since the great suffering and disability of the patient is largely relieved and the cancers of the urinary bladder are, on the whole, slow to generalize. Metastases are very rare as long as the tumor has not penetrated the muscular layer of the organ.

JOHN W BRENNAN, M D

## GENITAL ORGANS

**Blood Loss in Open Prostatic Surgery** ALBERT E GOLDSTEIN and SEYMOUR W RUBIN *J Urol*, Balt, 1948, 60 743

The authors have utilized the technique of photoelectric measurement of hemoglobin to determine the blood loss in the operating room in a series of 48 consecutive open prostatectomies. The entire operating room equipment which had contacted blood was washed in a solution of 0.4 per cent ammonium hydroxide of measured amount, the solution thoroughly mixed, the concentration of hemoglobin determined, and this figure corrected for the patient's own preoperative blood hemoglobin concentration, so that the result would be expressed in terms of cubic centimeters of blood lost.

In 16 cases of two-stage suprapubic prostatectomy performed, the smallest blood loss in the first stage was 3 c.c., the largest 102 c.c., and the average 34 c.c. In the second stage, the smallest loss was 19 c.c., the largest 569 c.c., and the average 157 c.c. The combined average was thus 191 c.c.

The smallest amount of blood loss during 5 one-stage suprapubic operations was 137 c.c., the largest 381 c.c., and the average 278 c.c.



Perineal prostatectomy was performed in 27 cases with radical removal in 4. The smallest blood loss in the conservative group was 128 c.c. the largest 1307 c.c. and the average 403 c.c. The average loss in the 4 radical cases was 1,131 c.c. The blood loss in 8 cases of retropubic prostatectomy averaged 403 c.c.

The authors present the view that although more blood was lost in the perineal procedures, the patients were less shocked than the patients who lost less blood during suprapubic procedures. The authors believe that the position of the patient, length of time of operation, handling of the tissues, and balance of the body fluids all play a part in the production of shock.

JOSEPH E. MAURER, M.D.

### Testicular Tumors Seminoma and Teratoma

ROBERT E. SCULLY and ASA R. PARHAM *Arch Path., Chic., 1948, 45: 581*

The author's study is based on a review of 37 cases of testicular tumors from the files of the department of pathology of the Peter Bent Brigham Hospital, for the period from 1914 to 1947.

Tumors of the testicle comprise 2 per cent of all cancers in males. They occur at any age, usually between the ages of 20 and 30 years. Approximately one of every 8 of these tumors is located in a cryptorchid testicle. Rarely a testicular tumor is bilateral. A history of trauma had been reported in from 20 to 68 per cent of cases, but most authors have minimized its significance as an etiological factor.

Testicular tumors metastasize primarily by way of the lymphatic channels. These, for the greater part, drain directly into the abdomino-aortic nodes, which extend from the bifurcation of the aorta to the level of the renal veins. There is widespread anastomosis between both sides. The abdomino-aortic nodes drain into the lumbar tracts, which ascend through the aortic hiatus of the diaphragm to the thoracic duct. There may be one or more channels from the testis that drain directly into the mediastinal nodes. Enlargement of the inguinal nodes indicates invasion of the parietal tunic and the scrotum. Blood stream metastasis likewise is common and occurs most frequently in the lungs, but may be widespread.

Patients with testicular tumors usually excrete measurable quantities of gonadotropins in the urine. Two distinct types have been identified: the first type of gonadotropin is biologically similar to the pituitary gonadotropin and the second type is biologically identical with the chorionic gonadotropin of pregnancy. In a certain number of cases the titer of chorionic gonadotropin is sufficiently high to justify an Aschheim Zondek or Friedman test of the conventional type for pregnancy.

In general the classification of testicular tumors has been based on one of two theories of pathogenesis, neither of which has been supported by convincing evidence. It was stated that (1) all the common testicular tumors are forms of teratoma and (2) the histologically uniform neoplasms represent the delayed development of teratoma. These authors con-

cluded that this histologically uniform tumor which he named "seminoma" because of its supposed origin from the seminiferous tubules, is a distinct tumor not arising from a teratoma.

The authors have retained the term "seminoma" because of its universal use for the common histologically uniform monocellular neoplasm. The term "teratoma" is used to designate a tumor arising from a cell which has the capacity to form structures normally derived from the three embryonic germ layers. There are two subtypes: one is characterized by the presence of neoplastic structures representing two or more germ layers, the other (the monodermal variety) is characterized by a type of tumor tissue foreign to the testis, the presence of which is best explained by regarding it as a one-sided neoplasm of a cell with totipotential capacities.

1. Seminoma (embryonal carcinoma)
2. Teratoma (embryoma)
  - (a) Histologically cancerous
  - (b) Histologically benign (adult teratoma)
3. Interstitial cell tumor
4. Miscellaneous group

The results of the conventional Aschheim Zondek and Friedman tests are usually negative in cases of seminoma. The seminomas constituted 46 per cent of testicular tumors. Testicular enlargement was the presenting symptom in 12 of 14 cases of seminoma. The incidence of metastases in case of seminoma is controversial. In the authors' series 4 of 14 patients had metastases at or within one month after entry to the hospital; in the remaining 10 patients, the tumor metastasized subsequently. Usually involvement of the abdominal or cervical lymph nodes gave the first indication of tumor spread; terminally, widespread blood borne metastases were common. The histological structure of the metastases in all cases examined was identical to that of the primary tumor.

The striking x-ray sensitivity of seminoma has been noted by numerous authors. Scully and Parham indicated that the good prognosis of seminoma in their cases was in accord with the experience of numerous other investigators.

The typical specimen of histologically cancerous teratoma is a circumscribed, firm mass which has enlarged and replaced all or the greater part of the testicle. Microscopically, the tumor is composed of an intimate mixture of teratomatous and cancerous neoplastic tissue.

Testicular teratoma may arise from (1) totipotent sex cells or their embryonic products or undergo as a type of neoplasia due to parthenogenesis, (2) intratesticular inclusions of totipotent primitive embryonic cells (blastomeres). The former variety is far more likely in view of the predictive value of tumor for the sex gland, and the distinctive features of teratoma in this location compared with extra-genital teratoma.

Histologically, cancerous teratoma is characterized by the presence of the excretory apparatus of the sex gland and the distinctive features of the tumor cells.

amounts of trophoblastic neoplastic tissue giving the highest titers. Histologically, cancerous teratomas constituted 43 per cent of tumors in this series.

Numerous authors have observed that these tumors tend to metastasize rapidly and that early blood stream dissemination is frequent. This impression was borne out in the authors' series. The radioresistance of cancerous teratoma has been noted by numerous authors and this was again borne out by the authors' series of cases.

Histologically, benign teratoma may fall into one of three ill defined subtypes (1) organized teratoma, (2) unorganized teratoma, (3) simplified teratoma. An organized teratoma is a rare complex tumor in which rudimentary organs are formed and may be so arranged as to resemble a malformed fetus. In the unorganized teratoma neoplastic structures of bi-dermal or tridermal origin appear in disorderly arrangement in an attempt at organ formation. Simplified teratoma is the monodermal form. Its most common variety is the epidermoid cyst, and less frequently encountered is the dermoid cyst. Often it is found that histologically benign teratomas have metastasized. The secondary deposits may show histologic structure of cancerous teratoma or embryonal adenocarcinoma. Quantitative studies in a small series of cases have revealed little or no increase in excretion of gonadotropins in the urine of patients who have these tumors. The metastases of histologically benign teratoma have been stated to be radio-resistant.

In summary, the author states that over 95 per cent of testicular neoplasms fall into two classes: seminoma and teratoma. The seminoma apparently arises from a primordial germ cell. Its histological uniformity is due to the inert characteristic of its cell which appears incapable of differentiation. The tumor usually grows relatively slowly, metastasizes late, and principally by the lymphatic route. It is highly radiosensitive and occasionally radiocurative. The testicular teratoma apparently arises from the totipotent sex cell or from one of the embryonic predecessors of this cell. Histologically, it may run the gamut from a highly undifferentiated embryonal neoplasm to a mature teratoma showing no microscopic evidence of cancer. The tumor characteristically grows rapidly and metastasizes early, commonly by way of the blood stream. It is rarely radiosensitive, and almost never radiocurative. Occasionally seminoma and teratoma grow side by side, and occasionally they may become intimately mixed. The article contains many excellent illustrations of the types of tumor described by the authors.

CONRAD A. KUEHN, M.D.

#### MISCELLANEOUS

**Renal Response to Thermal Stimulus** L. D. OBELL,  
G. T. ARACON and R. C. SMITTER *Am J Obst*,  
1948, 56 835

The authors report their findings of renal activity following a 15 minute immersion of one hand or a

foot in an ice water bath at a temperature of one degree centigrade. This test was carried out on 33 women—22 with toxemia of pregnancy, 1 woman with a glioma of the spinal cord during pregnancy, 1 with diabetes insipidus during pregnancy, and 9 nonpregnant women.

The results show a decreased flow of urine, an increase in the specific gravity of urine and, in some instances, a change in protein excretion per minute. Variations in systolic and diastolic blood pressure accompany this experience but do not correlate, in the degree of the response, with the protein excretion per minute.

The fetal heart rate does not vary significantly. Maternal pulse and respiratory rates tend to decrease.

Experiments conducted under anesthesia indicate that ice immersion may stimulate the liberation of an antidiuretic hormone. The site of liberation is probably not within the immersed limb or the kidney, it appears to be above the level of the fourth cervical. The phenomenon is not abolished by inhalation anesthesia. The site of liberation may be the posterior pituitary gland.

JOHN R. WOLFF, M.D.

#### Neuromuscular Dysfunction of the Urinary Tract

JAMES C. KIMBROUGH, DAVID K. WORGAN, and JOHN N. FURST *J Urol*, Balt., 1948, 60 780

The authors present 6 cases of neurogenic dysfunction of the urinary tract. All of the patients had atony of the bladder and ureters with hydronephrosis, all patients complained of abdominal symptoms prior to urological investigation, a diminished renal function, varying from moderate to extreme, was observed in all cases. In none of these patients was a sensory or motor impairment found upon general neurological examination, and none demonstrated idiopathic dilatation of the intestine.

The treatment administered by the authors in the cases presented included ureteral meatotomy, transurethral resection of the vesical neck, presacral neurectomy, and renal sympathectomy. Measures to control infection in the urinary tract were instituted.

The need for careful follow-up therapy in all cases of neurogenic dysfunction of the urinary tract is stressed. The opinion is mentioned that hydronephrosis without tortuosity of the ureters is suggestive of neurogenic disease.

JOSEPH E. MAURER, M.D.

**Urinary Tuberculosis** REED M. NESBIT and A. WAITE  
BOHNE *J Am M Ass*, 1948, 138 937

The authors contend that all patients with either unilateral or bilateral renal tuberculosis should receive prolonged sanatorium care and streptomycin therapy.

This contention is supported by the following pertinent facts:

1. A patient in whom ulcerative lesions eventually healed on this regimen is cited in refuting the claim of other authors that only very early renal tuberculosis can be cured with streptomycin.

2 Reference is made to the exhaustive pathologic studies by Medlar who examined serial sections of the kidneys from individuals who died of pulmonary tuberculosis and found that bilateral cortical infections were present in all the kidneys

3 Combined statistics from the Squier Clinic, New York, the Mayo Clinic, Rochester, Minnesota, and the University Hospital, Ann Arbor, Michigan, reveal that only about half of the patients can be cured by nephrectomy, even when the operation is done under ideal circumstances

The use of very small doses of streptomycin for short periods with the hope of avoiding toxicity is condemned. Although optimal dosage and duration remain uncertain, the authors recommend 20 gm of streptomycin daily for 60 days. At the end of this time, complete studies of the urine and retrograde pyelograms should be made. If these show evidence of healing, the treatment should be continued for an additional 60 days. If the 60 day survey reveals no improvement, nephrectomy is justified but should be followed by 60 days of streptomycin therapy. All patients should have a minimum of 6 months of sanatorium care

ORMOND S. CULP, M.D.

#### **Tumor and Superimposed Cyst of the Urachus** (Tumor y quiste supurado del uraco) José S. DORTA *Rev argent urol*, 1948, 17: 174

The case reported by the author was that of a 59 year old male who complained of a indurated area in the midabdominal line from the umbilicus to the symphysis pubis. There was dense subcutaneous fat underlining the region which was very tender and which made palpation difficult. Cystoscopy revealed an infiltrating tumor in the dome of the bladder. This suggested the diagnosis of urachal cyst superimposed upon a vesical tumor.

Operation was performed and both masses were removed *in toto*, including resection of the umbilicus and the dome of the bladder. Convalescence was uneventful and was followed by deep roentgentherapy. The tumor was of an intramural type and has shown no evidence of recurrence either in the abdominal portion or in the bladder.

STEPHEN A. ZIEMAN, M.D.

#### **Cancer of the Urachus (Cancer del uraco)** RICARDO ERCOLE *Rev argent urol*, 1948, 17: 193

Cancer of the urachus is a rare disorder. There are apparently only 164 cases of this condition on record. It is a disease of adult life and usually involves the dome of the bladder. For this reason therapy involves bladder surgery.

The case reported is that of a 64 year old male who complained of pain in the hypogastrium, burning on urination, and polyuria. Only on cystoscopic examination was the presence of a tumor observed. This was a sessile, ulcerated fungoid mass in the dome of the bladder, a section of which was removed for biopsy. The pathologic report returned gave a diagnosis of cylindrical papillary epithelioma with origin in the epithelial rests of the urachus.

The author calls attention to the fact that tumors in the upper regions of the bladder may well be of urachal origin and must be differentiated from primitive adenocarcinoma of the bladder. The latter, it is stated, arise from the bladder mucosa and secondarily invade the muscle layer, whereas urachal tumors invade the muscular layer primarily and the mucosa only secondarily. Treatment consists in resection of the tumor, which may include the dome of the bladder or even complete cystectomy and removal of all umbilical tissue if the extension of the growth demands it.

STEPHEN A. ZIEMAN, M.D.

# SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

## CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC

**Legg-Perthes' Disease A Syndrome of Many  
Etiologies?** S Z DRAZNIN and KARL SINGER.  
*Am J Roentg*, 1948, 60 490

This disease was first described by Legg and independently by Waldenstrom in 1909, and in 1910 by Calve and Perthes. The latter gave a more clear-cut description of the clinical picture and the roentgenographic findings. Among the names given to the disease are osteochondritis deformans juvenilis, pseudocoaxalgia, quiet disease of the hip, osteochondrosis, and coxa plana. Gill has expressed the belief that the primary location of the disease is in the metaphysis of the neck rather than in the capital epiphysis.

Among the etiological theories advanced are the following: traumatic, infectious, congenital stigmata, unrecognized congenital dislocation, rickets, rheumatic, endocrine, embolic, vascular, familial osteochondritis, similar to Koehler's disease, and alterations in the calcium-phosphorus metabolism. Gill states that it is doubtful that all types of osteochondritis deformans juvenilis are manifestations of the same pathologic process. The condition is often mistaken for acute osteomyelitis or tuberculosis of the hip joint.

The authors have added Gaucher's disease to the list of etiologic factors. They present a case of proved Gaucher's disease which had been followed up for 18 years. The patient presented the roentgenographic features of Legg-Perthes' disease.

DANIEL H. LEVINTHAL, M D

**Diffuse Inflammation of Cartilage A Case Report  
of a Hitherto Unreported Entity** EVERETT J  
GORDON, AARON W PERLMAN, and NATHAN  
SHECHTER *J Bone Surg*, 1948, 30-A 944

This comprehensive report of a case of diffuse inflammation of cartilage observed over a period of 3 years is considered most unusual in that no diagnosis has been made in spite of extensive pathologic studies.

A 34 year old negroess first complained of a productive cough and dyspnea. Roentgenograms of the chest showed no evidence of tuberculosis. After several months, swelling and tenderness of the knee and ankles was observed, with remissions and exacerbations, sometimes febrile. Swelling of an eye and both ears, and increasing cough and hoarseness ensued. Hospitalization failed to yield a definite diagnosis, although exhaustive studies were carried out. Fluid aspirated from the involved knee joint did not yield organisms, and sulfamerazine therapy did not influence the clinical picture. Tracheotomy was necessary in patients with severe obstruction due to chondritis of the tracheal rings.

A 2-plus Kahn test led to antisyphilitic therapy of potassium iodide and bismuth in oil. A total of 1,320,000 units of penicillin was administered. On x-ray examination the left knee and both ankle joint spaces showed narrowing. Episodes of iritis and conjunctivitis recurred repeatedly. There was persistent tender swelling of both ears and of the bridge of the nose. Remissions and exacerbations continued in the various affected areas.

Because of extreme pain from the slight motion residual in the left knee, arthrodesis was undertaken, following which the patient failed to respond. Autopsy was not secured.

Careful studies of cartilage taken from the various sites affected have been made by several pathologists. Nothing more conclusive than "diffuse chondritis and perichondritis" has been determined.

FRANCES E. BRENNKECKE, M D

**Tenosynovitis of the Extensor Carpi Ulnaris Tendon  
Sheath** DOUGLAS D. DICKSON and CLARENCE A  
LUCKEY *J Bone Surg*, 1948, 30-A 903

Nonsuppurative tenosynovitis of various tendon sheaths of the hand, frequently the extensor pollicis brevis or abductor pollicis longus, is described. Tenosynovitis of the extensor carpi ulnaris tendon sheath is here presented as a clinical entity proved by surgery in 6 cases.

The history usually dates from a twisting injury to the wrist, followed by pain deep in the wrist joint, which may be aggravated by all wrist motions. There may be swelling about the distal ulna and sensory disturbance along the dorsal cutaneous branch of the ulnar nerve. Examination shows tenderness along the tendon and may elicit grating in the sheath with motion. Resisted motion defines the pain more readily.

Pain which persisted or remained in spite of varying periods of wrist immobilization led to surgical exploration of the 6 cases presented. Edema of the subcutaneous tissues surrounding the dorsal branch of the ulnar nerve was a constant finding. The dorsal carpal ligament was sectioned to show the extensor carpi ulnaris tendon sheath within which the synovia was thickened, and many new vessels were present. The tenosynovitis was most marked in the snug portions of the sheath, i.e., the channel on the ulna, and at the insertion.

Probably hemorrhage within the tendon sheath produces the nonspecific inflammatory reaction in the synovia.

The diagnosis of tenosynovitis should be suspected when the patient complains of pain deep in the wrist. Opening of the fibrous tunnel throughout its length would probably relieve the symptoms, although in these cases the thickened synovia and granulations were removed in addition.

FRANCES E. BRENNKECKE, M D

## SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC

**The Treatment of Compound Injuries of the Knee Joint** (Zur Behandlung offener Kniegelenksverletzungen) JOHANNES VOLKMANN *Chirurg*, 1948, 19 343

In cases of compound injuries of the knee joint in which x-ray facilities are unavailable the joint is left open. The knee is splinted, aspirated, and irrigated with a sulfonamide compound. The joint may stay open up to 36 hours without any harmful effects.

As soon as a well equipped operating room is available a tourniquet is applied to the leg under general anesthesia and an incision is made similar to the one used in meniscectomy. The wound is debrided with 1 to 1,000 ravinol. The synovia is closed tightly with catgut and the capsule is united with cotton sutures. The skin may be left open or is loosely sutured. No drain is used. A long leg cast is then applied. Sulfanilamide is given by mouth. Mobilization of the leg is begun as soon as the condition improves. First the foot is left free and then the hip, and finally the cast is removed entirely.

In cases in which conservative treatment fails, 4 wide incisions are made over the knee joint. Once the infection has subsided, closure of the wound is attempted.

GEORGE I. REISS, M.D.

## FRACTURES AND DISLOCATIONS

**Intracapsular Fractures of the Neck of the Femur Follow-Up Report of 130 Patients Treated by Internal Fixation with the Smith-Petersen Nail** CHARLES S. NEER and HARRISON L. McLAUGHLIN *Am J Surg*, 1948, 76 528

The authors review 130 consecutive intracapsular hip fractures treated on the Fracture Service of the Presbyterian Hospital, New York, between 1932 and 1944. True intracapsular lesions occurred in approximately 50 per cent of all hip fractures. A Smith-Petersen nail was used in each case. Fractures of more than 2 weeks' duration were excluded.

Every hip fracture was considered an acute emergency. Operation was usually performed within 1 or 2 hours, and in 80 per cent of the cases within 6 hours of admission. Impacted valgus lesions were nailed without reduction or visualization of the fracture. All displaced fractures were reduced prior to fixation. In 73 cases this was done under direct vision and in 31 cases under roentgenographic control. Subcapital oblique fractures proved to be the most difficult to reduce and frequently could not be reduced adequately by manipulation alone. The authors have developed a policy of modifying the lesion so that the line of fracture approaches the horizontal plane. Following operation, 65 per cent of all the patients were allowed out of bed within 24 hours. Those physically able to use crutches began to walk without weight-bearing in a walker about the fourth postoperative day and were promoted to crutches as rapidly as they could tolerate them.

The authors believe that the morbidity constantly diminished in direct proportion to the speed and efficiency with which stabilization of the fracture was carried out. The mortality was divided into three categories: (1) operative mortality, including deaths from any cause during the first 30 days following operation (there were 2 deaths in this group, 1 from a pulmonary embolism 28 days after operation, and 1 from cardiac failure 4 days after operation), (2) mortality related to injury, including deaths related to the injury occurring within 9 months of operation, (there were 2 deaths in this group, 1 at 4 months, from pulmonary embolism, and 1 at 7 months, due to infection of the hip and pneumonia), (3) mortality unrelated to injury, including all deaths from unrelated causes between the end of the first month and the ninth month (there were 8 in this group: 3 cardiac infarctions, 2 cerebral accidents, 1 malignancy, 1 renal failure, and 1 suicide).

There were 26 cases of impacted valgus fractures. There were no deaths or wound infections in this group. The average hospital stay was 14 days, and the average weight-bearing time 5 months. Twenty-three cases (92%) were followed up adequately, and among these there were no nonunions, 3 cases of mild necrosis, and 1 case of severe necrosis. "Mild" necrosis indicates avascular changes affecting only the roentgen texture of the femoral head. "Severe" necrosis indicates changes pronounced enough to change the shape or contour of the femoral head. The term "arthritic change" tends to confuse the issue and is omitted.

There were 104 cases of displaced fractures. The operative mortality was 1.3 per cent in 73 cases treated by open reduction and 3.2 per cent in 31 cases treated by closed reduction and lateral nailing. Closed reduction and lateral nailing constantly required more time than open reduction and nailing under direct vision. It was also a constant observation that (1) regardless of the characteristics of the fracture, reduction and fixation were accomplished more certainly and accurately when carried out under direct vision, and (2) this unselected group of patients withstood the effects of open reduction as well as, if not better than, manipulative reduction and blind nailing.

The early complications of 73 displaced fractures treated by operation were: poor reduction (15%), serious infection (1 case), trivial infection (8%), and loss of fixation (15%). The early complications of 31 cases treated by closed reduction and lateral nailing were: poor reduction (45%), trivial infection (10%), and loss of fixation (7%).

There were 21 cases of nonunion in 101 displaced fractures (72% of all the nonunions were in the subcapital fractures). Among 73 displaced fractures treated by open reduction, there were 16 cases of nonunion. Eleven were attributed to poor reduction, 2 to poor fixation, 2 to too early ambulation with weight-bearing, and 1 case to failure of the local circulation. Among 31 displaced fractures treated by closed reduction and lateral nailing, there were 5

cases of nonunion. Four were considered to be due to poor reduction and 1 was due to poor fixation.

In determining the number of cases of avascular necrosis, 18 months were considered to be the minimum adequate follow-up period. Thus, only 74 of the 104 displaced fractures were considered. Forty-two per cent of the healed fractures treated by open reduction and 54 per cent of those treated by closed reduction and lateral nailing subsequently developed aseptic necrosis. Eleven months was the average interval between operation and demonstrable early avascular changes. In spite of the much higher proportion of subcapital fractures in the open reduction group, the incidence of aseptic necrosis remained consistently less than in the simpler cases treated by closed reduction. This finding contradicts the widespread impression that open reduction contributes to avascular necrosis.

In 18 cases observed between 1933 and 1937 a flap of rectus femoris or vastus lateralis muscle was inserted into a decorticated area on the anterior surface of the head and neck of the femur in the hope that it would increase the local blood supply to the head fragment. The results of analysis of 13 suitable cases warrant little optimism that the procedure was of any help in preventing aseptic necrosis or of any aid in the healing of the fracture.

The authors consider these results discouraging and humbling. Almost every poor surgical result was found to be due to some controllable defect in the technique of therapy. Although the patient was satisfied in 86 per cent of the cases treated by open reduction and 92 per cent of those treated by closed reduction and lateral nailing, the surgeon was satisfied in only 25 per cent of the former and 20 per cent of the latter.

The authors arrive at the following conclusions:

1. The best time for reduction and fixation of a hip fracture is immediately after the fracture.
2. Good treatment for impacted valgus fractures of the femoral neck is internal fixation and as little confinement to the bed as possible.
3. Open reduction, properly done, is surer, less time consuming, and no more dangerous than closed reduction and blind nailing.
4. Open reduction does not increase the incidence of subsequent aseptic necrosis.
5. Results are known only after objective evaluation.
6. Almost all the bad results of hip nailing are still the results of bad hip nailing.

JOHN J. CRANLEY, JR., M.D.

**General Conceptions of Pseudarthrosis. Statistical Considerations.** (Concepto general de pseudoartrosis. Consideraciones estadísticas) OSCAR R. MARÓTTOLI. *An. Chirurg.*, Rosario, 1948, 13: 23.

During the period from 1943 to 1946, at the public hospital in Rosario, where the injured are brought directly for immediate treatment, 7,654 fractures were supervised continuously during the entire period of healing. Only 0.1 per cent of this number

presented pseudarthrosis. In the author's private practice, on the other hand, the pseudarthroses were much more numerous. They occurred mostly in patients who had been originally treated on other services. In the author's material the fractures most prone to develop pseudarthrosis were those of the neck of the femur and of the carpal scaphoid bone.

True pseudarthroses may be roughly classified into (1) those which do not consolidate because of the absorptive processes in the ends of the bony fragments (the author ascribes these to the excessive congestion and dilatation of the blood vascular system and states that these pseudarthroses will heal without further trouble, as a rule, when properly immobilized), and (2) the fractures which fail to consolidate because of poor blood supply. These pseudarthroses will not heal, as a rule, because of the eburnation and occlusion of the marrow cavity of the fragments, and the line of fracture and the bone ends will have to be removed surgically.

The author concludes, from his own experience and from a study of the literature, that the fractures most resistant to the processes of consolidation are those which are most difficult to immobilize properly, and that the development of the pseudarthrosis is largely a result of improper treatment methods. Certainly there is nothing about fractures of the neck of the femur and of the carpal scaphoid bone which suggests that they would not heal as readily as other fractures if they could be sufficiently retained during the period of consolidation.

JOHN W. BRENNAN, M.D.

**The Experiences and Results of Various Operations for Habitual Dislocation of the Shoulder** (Erfahrungen und Erfolge bei den verschiedenen Operationsmethoden der habituellen Schulterluxation) OSWALD ADAM. *Chirurg*, 1948, 19: 368.

This article is based on 23 operations. Ten shoulders were operated on according to the Eden-Hybenette method, which consists of an insertion of a tibial graft anterior to the humeral head. Nine shoulders were operated on according to the Loeffler-Joseph method (modified Nicola) and 3 according to the technique described by Heymanovitch which is very similar to the Nicola operation. There was only 1 case in which only the capsule was tightened. The author concluded that the Eden-Hybenette method of repair gives the best results.

GEORGE I. REISS, M.D.

## ORTHOPEDICS IN GENERAL

**Estrogens and Bone Formation in the Human Female.** MARY S. SHERMAN. *J. Bone Surg.*, 1948, 30-A: 915.

A review of the literature on the relation between blood calcium levels and ovulation in birds and small mammals introduces an interesting case study. Interrelation of estrogens and bone growth in human females is known to exist but its mechanism is not understood. Postmenopausal osteoporosis has been

established clinically by Albright as a hormonal deficiency influenced by the injection of estrogens, without demonstrable increase in bone density. A spectacular variation in bone density during the administration of estrogens is demonstrated.

The woman was perfectly well until the age of 54, when the right tibia began to bow. Soon thereafter, while jumping rope (!), the left knee was injured. Roentgenograms were interpreted as showing Paget's disease but no fracture. Later in the same year the patient suffered a fracture of the lower right femur with moderate trauma, and she became bedridden because of the fracture and increasing bone pain. Deafness began to develop. Subsequent roentgenograms showed changes in the skull, pelvis, femurs, right tibia, and right humerus. The condition was diagnosed as parathyroidism and two parathyroid glands were removed, but the patient's condition continued unchanged.

During the next 2 years she was bedridden with agonizing bone pain, multiple fractures, cramps, and muscle twitching. At the age of 58 years she was admitted to the University of Chicago Clinics. Anesthesia was needed to control pain so that roentgenograms could be taken. Clinically, the right leg seemed boneless, and roentgenograms scarcely demonstrated the tibia, while the extremely osteoporotic femur presented multiple fractures.

Extensive studies, particularly on calcium excretion, were carried out and a biopsy of affected bones was secured. Beyond a marked decrease of bone substance, these specimens were not remarkable. On the basis of the data assembled, i.e., normal blood calcium and phosphorus, low urine calcium, and a normal histological picture, a diagnosis of Paget's disease with superimposed postmenopausal osteoporosis was entertained. (The patient had a surgical menopause 17 years earlier.)

Massive doses of estrogenic hormone gave a rapid change of clinical picture in 3 days, and after a month the patient sat in a chair for meals. Roentgenograms at one month showed well defined bones in the right leg with abundant callus healing of the fractures in the femur. Biopsy specimens affirmed this reconstitution of bone. Withdrawal of estrogen therapy promptly produced an exacerbation of symptoms which receded on resuming the estrogen therapy. A maintenance dose was worked out, and the patient has been kept on that for a period of 2 years, with no untoward symptoms.

FRANCES E. BRENNKE, M.D.

#### A Study of the Longitudinal Arch of the Foot A. K. BASU *Ind J Surg*, 1948, 10: 255

The influence of postural tone on the longitudinal arch of the foot is not clear. Postural tone is a state of continuous contraction of certain skeletal muscles which maintain the position of posture. This tone is a system of reflexes, whose afferent impulses originate in the sense organs of a group of muscles, aided by the eyes and vestibular apparatus. Exact anatomic localization of the center is equivocal, but it

may be found in the red nucleus and in the rubro-spinal tract.

Collapse of a longitudinal arch is predicated upon the superimposed dead weight and/or long periods of standing on the foot. Nurses, policemen, and waitresses rate highest in pes planus. In contradistinction, people who walk for long distances, with or without shoes and enjoy rest between long hikes develop less static disturbances of his feet. Hence, the hypothesis of muscle indefatigability in the maintenance of a suitable arch is not tenable.

The author undertook to study the behavior of the longitudinal arch under (1) spinal anesthesia, (2) complete paralysis of the lower extremities, (3) extensive inflammatory conditions about leg and foot, (4) acute toxemic conditions, (5) late stages of pregnancy, and (6) footprints obtained from recently amputated legs.

Spinal anesthesia studies were carried out on 15 patients who underwent various surgical operations under spinal anesthesia and revealed negligible longitudinal arch changes.

Twenty cases of paralysis of the lower extremities were studied. The paralysis, for the most part, was due to trauma. In 2 cases it was due to transverse syphilitic myelitis and cerebral thrombosis, respectively. According to the postural theory, abolition or relative diminution of the arch would be envisaged, but the observation failed to show any appreciable change in the integrity of the arch.

Nineteen cases of acute inflammatory lesions of the leg and foot were included in this series. The inflammations were ascribable to cellulitis, osteomyelitis, and compound infected fractures of the foot. Again, according to the postural theory, i.e., inhibition of the postural tone of the inflamed muscles, falling of the arches was not evident. When the inflammatory agency included the ligamentous capsular apparatus, however, the arch did collapse rapidly.

Twenty-eight cases of an acute toxemic condition were observed, the patients were suffering from pneumonia and enteric fever. It is alleged that the tone of the musculature, under toxemic states, was markedly reduced. In none of these patients, nor in others chronically ill with emaciating diseases, did collapse of the longitudinal arches ensue.

The footprints of 30 pregnant women were studied either before or after delivery. Since flaccidity and generalized ligamentous relaxation is emblematic of pregnancy, it may be expected that pes planus is a concomitant of pregnancy. The average arch fraction was 45.

Seventy-two pounds of pressure were exerted on each of 19 feet on recently amputated legs. If the arch was solely maintained by the postural tone of the muscle, lowering of the arch would be expected. This did not occur.

Several feet were prepared and comparable weights (36-72 lbs.) were arranged to exert perpendicular pressure on the longitudinal arch to determine the influence of ligamentous support on the

arch of the foot One foot had all of its ligaments intact, whereas, its fellow had its ligaments cut In the latter, the same weight caused collapse of the arch, and in the former the arch maintained its relative position

Stages in the development of the arch of the foot after birth were studied About 200 extremities of babies from birth to the age of 10 years were observed Immediately after birth, and up to the age of 5 months, the arch was not demonstrable The toes were divergent, the heel was small, flexion creases were prominent, and the foot assumed a triangular characteristic similar to prints obtained in a matured monkey It was not until after 18 months that the arch made its appearance Between the ages of 2 and 3 years, the rudimentary arch was found in 56 of the 60 prints examined The adult form of the arch was discernible at between the ages of 4 and 5 years It could be noted that until this time the foot of an infant was pliable and inverted, and contained copious deposits of fat After this period the arch assumed rigidity and the foot exhibited characteristics of maturity

The author examined about 200 fetuses The smallest measured 8.5 mm in length and the largest had reached full term No discernible differentiation of the hands and feet could be made until the fetus reached the age of 6 weeks At this time digits appeared in both the hands and feet The digits were radially divergent with abduction of the hallux and the pollex At the eighth week or in the 28 mm fetus, the heel had appeared and the foot assumed an angle with the axis of the leg

The dissection of the feet of many fetuses disclosed the longitudinal arch to be fairly complete when the heel appeared fully developed (in 8 weeks) Although some of the tarsal bones were still in the cartilaginous state the skeletal components of the arch had achieved a well defined outline Other pertinent ontogenetic data were the average length of the tarsal bones in an embryo of 20 mm (1) the average length of the heel was 21 per cent of the length of the foot, (2) that of the tarsus was 44 per cent of the length of the foot, (3) that of the metatarsus, 26 per cent, (4) and that of the phalanx, 16 per cent of the length of the foot

Since the author has confined his exhaustive studies to barefooted patients, he has arrived at the conclusion that, on the whole, the arches of the barefooted do not differ from those of persons who wear shoes The arches of the latter may be lower with slight abduction of the forefoot Evidence has been presented that the real factors in the maintenance of the arch are the bony configuration on the medial aspect of foot and the strong ligaments

Examination of the feet of primate animals have shown the stigmata of Wolff's law With the changing of the mode of living, manner of locomotion, and discard of arboreal existence, the shape of the feet of these animals is constantly approximating that of man In the case of the gorilla in upright position the similarity is still closer to man, whose terrestrial habitation has governed the present configuration of his heel, the longitudinal arch, the large tarsal bones, and the relatively small forefoot

SAMUEL L. GOVERNALE, M.D.



# SURGERY OF THE BLOOD AND LYMPH SYSTEMS

## BLOOD VESSELS

**On the Treatment of Varicose Veins by Ligation of the Saphenous Vein and Injection in Both Central and Peripheral Directions According to Ollonqvist's Method** V. THOMASSEN *Ann. chir. gyn. fenn.* 1948, 37, 207

The author analyzes the treatment of varicose saphenous veins, in 340 patients, by the method of Ollonqvist. The technique consists of isolating the greater saphenous vein in the upper part of the thigh—the site being that at which an impulse is detected when the distended vein is tapped in the leg or lower thigh—and slowly injecting 2 c.c. of 20 per cent sodium chloride solution proximally, then 5 to 10 c.c. of the same solution quickly, distally. The vein is ligated after each injection, and then divided.

The immediate results of treatment were good. In 57 per cent of cases occlusion of the veins occurred after a single injection, and in 43 per cent of cases postoperative injections were necessary. Undesirable effects were (1) pain which occurred locally, and with a peripheral radiation in most cases, (2) periphlebitis in 2.6 per cent of cases, (3) wound infection in 0.4 per cent, (4) postoperative hemorrhage from the central stump in one case, (5) necrosis of the skin from leakage of the sclerosing solution from the vein in rare instances, (6) brown pigmentation along the course of the injected vein in many cases. No cases of pulmonary embolism occurred.

In a follow up of 133 patients who had undergone treatment from 2 to 9 years previously (a total of 210 ligations), evidence of recurrence was observed in 120 (57%), the remaining patients were free of recurrence. Seventy-five per cent of patients with recurrences had recanalization of all or most of the saphenous vein, and the chief cause of recanalization and recurrences is to be found in insufficiency of the deep communicating veins.

The author believes that the great advantage of the sclerosing method of treatment is the freedom from embolic complications. In a collected group of 1,471 operations, only one doubtful case was observed.

EDWARD H. CAMP, M.D.

**The Etiology of Leg Ulcers and Their Treatment by Resection of the Popliteal Vein** GUNNAR BAUER *J. internal chir.*, Brux., 1948, 8, 937

The author believes that a previous thrombosis is the commonest cause of the lower leg syndrome. This syndrome is characterized by chronic edema of the lower leg, pain of a dull bursting character, skin lesions in the form of constricting bronze-colored induration, and typical ulcers.

In an effort to discover the causative factors of these ulcers in patients who have not previously had a thrombosis, careful studies were made of 100 patients with varicose veins or leg ulcers. Retro-

grade injections of the femoral or great saphenous veins were made with the use of 20 c.c. of radio opaque media, and roentgenographic studies were carried out. These roentgenograms presented two characteristic pictures. Group 1 comprises 45 cases demonstrating a normal femoral vein with competent valves. Group 2 comprises 55 cases showing the entire femoral and popliteal veins, the deep veins of the leg and, at times, the subcutaneous varicosities to be filled with the contrast material. The author considers this to be a demonstration of a pathological femoral and popliteal vein, with incompetent valves, affording the opportunity for a retrograde flow of blood. In the latter group were found principally the cases with the leg syndrome. The varicosities in group 1 were rarely symptomatic and usually required only high resection of the great saphenous vein, preferably combined with the retrograde injection of a sclerosing solution.

To further study the pathological physiology in deep venous insufficiency, determinations of the pressure in the popliteal vein were made. It was found that in all the veins of the lower extremity a hydrostatic pressure exists that at any given point is roughly equal to, or just below, the weight of a column of water extending vertically from the point of measuring to the level of the heart. When the vein is obstructed distal to the site of measurement there is a greater rise in the cases of proved valvular insufficiency of the femoral vein. It is believed that the orthostatic venous overloading is the cause of the bursting pain almost always complained of by these patients, and that this condition probably leads to the edema.

Evidence based on phlebographic studies is presented to show that a frequent cause of the lower leg syndrome is thrombosis, and 25 such cases are reviewed. Thirteen of these showed evidence of recanalization, which, in turn, implies that the vein valves have been permanently destroyed. The remainder have large satellite femoral veins which bypass the thrombotic areas and produce, in effect, a similar situation.

Thirty cases were observed in which the femoral insufficiency was not caused by thrombosis. These presented a different picture. Microscopically there is a low degree of phlebosclerosis. There is probably a resultant loss of elasticity of the vein wall and valvular incompetence. A marked hereditary influence was found. The author believes that since exact knowledge is lacking, this group should be called idiopathic.

Interruption of the popliteal vein by means of ligation and segmental resection is advocated as the logical treatment, in preference to the higher ligation recommended by Linton and Hardy. The objection to high ligation is that the femoral vein below this level is often filled up with blood from

muscle veins or incompetent satellite veins, and the back pressure on the lower leg is maintained. Fifty-four such operations have been performed at the Mariestad Hospital, in Sweden. The immediate results were good. Twenty-four patients were followed up after a period of 3 to 14 months and the bursting pain had disappeared in all, edema remained in 4, induration in 10, and ulceration in 2.

LEROY J. KLEINSASSER, M.D.

#### Management of Venous Thrombosis and Pulmonary Embolism Following Injury to the Extremities

FRED B. AURIN and LOUIS G. HERRMANN *Am J Surg*, 1948, 76: 586

The general incidence of venous thrombosis in patients who have sustained injury to the legs is almost 12 per cent as compared with 2 per cent of hospitalized surgical patients in the Midwest. Such clots usually occur in the large veins of the traumatized extremity, or in the pelvic veins in cases of pelvic fractures.

Regular and frequent examination of the thigh, calf muscles, and feet of all patients is essential in the diagnosis of initial phases of venous thrombosis. Promoting venous return from the legs and pelvis is an excellent method of prophylaxis against thrombosis and embolism, thus, good heart action, activity of the muscles of the extremity to pump blood along the vessels, and the gravitational effect of slight elevation of the foot of the bed are important features in the prevention of this complication.

Once thrombosis has been established, treatment must be designed to limit extension, prevent embolism, and correct local impairment of venous circulation in the affected extremity. The author uses heparin and dicumarol as the primary measure, followed by ambulation when local signs have subsided. Such anticoagulant therapy is maintained for 10 to 14 days unless the patient is confined to bed because of the primary disease, in which case dicumarol is administered to maintain a prothrombin concentration of from 30 to 50 per cent of normal.

EDWARD H. CAMP, M.D.

#### The Value of Transmetatarsal Amputations in the Management of Gangrene of the Toes

WESLEY FURSTE and LOUIS G. HERRMANN *Arch Surg*, 1948, 57: 497

Since 1934 transmetatarsal amputation has been performed for gangrene in 91 cases with a follow-up in 85. The patients with cellulitis in addition to gangrene were first treated with penicillin until the infection subsided. Inhalation anesthesia was most often used. All the amputation wounds were left open except 1 in which a partial closure was done. However, more tissue was left on the plantar surface than on the dorsum of the foot in order that the final closure would provide a long plantar flap. Secondary procedures such as the application of a

TABLE I—RESULTS WITH TRANSMETATARSAL AMPUTATIONS

Disease	Results for amputations with adequate follow up						Number of amputations without adequate follow up
	Excellent	Good	Fair	Poor	Questionable evaluation	Total	
Gangrene diabetes	9	6	4	21	1*	41	1
Gangrene arteriosclerosis	7	1	1	12	5†	26	3
Gangrene frostbite	8	3	0	1	0	12	1
Gangrene osteomyelitis	1	0	1	0	0	2	1
Gangrene arterial embolism	1	0	0	0	0	1	0
Indolent ulcer neurotrophic	0	0	1	1	0	2	0
Gangrene thromboangiitis obliterans	0	0	0	1	0	1	0
Total						85	6

\*The 57 year old diabetic white woman considered to have a questionable result died 8 days postoperatively of a myocardial infarct demonstrated at autopsy.

†The patients with arteriosclerosis considered to have questionable results were as follows:

1. A 74 year old white man with an ulcer of his stump who died 7 months after the transmetatarsal amputation because of probable carcinoma of the stomach.
2. A 58 year old white man who died 1 month after operation without definite determination of the cause of death.
3. A 58 year old Negro with a well healed stump for 6 25 months postoperatively who suffered frostbite and required a low leg amputation.
4. A 68 year old white man who died 1 month postoperatively with bronchopneumonia.
5. A 67 year old white man who died 2 weeks postoperatively with pneumonia.

free graft to the granulating stump were frequent. In the cases in which good healing was obtained the patients had little difficulty in standing or walking on the shortened foot. There was no phantom limb pain.

The results were best when the gangrene was due to frostbite. On the other hand, in the presence of intrinsic arterial disease (thromboangiitis, diabetes, and arteriosclerosis) only 36 per cent of the results were classified as good or excellent. The details of the follow up are given in Table I, above.

The hospital mortality in the diabetic and arteriosclerotic group was 14 per cent, which is lower than the 22.7 per cent for major amputations in diabetes at the same institution, and 23.9 per cent in arteriosclerosis obliterans without diabetes.

The authors conclude that the operation is safe and is rarely associated with phantom limb pain, but there must be a judicious selection of cases, the operation must be carefully performed, and preoperative and postoperative care must be adequate.

THEODORE B. MASSFELL, M.D.

# SURGICAL TECHNIQUE

## OPERATIVE SURGERY AND TECHNIQUE, POSTOPERATIVE TREATMENT

**Parenteral Use of Water, Dextrose, Electrolytes,  
Fat, and Vitamins** WALTER G MADDOCK *Arch  
Surg*, 1948, 57 553

This article is a consideration of the therapeutic needs of persons unable or not permitted to take sufficient fluids or food by mouth. In the majority of cases treatment can be kept relatively simple. The use of chemical studies and laboratory data is important and their interpretation is discussed. The body's daily water requirement is discussed particularly in view of its importance to renal function, and the importance of the specific gravity of urine is emphasized and explained.

The use of dextrose solutions for intravenous use should be used specifically for the introduction of water and carbohydrates, but they have no specific value in shock or for replacing electrolyte loss. Protein hydrolysate solutions are indicated in the presence of undernutrition. Five grams of salt given parenterally should be enough for maintenance unless there is evidence of abnormal loss. Probably during the immediate postoperative period (2 days) sodium chloride should not be given.

Dehydration presents a special problem, and deficits should be studied and properly replaced.

Dehydrated patients are usually studied to determine

1 The combining power of plasma carbon dioxide. This test should be augmented by a clinical distinction between "metabolic" and "respiratory" disturbances. If the alteration is the result (partially or totally) of a respiratory disturbance the plasma pH should be determined.

2 Serum sodium

3 Serum potassium

4 Plasma chlorides

5 Blood nonprotein nitrogen

6 Plasma proteins

The symptoms and signs of dehydration are more acute as the deficit develops more rapidly. The manner in which dehydration develops may alter the picture, the dehydration may be due primarily to water loss or to electrolyte loss.

Specific case examples of types of loss and water and electrolyte needs are discussed, including (1) vomiting from pyloric obstruction, (2) vomiting from duodenal, jejunal, or upper ileal obstruction, (3) bile or pancreatic fistula drainage, (4) ileostomy drainage and diarrhea, (5) ketosis of diabetic and nondiabetic origin, (6) nephritis, and (7) burns.

To develop "working approximates" for parenteral therapy a consideration of the history, physical examination, and laboratory studies including the volume and the specific gravity of urine, the hemoglobin and hematocrit values, plasma chloride, pro-

tein, carbon dioxide combining power, and blood nonprotein nitrogen may be needed.

The common and special solutions for parenteral use discussed are (1) isotonic sodium chloride, (2) Ringer's solution, (3) lactated Ringer's solution, (4) hypotonic sodium chloride, (5) hydrochloric acid, (6) ammonium chloride, (7) sodium bicarbonate, and (8) sodium lactate.

Renal insufficiency in dehydration may be due to the lowered filtration pressure caused by dehydration, the presence of actual kidney disease, the lack of water, or both of the latter causes. A good intake of water must be provided.

The daily gastrointestinal loss should be calculated and replaced by parenteral therapy.

The parenteral uses of potassium, fat emulsions, and vitamins are discussed in the light of present information.

The basic information for the administration of nutritional substances is one of the recent great advances, and the ability to maintain a normal environment for the patient's cells has saved countless lives.

W F MONTGOMERY, M D

**An Attempt to Evaluate the Different Modern  
Methods for the Prevention and Treatment of  
Thromboembolism** J P STRÖMBÄCK *Acta chir  
scand*, 1948, 97 113

The retardation of venous drainage is a factor of primary importance in the etiology of thromboembolism. Early ambulation after operation is the best method that is known at present for the prevention of thrombosis. The author believes that it should be begun on the day of operation, or not later than 2 or 3 days following the operation.

Dicumarol may have a valuable auxiliary effect. It should be started on the day after operation and the prothrombin percentage should be kept at from 10 to 30 per cent during the entire period of healing. Dicumarol is contraindicated in patients with liver injury, in those having a tendency to hemorrhage, in cases in which control of bleeding from the wound is incomplete, and in certain renal affections.

The ability to diagnose complications of thrombosis early must be developed by both doctors and nurses. The treatment of manifest thromboembolism with heparin supplemented by dicumarol, as early as possible, followed by early ambulation seems to offer the best guarantee of good immediate and late results.

Venous interruption as a prophylactic or therapeutic measure is not dealt with in the present study.

JAMES WEAVER, M D

**Reconstruction Following Irradiation Injuries**  
PAUL W GREELEY *Arch Surg*, 1948, 56 741

Radiation injuries may be secondary to necessary treatment for malignancy, may follow overzealous

treatment of cutaneous lesions, may develop in patients with unusually susceptible skin, or they may be due to therapy given with an improperly calibrated machine. Symptoms of x-ray dermatitis are characterized by severe pain, itching, and ulceration. X-ray dermatitis is associated with an obliterative arteritis and hyalinization of the vessels of the involved skin. Subsequently, anemic gangrene or white necrosis with ultimate ulceration follows. The surrounding skin becomes telangiectatic and keratotic. Squamous cell carcinoma may develop in a certain percentage of the latter areas. Because the pathologic reaction is irreversible, permanent cure can be obtained only when the involved tissue is excised up to the area of the normal blood supply. Reconstructive surgery is required for the completion of treatment. The defect may be closed by primary suture with undermining or by a skin graft or skin flaps.

BENJAMIN G. P. SHAFIROFF, M.D.

#### ANTISEPTIC SURGERY, TREATMENT OF WOUNDS AND INFECTIONS

**The Treatment of Open Traumatizations of the Hand in Miners** (Tratamiento de los traumatismos abiertos de la mano en los mineros) VICENTE VALLINA GARCÍA. *Cirug. apar. locomotor*, 1948, 5: 450

The importance of functional integrity of the hands in miners cannot be exaggerated, and 10 years of experience in the care of lesions of the hands has convinced the author that, from the standpoint of subsequent working capacity, an open fracture of a phalanx or metacarpal may be as important as a fracture of the femur, spine, or pelvis. The permanent incapacities observed after more or less important injuries to the hand, the customary resistance to treatment of certain posttraumatic sequelae, and the passive resistance of the patients, who see in invalidity their liberation from the hard and dangerous work in the mines, have stimulated the author's interest in the treatment of these cases.

The surgical procedure to be followed in open traumatizations of the thumb or its metacarpal is totally different from that of the rest of the hand. Functionally, the thumb is the equivalent of half of the hand, and the working future of the patient, to say nothing of the resources of the insurance company, will depend on the behavior of the surgeon, whose constant preoccupation should be to conserve the thumb and never remove it before having done every thing possible to keep it, as even a rigid thumb may be very useful to its host.

In traumatic amputation of the thumb, treatment consists only of cleansing the wound with physiologic salt solution, ligating some artery if necessary, and awaiting cicatrization. If the amputation runs through the metacarpophalangeal joint, the skin may be sutured if it is not lacerated.

It may be stated in general that in all other open lesions of the hand the patient is kept in bed for the first 8 days, a sulfonamide, preferably cibazol or

sulfathiazole, is administered for from 2 to 4 days, and an abduction splint and a plaster cast are used, the latter extending from the upper part of the forearm to the indicated part of the involved finger.

In open fracture of the phalanges of the thumb, if the patient is seen within 6 hours of the accident, thorough cleansing of the hand is followed by conservative treatment and closure of the wound, if more than 6 hours have elapsed, the wound is left open. In infected fracture, the necessary incisions are made, the fracture is reduced, a vaseline gauze dressing and a closed plaster cast are applied, and 30,000 units of penicillin are given every 3 hours, in these cases the patient is kept in bed up to 2 weeks after disappearance of the fever. If sequestrectomy is necessary after healing, it is performed with minimal traumatism and the avoidance of curettage, which often causes chronic and rebellious osteitis.

Open fractures of the first metacarpal are treated like those of the thumb, particular care being taken in the reduction of the articular fracture of the upper extremity of the bone.

Wounds of the thumb must be treated with the same precautions as those used in fractures because they give rise to the same consequences if they are let alone or incorrectly treated.

In open fracture of the phalanges of the other fingers, the problem is conservation of the function of the hand which is jeopardized by the presence of a finger that impedes the normal movements of the others. Any open fracture associated with extensive detachment of the skin, section of the tendons, lesion of the palmar collateral vessels, or involvement of a joint, must be treated by amputation at the metacarpophalangeal joint. In the other noninfected open fractures the wound is resected and, of necessity, left open in most cases. The digital splint is arranged so that the metacarpophalangeal joint is in 45 degree flexion, the first interphalangeal joint in 90 degree flexion, and the second in 45 degree flexion. From the first day, the nonimmobilized fingers must be moved from maximal extension to maximal flexion, the movements being performed several times each hour.

Infected fractures of the fingers are treated by amputation at the metacarpophalangeal joint.

In open fractures of the second to fifth metacarpals, among which those of the second are more frequent, consolidation is easily obtained even when immobilization is not very strict, because the interosseous muscles help to retain the fragments in place. From the first day, all fingers must be moved to the fullest extent possible. If the fracture is associated with a severe lesion of the skin or section of the flexor tendons, it is preferable to amputate the finger at the metacarpophalangeal joint, or through the focus of fracture if the latter is distal. Fracture of the head of the fifth metacarpal must be treated by immediate amputation at the focus of fracture.

Infected wounds of the fingers with involvement of the tendon sheaths or joints, and diffuse phlegmon of a finger with limited movements of the other

fingers must be treated by prompt amputation at the metacarpophalangeal joint, the wound being left open. The other fingers must be actively mobilized to their full extent of flexion and extension. In contused wounds with detachment of the soft tissues in the palm and exposure or laceration of the tendons it is best to amputate. In tendosynovitis which does not justify amputation, incisions are made on the borders of the fingers.

In recent wounds with section of the tendon, the latter is sutured only when the wound is clean and has been made with a cutting instrument, otherwise, the wound only is treated and suture of the tendon is given attention later. Sectioned extensor tendons of the back of the hand are sutured under these conditions, those of the back of the fingers are sutured and the fingers are immobilized in semiflexion because complete extension impedes flexion of the remaining fingers. If both flexor tendons of the fingers are cut, it is sufficient to suture only one, but when the tendon section is associated with fracture of the finger, amputation is performed.

RICHARD KEMEL, M D

**The Role of Chemotherapy in Wounds and Surgical Infections. A Study of the Significance of Gram-Negative Pathogens in Fresh Trauma and Chronic Infections.** DOUGLAS ACKMAN and FREDERICK SMITH. *Am J Surg*, 1948, 76 483

Gram-negative pathogens are not very common contaminants in fresh trauma or in surgical infections. They are found most often in lesions of the lower extremity. They tend to persist, although their presence rarely causes delay in healing. Despite their persistence, these organisms show almost no tendency toward invasion in fresh trauma when the circulation is adequate. Even in cases of gross contamination with gram-negative organisms in pre-existing surgical infections, revision grafts are almost equally immune when local and general physiologic conditions are satisfactory. These local conditions are well maintained by occlusive dressings, infrequently changed. There is no clinical evidence of a symbiotic relation between gram-negative and gram-positive organisms.

Topical application of creams of sulfathiazole, penicillin, and streptomycin have all failed to eliminate gram-negative pathogens in fresh trauma and surgical infections. Streptomycin has caused "fast" organisms in four instances. Some more recent experiences with this drug have been more satisfactory. When invasion by gram-negative organisms does occur, intramuscular streptomycin has given very encouraging results in the few cases so far observed.

JAMES WEAVER, M D

**Penicillin Therapy with Prolonged Interval Dosage Schedules.** W A ALTEMEIER. *Ann Surg*, 1948, 128 708

A study was made of the dosage of penicillin in the treatment of 161 selected cases of established surgical infections in an effort to determine the

clinical effectiveness of the single intramuscular injection of larger doses of penicillin in aqueous solution every 8 to 12 hours.

The clinical results obtained in the author's series of selected cases were very gratifying and were probably indistinguishable from those anticipated with injections of penicillin at 3 or 4 hour intervals with the possible exception of 2 cases of severe and extensive infections caused by the hemolytic streptococcus. The experimental and clinical evidence has indicated that for some unknown reason the antibacterial effect of penicillin persists for a considerable length of time after its disappearance from the circulating blood. Although the author's series of 161 cases was relatively small from which to draw any conclusions, it appeared that the maintenance of a more or less constant blood level is probably unnecessary for efficient therapy in the human being. A limited clinical experience revealed that the intramuscular injection of an aqueous solution of penicillin containing from 100,000 to 200,000 units every 8 to 12 hours was an efficient and effective method of chemotherapy in susceptible infections of moderate severity. This method overcomes the disadvantages and inconveniences of the 2 to 4 hour dosage schedule to a large extent and has not resulted in any increased tendency of the bacteria to develop resistance to penicillin.

This dosage schedule of administration of only 2 or 3 injections per 24 hours decreases the task of the nurse and releases part of her time for other more necessary nursing duties. The 8 and 12 hour dosage schedule is advocated at present by the author only in susceptible infections of moderate severity or less, until further experimental information is gathered.

JOHN E. KARABIN, M D

**Re-Evaluation of Penicillin Dosage Schedules.** W A ALTEMEIER. *Arch Surg*, 1948, 57 396

The clinical effectiveness of intramuscular injections of 100,000 units of aqueous penicillin administered every 8 hours and of 150,000 units administered every 12 hours was studied. A single intramuscular injection of 100,000 units of penicillin gave a concentration of 0.03 units per 1 ml of serum for 3 hours, and in 11 per cent of the patients that concentration was maintained for almost 7 hours. The level of 0.03 units is generally accepted as the therapeutic level.

Five different strains of pathogenic hemolytic *Staphylococcus aureus* showed a definite inhibition of growth for 24 hours when exposed in vitro to 2 units of penicillin per 1 ml of medium. Clinically, equal therapeutic benefit was obtained from penicillin when administered intramuscularly every 8 hours as when administered every 3 hours. With penicillin susceptible infections in human cases a constant blood level of the antibiotic was found to be unnecessary since its effectiveness persisted even after the blood penicillin levels were no longer measurable. However, in severe and fulminating infections the 3 or 2 hour schedule was recommended.

BENJAMIN G. P. SHAFIROFF, M D

### Anthrax 36 Human Cases of the External Type Treated Successfully with Penicillin A C LA-BOCSETTA *Am J M Sc*, 1948, 216 407

Anthrax in humans is seen principally as an occupational disease of veterinarians and workers in the wool and leather industries. As no methods for active prophylaxis have been developed, prevention depends largely upon the control of the infection in animals and the employment of general hygienic and sanitary measures. Reports of the Philadelphia Health Department show no tendency of the incidence of the disease to decrease. During the period from 1904 to 1947 there were reported 433 cases within the city with a mortality of 11.5 per cent. Specific antiserum, bacteriophage, and neoarsphenamine have been employed in the treatment of anthrax.

During the period from 1943 to 1947, thirty-six patients with uncomplicated cutaneous anthrax were treated with sodium penicillin in doses of from 100,000 to 200,000 units daily. Bacteriological confirmation of the diagnosis was obtained by smear or culture in 83.4 per cent of cases, in 6 cases (16.6 per cent) the diagnosis was not confirmed bacteriologically, but in the author's opinion the characteristic appearance of the lesions left no doubt of the clinical diagnosis. Of the bacteriologically positive cases 90 per cent became negative after 72 hours of treatment with penicillin. Positive cultures or smears were obtained in 2 patients after 6 and 15 days respectively. In many cases it was seen that the lesions continued to spread and the edema increased for a period of from 24 to 36 hours after treatment had been instituted, a phenomenon commonly observed when patients previously were treated with antiserum. No local treatment other than dry dressings and occasional splinting was used. The author concludes that intramuscular penicillin may be successfully used in the treatment of cutaneous anthrax.

WAYNE FIELD CAMERON, M.D.

### Treatment of Tetanus HOMER M SMATHERS and MILTON R WEED *Arch Surg*, 1948, 57 291

A plan of treatment of tetanus was formulated on the basis of experiences with 82 cases, in some of which intocostin and d-tubocurarine were used. In this series 36 deaths occurred within 48 hours of admission. It was found that enough antitoxin should be given to neutralize the unfixed tetanus antitoxin. When a tetanus producing focus was found it was eradicated by débridement.

Intocostin used for the control of muscle spasm was of temporary benefit and was associated with hypersecretion in the laryngotracheal tubes and a profound fall in the blood pressure. The use of d-tubocurarine suspended in wax and oil produced a prolonged curare effect with fewer side reactions. The dose varied from 0.6 ml to 2.0 ml daily. For sedation respiratory depressants were avoided, paraldehyde, chloral hydrate, or ether in oil were found to be most satisfactory. The plan of treatment follows:

#### Preoperative

- 1 Tetanus antitoxin sensitivity tests—skin and conjunctival
- 2 D-tubocurarine in wax and oil, 1 c.c. intramuscularly
- 3 Tetanus antitoxin, 60,000 units intravenously
- 4 Tetanus antitoxin, 10,000 units locally
- 5 Preoperative medication

#### Operative

- 6 General anesthesia
- 7 Tetanus antitoxin 20,000 units intrathecally
- 8 Débridement of wound

#### Postoperative

- 9 Sedation—chloral hydrate, paraldehyde, ether
- 10 Tetanus antitoxin, 5,000 units daily for from 5 to 10 days
- 11 D-tubocurarine in wax and oil intramuscularly daily to tolerance
- 12 Penicillin, 50,000 units intramuscularly every 3 hours
- 13 Maintain nutrition orally and parenterally
- 14 Available at bedside—nasal oxygen, laryngoscope, endotracheal tube, aspirating apparatus

BENJAMIN G. P. SHAFIROFF, M.D.

### ANESTHESIA

#### Certain Factors Influencing the Percentage of Oxygen in Mixtures of Nitrous Oxide and Oxygen

JAMES H. CROWLEY, ALBERT FAULCONER, JR., and JOHN S. LUNDY *Current Res Anesth*, 1948, 27 255

The authors report a study of certain factors which govern the percentage of oxygen available to a patient when mixtures of nitrous oxide and oxygen are administered by a circle-absorption semiclosed technique.

A description is given of the techniques used in this study.

Observations were made with the use of mixtures of nitrogen and oxygen which were found to behave, with certain limitations, in a manner similar to mixtures of nitrous oxide and oxygen.

The percentage of oxygen available to the subject was found to be much less than the percentage of oxygen delivered to the machine when slow total rates of flow were used. The more rapid the total rate of flow the more nearly did these percentages approach equality.

An important factor in the reduction of the percentage of oxygen available to the patient was found to be dilution of the nitrogen of the "bag mixture" during the first few exhalations of the subject.

Recommendations were made by which the dangers of incorrect estimation of the oxygen might be eliminated.

### SURGICAL INSTRUMENTS AND APPARATUS

#### New Incisions and Revised Techniques in Peripheral Surgery EMIL SFLETZ *West J Surg*, 1948, 56 565

The central theme of the present article is that of the surgical principles and problems involved in obtaining good exposure for definitive treatment of

peripheral nerve injuries. A series of diagrams and photographs is presented to illustrate various incisions and approaches advocated by the author for the exposure of nerves in the extremities. The conclusions are based on experience gained from the study and operative repair of 2,037 nerve injuries during the war years.

The incisions and surgical approaches employed by the author are based on principles involving a more direct surgical approach to obtain adequate exposure of the injured nerve. The approach is made through fascial planes rather than through muscle substance. If it becomes necessary to incise muscle tissue, the incision should always be made in the direction of its fibers. When a muscle must be divided it is severed only at its point of fascial attachment so that it may be easily repaired. Skin incisions which are perpendicular to flexion creases must be avoided since a traction scar will invariably result. Not only is the skin involved in the production of contractures, but there is involvement of the subcutaneous tissues and fascial layers as well.

In cases in which the surgical exposure involves a joint area, the incision should generally be an interrupted one. This may be accomplished in one of two ways when the involved joint is in the cubital or popliteal space, a Z-shaped incision, as described by the author, is used, when exposure is needed on either side of a joint in a limited area, as in the wrist, the incision is interrupted and the area between is tunneled so as to provide adequate exposure.

ORVILLE F. GRIMES, M.D.

#### A Simple Method of Estimating Blood Flow with Special Reference to the Circulation in Pedicled Skin Flaps and Tubes. WILFRED HYNES. *Brit J Plast Surg*, 1948, 1: 159

The author states that a precise knowledge of both the arterial supply and the venous drainage of a pedicled flap or tube at each stage of its transfer has the following advantages:

1. The periods of waiting between the stages of the transfer can be reduced, sometimes by half. Besides shortening hospitalization, it reduces the

amount of scar tissue under the flap or inside the skin tube so that the tissues remain soft and pliable and require practically no trimming at the new inset.

2. Pedicles can be divided with confidence, and tiresome scar-producing division by delay can be avoided.

The methods advocated by Lewis, Douglas and Bucholtz, Douglas and Millican, and Lange and Boyd are discussed briefly.

The author's method, which he believes is simplest and gives the most complete information regarding the circulation, consists of the injection of 1/25th of a grain of atropine sulfate, dissolved in 0.2 c.c. of sterile water, into selected sites on the flaps or tubes. If a tubed pedicled flap is to be tested, a bowel clamp with the blades protected by rubber tubing is placed firmly across the end to be detached and the atropine injected just below it. If an open or direct flap is to be tested, a tourniquet is placed around the donor extremity and the injection is made in the most distal portion of the flap. By timing the appearance of three specific effects of atropine in the circulation, an estimation of the blood flow in a flap can be obtained.

Tachycardia is the most reliable sign of atropine absorption, 1/25th of a grain injected subcutaneously in the face of an adult raises the pulse rate from 72 to 104 in a period of 10 minutes and to 118 in a period of 20 minutes.

Changes in the pupil do not necessarily occur early, and a better test is the inability to read an ordinary newspaper. Inability to focus properly will occur in from 15 to 45 minutes.

Dryness of the mouth starts as a tingling sensation in the lips or in the back of the throat and is quickly followed by a feeling of increasing dryness in the mouth, throat, and larynx within 15 minutes after injection of 1/25th grain of atropine subcutaneously in the face.

Accurate timing of the appearance of the above three signs of atropine absorption, following its injection into a flap or tubed pedicled flap, will result in a reliable estimation of the blood supply both qualitatively and quantitatively.

EARL H. KLABUNDE, M.D.



# PHYSICOCHEMICAL METHODS IN SURGERY

## ROENTGENOLOGY

**An Evaluation of Phlebography of the Normal Lower Extremity** BERNARD S EPSTEIN, MILTON G WASCH, and LEO LOEWE *Am J Roentg*, 1948, 60 650

Acting upon their belief that the value of phlebography cannot be properly delimited until the range of normal variation has been thoroughly studied, the authors made phlebograms of a lower extremity in each of 35 patients who were free of any clinical evidence of pre-existent venous disturbance. The patients selected were those in whom intravenous urography was being done. Twenty cubic centimeters of either diodrast or neo-iopax in 50 per cent solution were injected within 60 seconds into a superficial vein on the dorsum of the foot or over either malleolus, with the leg placed in slight inversion. Immediately upon completion of the injection roentgenograms (made in quick succession) were centered, respectively, below the knee joint, just above it, and below the groin. In the last 8 patients, roentgenographs were taken in the lateral as well as the antero-posterior position, for better visualization of the leg veins. One-half of the first 20 examinations were conducted with a compression of 30 mm of mercury maintained about the calf, but when no difference could be observed in the phlebographic patterns obtained with and without compression, it was concluded that compression had not been of assistance in visualizing the deep venous system, and the practice was discontinued.

The authors review the normal anatomy of the venous system of the lower extremity, both superficial and deep, as a basis for evaluation of their radiographic observations. The latter consisted in an attempt to identify each vein visualized, and a review of the general venous pattern. They found that the lesser saphenous vein was excellently visualized in 6 patients, partially visualized in 26 patients, and not seen at all in 3. The long saphenous vein was well visualized in 10 individuals, partly visualized in 16, and invisible in 9. Visualizations of the deep veins of the leg were uniformly poor. In no instance was clear demonstration of paired anterior and posterior tibial and peroneal veins, as 6 well filled channels, achieved on the same patient. Almost all patients had some degree of opacification of a single anterior or posterior tibial or peroneal vein. Variations in caliber, and sudden transitions from filling to nonfilling were common. Occasionally a few transverse communicating channels were seen. The proximity of the channels of peroneal and anterior tibial veins made identification difficult if only one of these channels, or a part thereof, was visualized. Deep veins were somewhat better visualized in the antero-posterior view, while superficial veins and veins of the calf were better seen in the lateral projection.

The pattern formed by the latter appeared inconstant. Overlapping of the various systems further complicated interpretation.

The popliteal vein was excellently visualized in 21 patients, and partially visualized in 14. The femoral vein was well seen in 20 individuals and was only irregularly filled in 12, in 3 cases it was not seen. Filled collateral channels were occasionally demonstrated, and in 2 patients the deep femoral vein was opacified.

The authors comment that incomplete or irregular filling, or absence of filling of the leg veins has been considered by some workers as indicative of thrombosis, but they conclude from their work on these 35 clinically normal individuals that there is need for great circumspection in evaluating phlebographic patterns obtained by the usual techniques, particularly in the leg. They believe that phlebography cannot be considered a proved aid in the diagnosis of thrombophlebitis because the inconstancy of the patterns found in normal patients often makes it impossible to differentiate between the normal and abnormal.

LILIAN DONALDSON, M D

**The Possibility of Venous Embolism in the Course of Hysterosalpingography** (Sulla possibilità di embolie venose in corso di isterosalpingografia) MAURO PIEMONTE and PIERO PARACCHI *Radiol med*, Milano, 1948, 34 682

Approximately 30 cases of venous embolism following hysterosalpingography have been published in the literature. In the majority of cases the course is asymptomatic or only slight symptoms such as cough are present. Occasionally, however, pain in the hypogastrium, the formation of multiple emboli and infarcts in the lungs, obstinate cough, hematemesis, pain in the chest, anxiety, and rise of temperature may be observed. If the iodized oil reaches the left part of the heart, multiple cerebral emboli may form, leading to mental depression, loss of memory, and focal symptoms, such as amaurosis.

As a rule, the clinical course of venous emboli formed by iodized oil is favorable. Only 2 fatal cases have been reported.

Two factors favor the formation of emboli in the course of hysterosalpingography: (1) pre-existing disruption of the continuity of the endometrium (a) physiologic, namely, during the immediate post-menstrual period, and (b) pathologic, caused by traumas or neoplasms, and (2) excessive endouterine pressure. Even the moderate pressure under which iodized oil is injected may lead to disruption of the endometrium and entry of the radiopaque substance into a vein, when the resistance of the uterine mucosa is lowered, the tubes are occluded or had been removed operatively.

The author employed hysterosalpingography in a woman, aged 55, who was admitted with complaints of slight uterine bleeding. The clinical diagnosis was



fibromyoma After an injection of 15 c.c. of iodized oil into the uterine cavity, the right uterovaginal and pampiniform plexus and the left uterine vein were visualized. Roentgenograms of the chest demonstrated a uniform distribution of oil throughout the lungs. A sensation of constriction over the chest, dyspnea, profound asthenia, cyanosis, moist cough, headaches, and subfebrile temperature developed.

Two months later subtotal hysterectomy and bilateral salpingo-oophorectomy were performed. The atrophy of the mucosa overlying the fibroma probably facilitated the entry of the oil into the veins.

JOSEPH K. NARAT, M.D.

**Irradiation in Cancer of the Tongue** CHARLOTTE P. DONLAN *Am J Roentg*, 1948, 60: 511

The author reviews 83 proved cases of carcinoma of the tongue in patients who were treated in the Radiotherapy Department of Presbyterian Hospital, in New York, during the period between 1929 and 1946. The treatment of the tongue lesions consisted of the interstitial implantation of radium needles in the tongue plus roentgen irradiation, and roentgen irradiation alone. An attempt was made to give 8,000 gamma roentgens or more to the tongue when interstitial radium needles were used. Supplementary roentgen therapy was given if the radium dosage was less, or if the lesions tended to persist after the usual dosage had been given. When roentgen therapy alone was used, the aim was to give a tumor dose of 5,000 to 6,000 roentgens. The cases were classified as operable cases, inoperable cases, and borderline cases.

Twenty-two cases were classified as operable. The average duration of symptoms in this group was 9.25 months. Ten of 19 patients survived for over 5 years, a survival rate of 52.6 per cent. (Three patients were admitted after 1942 and therefore could not be included in this percentage rate.) Seven of the 10 patients who survived had neck resections, 4 of which were bilateral. Of these 4, only 1 patient showed histopathological evidence of disease in the nodes.

Nine cases were classified as borderline. The average duration of symptoms was 7.4 months. None of the patients survived 5 years, although 2 cases are too recent to have attained that survival period, both patients are living and well. In 1 patient a unilateral neck resection was performed 5 months after treatment of the tongue lesion, 1 had a pulmonary and esophageal metastases, and 1 had metastases to the femur.

There were 34 inoperable cases in which the average duration of symptoms was 7.5 months. The condition of the nodes was mentioned in 30 histories and of these, 12 had palpable nodes on admission. Only 4 of these 12 had neck dissections.

Two patients had unilateral neck dissections before receiving treatment for the primary lesion. In both of these cases the primary lesion was in the base of the tongue and difficult to diagnose.

Five of 23 patients lived 5 years or more, a survival rate of 21.7 per cent. Eleven cases were admitted after 1942 and therefore could not be included in the percentage.

Eighteen patients with inoperable lesions were treated by roentgen irradiation alone. The average duration of their symptoms was 5.8 months. In 2 of these 18 cases, pulmonary metastases developed.

Eight patients (44.5 per cent) had palpable nodes on admission. No neck dissections were done.

Two of 13 patients (16.9 per cent) lived over 5 years. Six patients had been admitted too recently to be included in this percentage group.

Among the 55 cases admitted up to, or before, 1942, there was an over-all 5 year survival rate of 30.9 per cent.

FRANK L. HUSSEY, M.D.

**The Roentgen Treatment of Carcinoma of the Larynx by the Concentration Method** (El tratamiento radiológico del carcinoma laríngeo por el método de la concentración) RAÚL MAYER *Diagnóstico y Tratamiento*, B. Air, 1948, 20: 2210

The author irradiated 216 patients with carcinoma of the larynx. Of this group, 123 were treated by radiation alone. The remaining 93 were treated for recurrences that followed surgery.

The Coutard method was used exclusively until 1942. The Coutard-Cutler or "concentration method" was developed soon thereafter and has been used since.

The Coutard method for treating laryngeal cancer was first used in 1933. During that year and in 1934, 18 patients were treated and of these, 3 were living and well at the end of 5 years (15.6%).

From 1935 up to and including 1937, 32 patients with inoperable laryngeal cancer were similarly treated, and of these, 8 (25%) remained well for from 5 to 7 years.

During the period from 1938 up to and including 1941, 38 additional patients were irradiated by the Coutard method. Of the latter, 9 (23%) remained well for 5 years.

The Coutard technique first used roentgen rays generated at 185 kV with 5 ma. In July of 1938, the voltage was changed to 200 kV with 10 ma. The distance remained constant at 70 cm with 2 mm of copper plus 2 to 3 mm of aluminum filtration. The fields varied in size from 49 to 144 sq. cm. Usually from 5,000 to 8,000 roentgens were delivered at a rate between 2.5 and 7 roentgens per minute in 6 to 12 days.

The Coutard-Cutler technique was developed in 1942. Roentgen rays generated at 200 kV, delivered at a distance of 70 cm, with a filtration of 2 mm of copper plus 2 mm of aluminum plus 3 mm of bakelite, were used. The milliamperes were varied in order to assure a tube output between 5.5 and 8 roentgens per minute.

Two lateral fields, one on each side of the neck, were treated daily, one in the morning and the other 6 hours later in the afternoon of the same day. The 6 hour interval was decided upon because severe re-

actions developed when a shorter period of time between the daily exposures was used

As a rule two portals (each 100 sq cm) were used, 1 portal being directed into each side of the neck. The smaller or localized laryngeal cancers were also treated through 2 portals, each of which measured 64 sq cm. The fields are gradually reduced in size until they reach a minimum of 9 sq cm in some cases.

No attempt is made to treat the involved cervical lymph nodes until the primary lesion has been adequately managed. Thereafter, the nodes are treated, care being taken to protect the previously irradiated areas.

The authors deliver 100 roentgens to each of the two fields daily. The daily exposure to each field is increased 25 roentgens until both fields receive 475 roentgens per day, a total of 950 roentgens daily. The treatment is usually completed in 16 days, at the conclusion of which time the patient usually has received 9,350 roentgens. The daily exposure is somewhat less in the presence of severe infection, for which penicillin is used freely.

In most instances a dry radioepidermitis develops, which is less severe than the skin reactions usually observed when the old Coutard technique was employed. The authors believe that the "concentration" technique is less exhausting to the patient than the old Coutard technique.

During the interval from May, 1942 to October, 1945, the "concentration" technique was used on 35 patients. Of this group, 13 (37.1%) remained well for from 2 to 5 years.

EUGENE P. PENDERGRASS, M.D.

#### Spindle Cell Tumors of the Gastrointestinal Tract

WILLIAM L. PALAZZO and MILFORD D. SCHULZ  
*Radiology*, 1948, 51: 779

The authors prefer the term "spindle cell tumor" to describe those tumors arising from mesodermal tissue, because the usual classification as neurinoma, neurofibroma, leiomyoma, or fibroma becomes so difficult in the malignant tumors.

The study is based on 140 cases of histopathologically proved spindle cell tumors of the gastrointestinal tract. They were found in 0.67 per cent of 12,000 protocols of autopsies and in 1.2 per cent of 5,313 surgical records at the Massachusetts General Hospital. Of the total, 9 per cent were located in the esophagus, 65 per cent were located in the stomach, 17 per cent in the small intestine, and 9 per cent in the large intestine. Spindle cell tumors accounted for 2.3 per cent of all esophageal tumors removed in a 16 year period, for 5 per cent of those in the stomach, for 7 per cent of those in the small intestine, and 0.2 per cent of those in the large intestine.

Thirty-three per cent of spindle cell tumors of the esophagus, and 36 per cent of spindle cell tumors of the stomach were malignant. Recurrence or metastasis, if present, was evident within 4 years, 54 per cent of the patients remained well and free of the

disease for an average of 8 years. In the small bowel, 7 (77%) of the spindle cell tumors were malignant and none of these patients remained free of disease for more than 3 years. Six (86%) of these tumors of the large bowel were malignant and one patient of this group is without disease 5 years after operation.

In discussing the criteria for roentgen diagnosis, the authors state that in their experience, smoothly circumscribed intramural tumors without ulceration or marked lobulation are more often benign, or are benign extrinsic lesions. This diagnosis is more reliable in the esophagus than the stomach. However, they conclude that there are no reliable criteria by which benignity of a spindle cell tumor can be recognized in the roentgen examination. In addition, the authors state that these tumors cannot be differentiated from cysts of the esophageal wall, mediastinal cysts, or tuberculous lymph nodes attached to the esophageal wall, aberrant pancreas, and even defects due to vascular anomalies.

PAUL R. NOBLE, M.D.

#### MISCELLANEOUS

Some Tracer and Therapeutic Studies with Artificial Radioactivity J. H. LAWRENCE *Brit J Radiol*, 1948, 51: 531

The author briefly discusses the formation of artificial radioactive isotopes by use of the cyclotron and atomic pile. Tracer studies have been conducted upon patients with rheumatoid arthritis by measuring the circulation time of radioactive sodium chloride. It is found that persons with this disease have a reduced circulation time and the uptake of radio-sodium is reduced.

Radioactive gold sodium thiosulfate has been given intravenously to rabbits suffering from chemically induced arthritis, as well as to controls. A relatively high uptake was found in the liver, kidneys, and the involved synovial membrane.

A discussion of polycythemia vera is presented in addition to the therapeutic application of  $P_{32}$ . More than 100 patients have been treated by the selective uptake of radioactive phosphorus in the bone marrow. Two doses of 5 mc each are given intravenously 1 month apart. One course of therapy has usually resulted in the return of the red count to normal, decrease in size of the spleen to normal, or nearly so, and relief of all symptoms of the disease.

In 116 cases of polycythemia, the author found the average age of onset was 49, and of 18 patients who died, the average age at death was 67. This series was compared to another series of 163 patients in this country of whom only 36 lived more than 5 years after the diagnosis was made. Previously, the common causes of death were thrombosis in the veins or arteries, cardiac failure, or leucemia. In the present series, thrombosis was rare, perhaps related to the depression of the red cells and platelets as a result of irradiation and return of the blood viscosity to normal, and possibly due also to some other cause.

of clotting of the blood. Four of this group of patients developed leucemia. In 250 patients with chronic leucemia, the average length of life approached 5 years. This method of treatment has given results not completely satisfactory, but it is devoid of the usual radiation sickness.

The use of I-131 in the treatment of hyperthyroidism and certain thyroid gland malignancies is noted. This centers about the selective localization of iodine within the thyroid gland in excess to other tissues. Hyperthyroid patients usually do not suffer a recurrence of symptoms and signs after one course of therapy.

The author briefly touches upon the surface application of P<sub>32</sub> by blotting paper for the treatment of cancers of the skin. In addition, the subject of radioactive colloids and labeled compounds as applied to medical research is presented.

HORACE G. BUTLER, M.D.

**Radioactive Iodine as a Diagnostic Aid for Intrathoracic Goiter** G. ANSELL and J. ROTBLAT *Brit J Radiol*, 1948, 51: 552

An intrathoracic goiter is considered by the authors as complete when four-fifths or more is in the thorax, and incomplete if at least one-half of it is palpable in the neck. This is further localized by the anterior, lateral, or posterior position.

A list of lesions and differential points from a radiological standpoint is presented according to the three positions occupied by an intrathoracic goiter. Doubt has existed in some few cases as to the diagnosis of such lesions and radioactive iodine was used for differentiation. The authors have administered a tracer dose of radioactive iodine in 5 such cases and include a description of their method and a case report.

A counter was built with sufficient lead shielding to stop gamma rays coming from any thyroid tissue in the neck, so that counts from only the chest would be recorded. The counter, in spite of its weight, was

made quite mobile and did not support itself upon the patient's chest. A diagram of the counter and shield is recorded. A lead collimator of 1 inch diameter was used in order to count smaller and more precise areas.

Experimentally, it was found feasible to map out the area in which radiation was contained by moving the counter over the area and measuring the activity at various points. A lead marker was placed on the chest wall to the left of the manubrium sterni and films were obtained in the posteroanterior and lateral positions.

Twenty-four hours before counting, 90 microcuries of I-131 were given. The counts were taken over various areas of the anterior chest and neck, and the areas were marked by a circle of adhesive plaster containing a number and the number of counts. A photograph was taken at the completion of counting and the lead marker served to correlate the position of the counts with the roentgen illustration.

The number of counts per time interval was plotted against the distance of the source from the central position of the axis of the counter, and an analysis of the results was made in order to determine the position of the goiter. The contour of the thyroid determined from the measurements agreed fairly well with the roentgenogram in spite of some impairment of accuracy. The curvature of the chest prevented the collimator from being flush with the chest wall in some areas, which caused a degree of error. Other errors may be created by an intrathoracic goiter of nonuniform consistency or of varied distance from the chest wall.

The authors point out that the majority of intrathoracic goiters will have sufficient uptake to be outlined. Large cysts within the mass may alter the estimation of contour. It is pointed out that only 15 per cent of thyroid carcinomas take up radioactive iodine and therefore such lesions could not be ruled out by this procedure. HORACE G. BUTLER, M.D.

## MISCELLANEOUS

### CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

**Parenteral Feeding of Protein** ROBERT ELMAN *Arch Surg*, 1948, 57 185

The value of parenteral protein feeding depends (1) on the importance of protein feeding itself, and (2) on the availability of adequate methods. The old idea that protein is available from the large dispensable body stores has been discarded. A basic principle in the treatment of disease is that all deficits should be avoided.

There are two general conditions in which the parenteral administration of protein is indicated. When there is a deficit of hemoglobin and plasma they are administered intravenously in the form of whole blood. The second condition, that of a deficit of protein food, presents a different problem of parenteral administration. Protein food normally becomes available to the body in the form of amino acids or combinations thereof.

For parenteral administration it is necessary to have a protein containing the minimum amount of essential amino acids. A second requirement is that the mixture provoke no serious consequences when injected either subcutaneously or intravenously. Solutions of hydrolyzed protein which we use at present must be mixtures of only pure amino acids.

Studies of the efficacy of protein food are discussed or suggested by the author under six categories as follows:

- 1 The maintenance of nitrogen balances
- 2 The effect on regeneration of plasma protein
- 3 The demonstration of tissue protein synthesis
- 4 The ability to promote normal growth in rats
- 5 The ability to promote normal weight gain in adult animals
- 6 Analysis of the protein for essential amino acid content

The author discusses the clinical observations which give evidence of the benefit of parenteral administration of protein to surgical patients. The author suggested that parenteral administration will control the patient's feeling of hunger. The use of parenteral administration in a special group of cases, patients with intestinal fistulas, is recommended. The theory of protein metabolism which maintains that plasma proteins are actually a medium of exchange between foods and body proteins is also discussed.

For the immediate nutrition of tissues, amino acids should be introduced in amounts of 100 gm. or more a day plus the same amount of dextrose, together with some salt and vitamins. Whole blood should be given in addition, largely to restore the red cell mass to normal. Plasma transfusions will be of value to increase the level of plasma protein. The salt content of plasma is a disadvantage, but it has been

eliminated by the newer preparation of salt-poor albumin which has proved to be more valuable.

W. T. MONTGOMERY, M.D.

**The Effect of Caronamide with Heparin on the Coagulation of Human Blood** HOWARD D. SIRAK, ROBERT S. MCCLEERY, and CURTIS P. ARTZ *Surgery*, 1948, 24 811

Caronamide has been used to prolong and augment the blood level of penicillin. When given orally, caronamide inhibits the tubular excretion of penicillin as well as paraminobenzoic acid, diodrast, and other compounds totally unrelated structurally to caronamide. Since heparin levels, like penicillin levels, are hard to sustain, it was believed that the effect of caronamide with heparin might be similar to that of caronamide with penicillin, making it more effective and less expensive to administer.

Ten patients were studied and the effect of caronamide with heparin was determined by performing heparin tolerance tests on successive days before and after the administration of caronamide.

The results were studied by determining the maximum response, the intermediate response, the minimal response, and the group averages in all patients. Heparin levels and prothrombin determinations were recorded and the time relationship of the administration of the two drugs was investigated.

The authors demonstrated that caronamide administered as a single 4 gm. dose, or as a course of multiple doses, markedly increased the effect of heparin on the coagulation time of human blood. Intravenous heparin in saline solution, given one-half hour after a single dose of caronamide, caused a progressive enhancement of the effect of an equal dose of heparin administered on each successive day.

In 8 of the 10 patients studied, this enhancement reached a peak in approximately 3 days and was manifested by a two to tenfold increase in response of the coagulation time to heparin. The peak was followed by gradual return to a normal response 2 to 3 days later.

Incomplete evidence suggested that the effect obtained in these cases was probably due to the formation of a new compound and not to a caronamide blockage of the renal excretion of heparin.

The fact that the enhancement of small doses of heparin can be achieved with the use of caronamide makes the outlook very promising for a reduction in the cost of heparin therapy.

JOHN E. KARABIN, M.D.

**Carcinogenic and Anticarcinogenic Substances** E. C. DODDS *Lancet*, Lond., 1948, 2 837

The production of chimneysweep squamous epithelioma, mule spinner carcinoma, cancer of the mouth, and other forms of carcinoma was long supposed to be a very slow process attributable to gen-

eral nonspecific chronic irritation acting over a long period. Subsequently it was proved that there was something extremely specific about the irritating action of soot. Commencing in 1921, Kennaway and his coworkers demonstrated that carcinogenic substances could be formed from materials containing only carbon and hydrogen, which led to the synthesis and isolation, from tar, of carcinogenic polycyclic hydrocarbons. Biological investigation revealed big differences in the quantitative activities of various compounds. The author points out objections to the concept that long-term irritation is necessary for the production of cancer.

Thus, in cancer of the penis the carcinogenic potentiality is conferred during the first few years of life and in spite of subsequent circumcision, malignancy occurs several decades later. Certain forms of industrial cancer similarly develop long after comparatively short exposure, e.g., cancer of the respiratory passages from exposure to dust in the carbonyl process, carcinoma of the bladder from B-naphthylamine and benzidine used in dye processing, pulmonary neoplasia similar to sarcoidosis as a result of beryllium dust.

Evidence points to the fact that the body itself can produce substances (estrogens) which change tissues to such an extent that they may later develop into carcinomas. Possibly other factors are involved in this malignant transformation.

Efforts to render the organism insensitive to carcinogens have generally proved to be disappointing. Only one method of protecting sensitive animals from the carcinogenic action of polycyclic hydrocarbons on the skin has been found and this immunity is only temporary (mustard gas). Extensive studies on a heterogeneous collection of supposedly anticarcinogenic substances have shown that some possibly exert slight beneficial effects. It appears probable that this is the consequence of a nonspecific action on the general health of the animal rather than a specific action on the growth itself. Several studies emphasize the fact that diet may play some part in malignancy.

Opinion is divided as to the influence on cancer of the folic-acid group of substances (diophterin and, particularly, terophterin). However, interest appears to have largely evaporated. A group of compounds, known as antifolic acid substances, has also been intensively investigated since these compounds seem

capable of damaging malignant cells. Promising results appear to have been obtained clinically with one of these agents, A-methopterin.

Coley's fluid has not given uniform results and therefore its administration has been generally discontinued. Stilbestrol, by its action on the anterior lobe of the pituitary gland, effects a kind of biochemical castration and thereby controls the local and secondary growths of prostatic cancer for a prolonged period. This was the first highly successful attempt with chemotherapy in the control of cancerous conditions.

The author points out that androgens are not entirely foreign to the female and therefore their empirical employment is unwarrantable. Opinion is reserved as to the effectiveness of testosterone propionate in mammary or genital tract carcinoma in women. The palliative use of nitrogen mustard has proved, on occasions, to have some beneficial effects at first. Urethane has similarly been administered for its palliative action on blood forming organs.

Thus, while there are a great many ways of producing cancer, with no fundamental connection between them, once the process commences we have no means of stopping or checking it by direct action. All the anticarcinogenic substances and agents act indirectly.

DAVID H. LYNN, M.D.

## EXPERIMENTAL SURGERY

### Studies in Cellular Growth. MAXWELL MALTZ. *Brit J. Plast. Surg.*, 1948, 1: 187.

Anti-mouse and human granulation tissue serums were prepared by injecting rabbits with antigens prepared from these two tissues. Wounded mice injected with small amounts of these sera showed accelerated healing. Larger amounts of the serum derived from mice retarded healing, whereas larger amounts of the serum derived from human granulation tissue had no retarding effect. Small doses of the serum from mouse granulation tissue plus small doses of an antisplenic serum stimulated cellular growth of sarcoma 180 in mice. A stimulating dose of the antisplenic serum plus a larger dose of the anti-mouse granulation tissue serum retarded and destroyed growth of this sarcoma.

This same combination retarded and destroyed spontaneous breast carcinomas in mice.

JAMES WEAVER, M.D.

# SURGERY

## GYNECOLOGY AND OBSTETRICS

### With International Abstracts of Surgery

*Official Journal of the American College of Surgeons*

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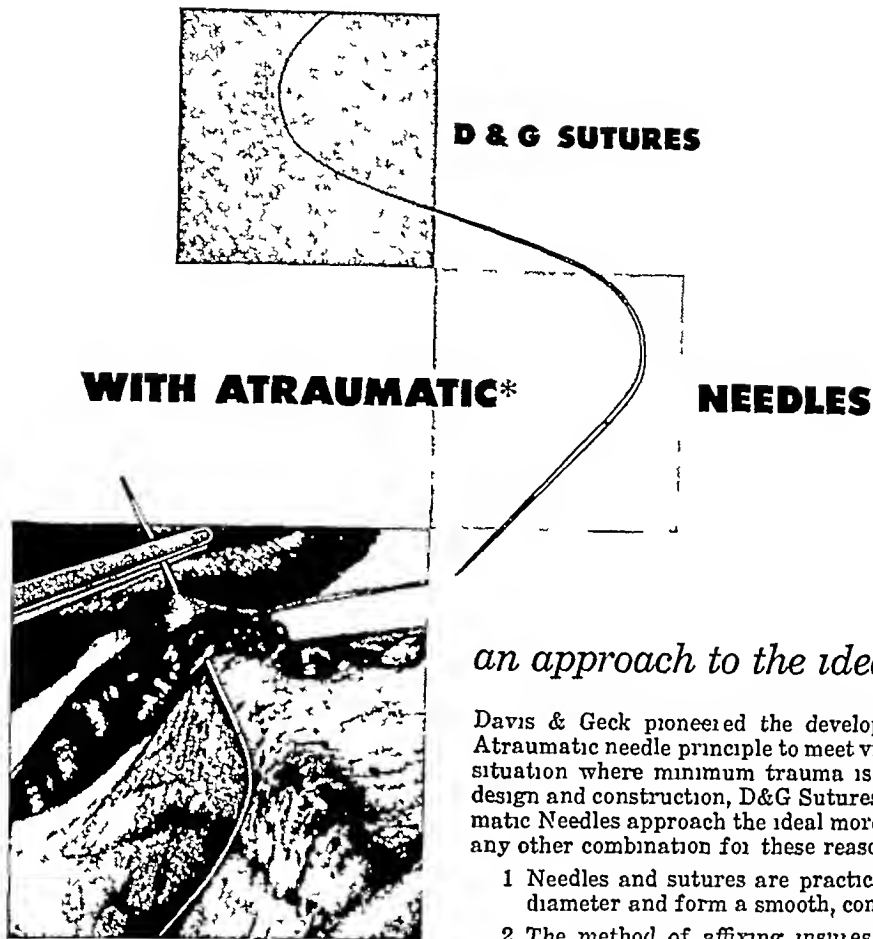
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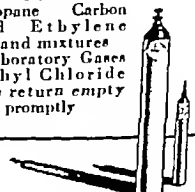
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# SURGERY

## GYNECOLOGY AND OBSTETRICS

VOLUME 89

AUGUST, 1949

NUMBER 2

### THE SURGICAL CORRECTION OF CONSTRUCTIVE PERICARDITIS

EMILE HOLMAN, M D, F A C S, and FORREST WILLET, M D, San Francisco, California

THE operation for chronic constrictive pericarditis, whose ill effects stem from the concomitant compression of the heart and its large vessels either by contracting scar or by the pressure of fluid confined within a rigid-walled envelope, has yielded varying results, some disappointing and some spectacularly brilliant. Twenty-two deaths on the operating table in 265 reported cases (Table I) provide abundant proof of the hazardous nature of the operation and 48 early postoperative deaths further testify to the extreme gravity of the disease. All the more gratifying, therefore, are the 118 cases reported as restored to normal health, and the 44 cases reported as improved.

The following important factors contributed to the success of the operation: its application in young individuals in whom other organs were normal and in whom liberation of the compressed heart was the only correction necessary, the availability of intratracheal anesthesia, and such adjuncts in after-care as oxygen, transfusions, and antibiotics, an adequate exposure of the heart which permitted ready access to critical areas for the removal of the offending scar, and the courage and technical skill of the operating surgeon which enabled him to pursue the operation until

adequate decompression of all critical areas had been achieved.

Factors contributing to poor results were such considerations as the etiology of the primary pericarditis, whether tuberculous or pyogenic in origin, the former being strikingly dangerous in the advanced chronic stage, the selection for operation of exceedingly ill patients whose only hope lay in liberating the hampered heart but who died on the operating table or within a few hours after operation, technical difficulties leading to lacerations in the thin walled auricle or in the myocardium of the right ventricle with fatal hemorrhage, inability to remove the scar because of penetration of cardiac musculature by calcium deposits, inadequate removal of scar necessitating secondary operations, failure to remove the scar over critical areas such as the inferior and superior vena cava, technical difficulties imposed by the type of operative exposure of the heart, and lastly the postponement of a correct diagnosis until changes had occurred in the cardiac musculature so that liberation of the compressed heart resulted in overdistention of attenuated and atrophied myocardium and in circulatory failure.

Considerable difference of opinion has been expressed by various writers as to what really are critical areas. Schmieden (30, 31), whose excellent articles stimulated internists to diagnose and surgeons to operate upon this theretofore rarely recognized entity, states

From the Veterans Administration Hospital Fort Miley and the Stanford University Medical School.

Presented in the Symposium on Surgery of the Heart and Great Vessels before the Clinical Congress of the American College of Surgeons, Los Angeles, California, October 18-22, 1948.

TABLE I

Author	Etiology			Mortality			Results		
	No of cases	T B C	Non T B C	At operation	Postoperative	Late	Not improved	Improved	Cured
Heuer and Stewart survey of literature to 1930 (19)	143			19	28	13		25	50
Blalock and Burwell 1941 (6)	20	14	6		4 1	3			7 5
Harrington 1944	24	5	19	1	2 3			2 7	1 8
Heuer and Stewart (18)	7* 11			0	0	3**	3**	3* 4	4* 4
Beck	46			1	8	4		2	31
Sellers	5	3	2		1			1	1 2
Harrison and White	12* 16	3 2	0 14	1* 1	2* 1	3* 2		1* 3	5* 9
Total	265			22	48	25		44	118

\*Cases included in the survey of Heuer and Stewart (19)

\*\*The same patients

"The operative technique is based upon the following fundamental principles (1) liberation of the left ventricle first, in order that it can receive and immediately deliver to the systemic circulation the increased output of the right ventricle following its subsequent decortication and thus avoid the right-sided venous congestion that would otherwise occur, (2) freeing of the right ventricle, which then usually dilates more efficaciously and beats stronger. Owing to the thin wall of the auricles, these should not be freed. In order to avoid the development of deficiency of the auriculoventricular valves, thus leading to the immediate occurrence of an inflow venous congestion, the decortication should never be performed beyond the coronary sulcus.

"Special attention must be given the apex of the heart which is usually firmly fixed and considerable difficulty is encountered in the attempts to liberate it. If decortication of the apex of the heart, which is bound down to the diaphragm, should not be successful, normal systolic contraction is impossible, because during inspiratory depression of the left dome of the diaphragm the heart is elongated and during systole becomes lancet shaped. In order to remedy this undesirable condition left-sided phrenicotomy is generally recommended, since this results in sufficient relief."

Graham in his book, "Surgical Diseases of the Chest" quotes Schmieden at length, and adds "It is not infrequently necessary to perform a Talma operation, since the operation of cardiolysis may take care of everything but ascites." A patient is presented in whom decortication failed to influence the ascites, and for whom a Talma operation was being considered when he died.

Churchill, who in 1928 operated successfully upon the first case in America, states

"If the scar extends laterally over the left ventricle this region should be removed as the first step. Excision may be carried as far as the phrenic nerve, but I have in no instance sacrificed this structure.

"The sulcus formed by the descending branch of the left coronary artery is apt to be the site of densely adherent scar, and this region should be approached with caution to insure the preservation of this important vessel. In one instance a thickened calcified band 2 millimeters in diameter marked this sulcus. A maneuver that has been advantageous in several instances has been to establish a new plane of cleavage over the right ventricle so that the interventricular groove may be approached from both sides.

"A second very adherent region is the right auriculoventricular groove, in intimate association with the diaphragmatic pericardium. In many cases of the disease the mobilization of the auriculoventricular groove has been a crucial step in relieving the obstruction to right ventricular filling. Keith has shown that the free motion of the auriculoventricular groove is an important physiologic mechanism in the action of the right heart. Every effort, therefore, should be made to free this area if it can be done with safety, and once past it, the inferior cava can usually be readily exposed. Actual decortication of the auricle is a hazardous procedure owing to the thin wall of this chamber of the heart. It has been attempted in only 3 instances.

"Dissection of the diaphragmatic pericardium and scar from the heart should be as complete as possible but in no instance has it been carried to the left auricle.

"When an area of encapsulated fluid exists it is important to resect the wall of the cavity that is in contact with the surface of the heart. The removal

of the parietal pericardium over such an area can be accomplished simply, but will not have the desired effect. A new line of cleavage must be established and a true decortication of the heart carried out."

Heuer and Stewart (18), who present an enviable record of 18 cases without a post-operative death, state

"How much of the pericardium it is necessary to remove in order to achieve satisfactory results is a difficult question. We have removed as completely as possible the pericardium over the left and right ventricles, but have not attempted to remove the adherent pericardium over the auricles. An effort has been made to free the apex, and if possible the dissection is carried well down on the diaphragmatic portion of the pericardium. No attempt has been made to go beyond the right auriculoventricular groove, nor have we attempted to free the great vessels at the base."

Blalock and Burwell, whose review in 1941 is recommended for its excellent presentation of the pathologic, physiologic, clinical and surgical aspects of the disease, state

"Most are agreed that actual decortication of the auricles is a hazardous procedure due to their thin walls and should not be attempted. If the ventricles are properly freed of scar, the undecorticated auricles are able to conduct sufficient blood to the ventricles to supply the needs of the body. Several observers have commented on the need for the removal of the scar from the site at which the venae cavae enter the heart. It is our impression that this is rarely necessary and even more rarely accomplished successfully. Schmieden states that complete liberation of the left ventricle is the most important part of the procedure and that in most cases this is the only surgical measure that is necessary. We question seriously the correctness of this view. Most patients with constrictive pericarditis have remarkably little dyspnea and edema of the lungs in comparison with the marked evidence of congestion in the systemic circulation. Most of the signs and symptoms are attributable to back pressure from the right side of the heart. In our experience, major emphasis has been devoted to decorticating the right ventricle."

"An interesting unanswered question is concerned with the reason for the very slow improvement that occurs in many patients following pericardiectomy. The prevailing opinion is that the constriction has resulted in atrophy of the heart muscle and that a considerable time is required for a return to the normal condition. This explanation does not suffice in all instances. At any rate, *one should not despair if the improvement is slow and if a period of many months is required for the desired decline in the venous pressure and the elevation in the cardiac output*."

Harrington, in his report of 24 personally observed cases, states

"I believe it is advisable to separate as much of the pericardial scar as possible from the ventricles, the right auricle and orifice of the inferior vena cava, and it is of particular importance to separate the attachment of the right ventricle to the diaphragm. It is of equal importance to separate the apex of the heart and I believe that this should be done early in the operation if possible. Separation of the heart muscle from its fixed attachments to the diaphragm is one of the most important considerations in re-establishing the action of the heart."

Beck, in discussing Harrington's article, states

"The compression scar must be removed whenever it exists. Ventricles, auricles, venae cavae must be relieved of any compression in order to obtain a cure. Partial operations yield partial results and increase the probability of recurrence of scar."

Sellors, who presented in 1946 the latest review of the subject in the English literature, states

"Excision should aim primarily and possibly only at freeing the ventricles, though for anatomical reasons even this is rarely achieved. The very thinness of the auricles and the great veins makes interference over them a hazardous undertaking. *At no time is it wise to carry dissection beyond the range of vision or unimpeded access.* The obliquely placed auriculoventricular groove marks the upper limit, and though clearance beyond this area is frequently advocated it can be seen from a section of this region that there is little margin for error. *It is highly doubtful that the constriction around the caval and auricular regions could ever produce such a degree of stenosis that a direct surgical attack on this region should be necessary.*"

"A lowering of the venous pressure and reduction of ascites and liver size may be noted within a few weeks, but full and final improvement should not be expected within 12 to 18 months. The venous pressure often persists at a high level without causing the patient much inconvenience."

Decker, writing in 1947, argues that only the left ventricle requires decortication and that only a limited amount of pericardium should be removed as it is not an unnecessary organ!

The marked diversity of opinion expressed by these writers as to the extent of necessary decortication arrests one's attention. Striking also is their resigned acceptance of a long delay in securing improvement and reduction in

venous pressure following a presumed adequate pericardiectomy

The purpose of this paper is to emphasize two all important principles in the operation for constrictive pericarditis first, the necessity of exposing adequately the entire heart and its great vessels, so that the surgeon may have ready access to every strategic area requiring liberation, and, second, the imperative need of a wide removal of the diseased pericardium, not only that overlying the easily accessible anterior surface of the heart, but also that lying beyond or around each border of the heart, including most particularly the decortication of the right and inferior borders, and of the superior and inferior vena cava

As to the operative approach for exposure of the heart, most of the above authors have employed the left parasternal incision with excision of segments of the third, fourth, fifth, and sixth ribs and removal of the left half of the sternum. One of the serious limitations of this approach is revealed in the following comment by Churchill

"For a time during the freeing of the adhesions about the vena cava, adequate exposure necessitated pressing on the right side of the heart with the flat surface of the hand. This distinctly interfered with the filling of the heart, and the anesthetist reported that the blood pressure could not be obtained"

Decker, in common with a few others, prefers the intrapleural approach through the left sixth interspace

Both the left parasternal and the left transpleural incisions provide an unsatisfactory exposure of the right cardiac border, the liberation of which we believe to be the most essential part of the operation. Beck (3) realizing their inadequacy, has employed a bilateral approach through an H incision, but the intact midsternum limits greatly the necessary efforts of the surgeon. We should like to emphasize that the median sternotomy, from xiphisternum to second interspace provides an adequate and satisfactory approach. Some authors have recognized its value (Lilienthal, Roberts and Wilson), others state that its use is unnecessary, but we believe its merits will be increasingly appreciated. Having employed the usual left-sided parasternal approach in 2 patients, in which the right side

was liberated with great difficulty, we then employed the median sternotomy in the next 7 patients, with extraordinary improvement in the ease and effectiveness with which the necessary decortication could be done

As evidence that a more liberal decortication is necessary if delay in improvement or the persistence of a high venous pressure are to be avoided, we may cite the cases of secondary operations reported by several authors. Schmieden (30) recounts an instance in which he resected a "funfmarkgrosses" fragment of pericardium (about 5 by 5 centimeters) which failed to correct the ascites and edema until a greater resection was performed

In 2 of their 18 patients Heuer and Stewart (18) found it necessary to perform a second operation to free a greater part of the right heart. In 1 patient the second pericardiectomy was performed 5 years after the first operation, and in a second patient 8 years after the first operation. These authors also present some significant observations with reference to delayed improvement in their remaining patients

"In 7 patients improvement was evident at once or before the expiration of a month, improvement in 2 did not become pronounced until after the lapse of 2 or 3 months, in 5 not until after 6 to 10 months, and in 1 not until after 1 year. In 2, improvement was gradual, and in 3 improvement failed to occur. We have learned not to be discouraged if improvement after operation is not evident at once or rapidly"

Neuhof's experiences in 2 cases as presented by Friedberg and Hitzig are equally instructive. In Case 1 at the first operation in January, 1936, "a large portion of the pericardium overlying the right ventricle was removed," which, however, failed to correct the ascites, the pleural effusion, and the elevated venous pressure. In June, 1936, at a second operation the heart was approached through a left transpleural incision and a 7.5 by 5.5 centimeter fragment of pericardium was removed from over the left ventricle. Venous pressure remained elevated for 6 months but by December, 1936, it had dropped to 4 centimeters and the patient was well. In a second patient with ascites of a year's duration in whom a block of the inferior vena cava was postulated, the right side of the heart was

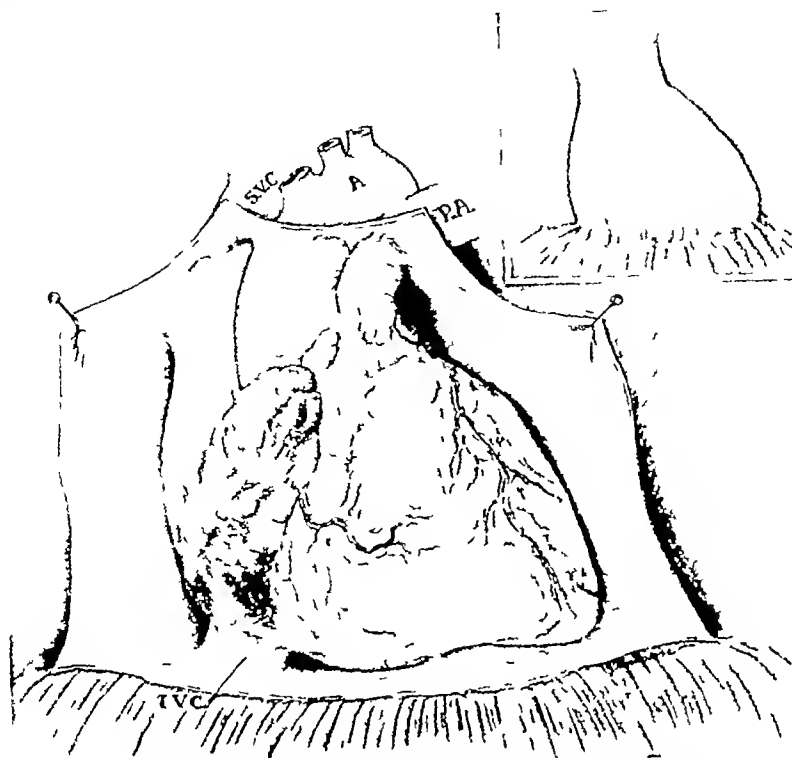


Fig 1 Drawing from autopsy observation showing normal appearance of superior and inferior vena cava, indicating that both lie within the pericardium for 1 to 2 centimeters before entering the right auricle and are therefore subject to compression either by intrapericardial fluid or by contracture of pericardial scar or by the late calcium deposits in pericardial effusions

freed through a right-sided approach at the first operation, which failed to correct the pleural effusion and the ascites. At the second operation 6 months later through a left transpleural approach, the pericardium over the left ventricle was excised. After this operation the ascites persisted temporarily, requiring 1 paracentesis, followed by complete recovery.

Harrison and White report 2 instances from Churchill's clinic in which reoperation was necessary. In 1 patient, ascites persisted for 2 years after the first operation but disappeared completely after a second pericardiectomy. In the second case, despite 2 pericardiectomies 14 months apart, and an omentopexy 4 months after the second decortication, the ascites was not corrected. At autopsy 6 years after the omentopexy it was seen that an area of the lower anterior portion of the pericardium measuring only 6 by 5 centimeters

had been removed. There still remained over the left anterolateral aspect a calcified plaque 9 by 6 centimeters and over the anterolateral aspect of the right ventricle an area of pericardial calcification measuring 9 by 4 centimeters.

It may be categorically stated first, that a limited or incomplete removal of constricting scar may result in failure or long delay in the correction of ascites, and second, that when ascites does persist, not a Talma operation, but the removal of more scar is indicated. Failure to lower a high venous pressure may follow inadequate removal of scar overlying one of several areas: the right ventricle or auricle, the superior or inferior vena cava, or even the pulmonary artery at the base of the heart. Indeed, the pericardium over the left ventricle has not in any of our cases been as greatly thickened nor as "oppressive" as has



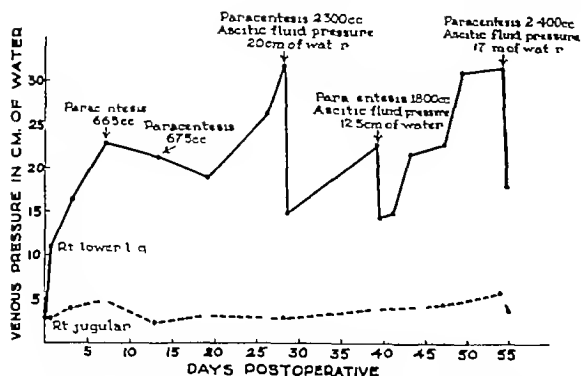


Fig 2 Constriction of inferior vena cava in a dog to  $\frac{1}{2}$  its normal diameter produced a rise in venous pressure in the leg and a marked ascites noticeable on the 7th day. Note that the ascitic fluid reached a pressure as high as 20 centimeters of water, and that removal of the fluid reduced the venous pressure in the leg from 34 centimeters to 15 centimeters of water. A venous pressure of about 15 centimeters of water in the leg seemed to be the critical level at which ascites would develop.

the pericardium over the right heart and the 2 caval vessels. An explanation for this may lie in the greater and more forceful pulsating action of the left ventricle which forces the irritating pericardial fluid of the precontractive period into the less active and more quiet areas with consequently greater inflammatory excitation of the overlying pericardium. If the strongly pulsating, highly muscular left ventricle can be hampered visibly in its activity by a constricting pericardium as seen at fluoroscopy, how much more vulnerable to such constriction would be the easily compressible superior and inferior venae cavae as they lie in the intrapericardial space (Fig 1). The effects of such compression have been studied in our experimental laboratory. Constriction of the inferior vena cava to one-half its normal caliber in a 14 kilogram dog produced a permanent ascites in approximately 7 days (Fig 2). Constriction of the pulmonary artery to approximately one-half its normal caliber led to the development of an ascites in about 7 days (12). Constriction of the superior vena cava alone above the azygos vein produced no trouble, but when constricted below the entrance of the azygos vein, a pleural effusion occurred on about the ninth day (13). This last observation suggests that the pleural effusions so commonly observed in the presence of constrictive pericarditis may not be

due necessarily to compression of the left heart but to superior vena caval constriction. Even more imperative, therefore, is the need of decorticating the superior vena cava.

The thickened pericardium lying between the inferior border of the heart and the diaphragm is also a critical structure requiring excision. Probably as the result of gravity, the irritating pericardial fluid, which precedes the scarring, is directed to the bottom of the pericardial sac, thus subjecting the diaphragmatic pericardium to the greatest inflammation, and therefore, to the greatest thickening and greatest subsequent contraction. This thickened pericardial sheet anchors the heart rigidly to the diaphragm, so that as the latter descends in inspiration, the heart is hampered even further by traction resulting in limitation of its filling and of its contraction. It is this increased restriction of cardiac filling and contraction during inspiration to which may be ascribed the momentary disappearance of the pulse, the so called paradoxical pulse, that invariably accompanies constrictive pericarditis.

The calcified and thickened pericardium on the posterior aspect of the heart cannot and need not be removed, but it is important to recognize that fibrous tissue will continue to contract, that the removal only of the easily accessible anterior pericardium is quite inadequate, and that a satisfactory pericardiectomy must include also excision of the constricting envelope beyond the left cardiac border, beyond the right cardiac border, and beyond the inferior cardiac border. This beyond the border decortication is necessary in order that the scar that remains may not in contracting further, enclose the heart in its grip.

Our observations indicate also that there is considerable variation in the thickening of the pericardium, and therefore in the effects of its constriction, depending upon the part of the heart or great vessels involved. In Case 2 the patient had been troubled with ascites for 6 years which then spontaneously disappeared. There followed a puffiness of the entire face and head (Fig 3) due to peripheral edema which fluctuated with chemically induced diuresis. At operation, following decortication

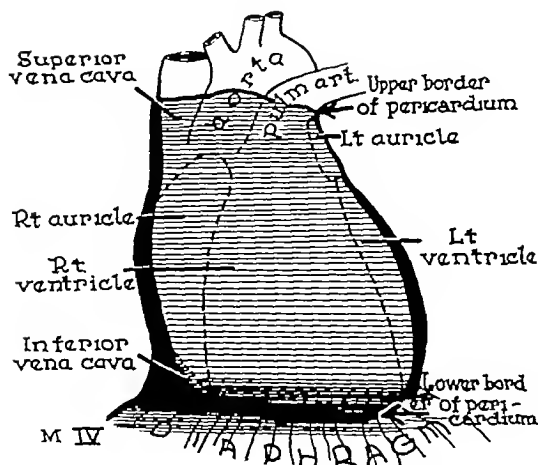


Fig 7 (Case 4) Diagrammatic presentation of operative findings showing marked thickening of entire pericardium without calcification, with particular thickening of the pericardium between the heart and the diaphragm, compressing the inferior vena cava and producing ascites, which disappeared promptly following pericardiectomy

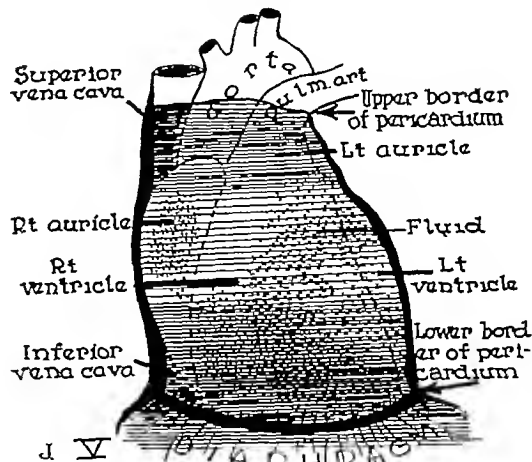


Fig 8 (Case 5) Diagrammatic sketch of operative findings showing thickened pericardium, particularly across the base of the heart. A pocket of intrapericardial tuberculous pus lay over the anterior heart surface. Stippling shows areas of calcification which penetrated the cardiac musculature

It may be true, as Blalock and Burwell contend, that compression of the right heart is usually responsible for most symptoms, but we would add that constriction of the vena cava may continue to be a disappointing source of trouble if only the right heart is

decorticated and actual liberation of the venae cavae is disregarded

That late improvement may occur even after a limited pericardiectomy is patent. A possible explanation is that the heart through more vigorous pulsation may slowly extrude

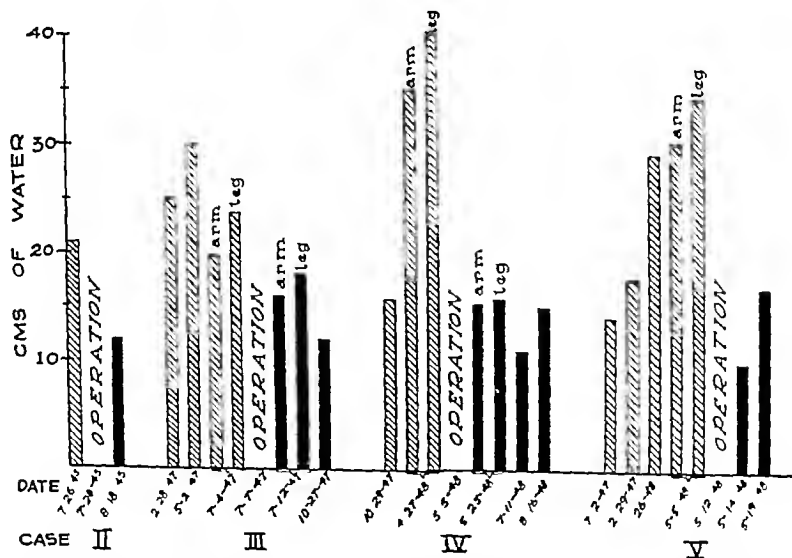


Fig 9 Marked reduction in venous pressures as determined before and after operation. Note preoperative differences in pressure in arm and leg in last 3 cases, probably explicable on basis of an associated ascites

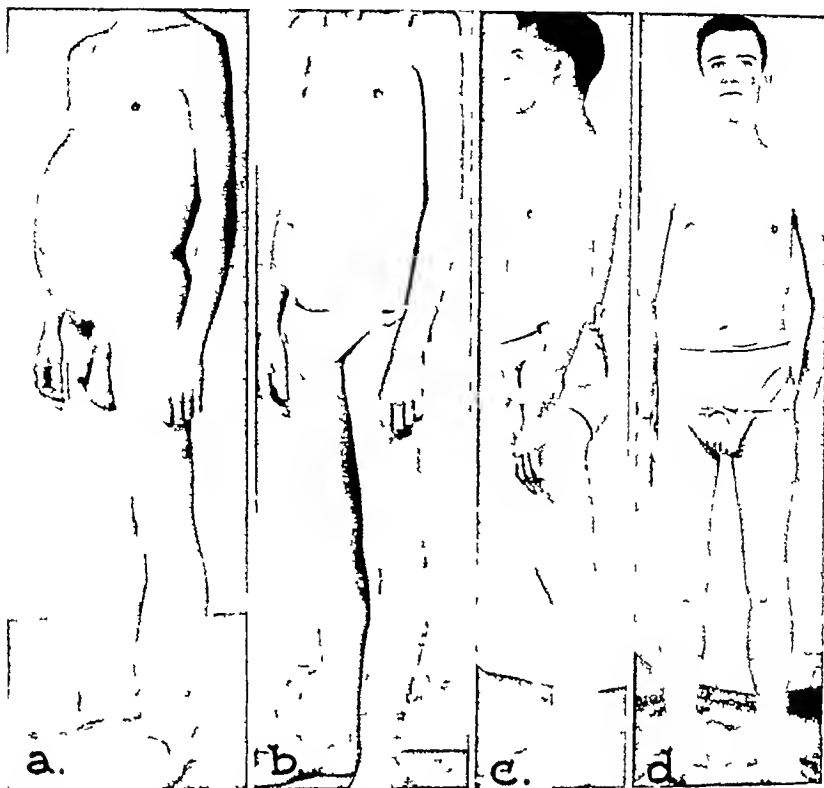


Fig 5 (Case 3) a, Marked ascites, bilateral varicocele, and bilateral varicose veins in presence of constrictive pericarditis b, Prompt improvement within 3 weeks after operation performed on July 7, 1947, which disclosed a marked constriction of the inferior vena cava c, d, Complete cure October 24, 1947

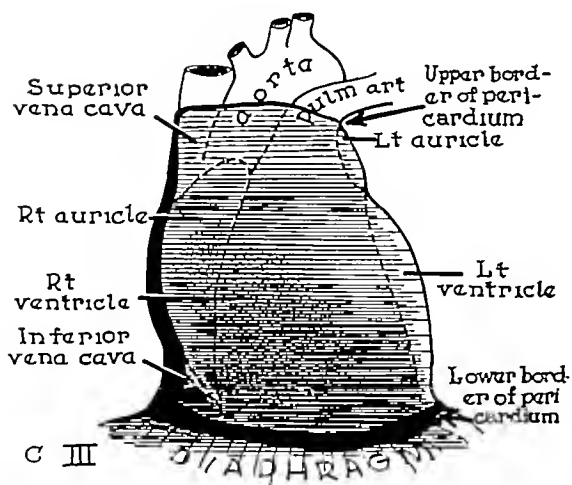


Fig 6 (Case 3) Diagrammatic sketch of operative findings showing very mildly thickened pericardium over the left heart, marked thickening and calcification over the right heart and inferior vena cava, and along the inferior cardiac border fixing the heart rigidly to the diaphragm

sure of arm and leg were recorded before operation. These differences were undoubtedly related to the associated ascites, the result probably of inferior vena cava compression. A somewhat high residual venous pressure in Case 5 is attributed to our inability to remove calcified tuberculous scar penetrating the cardiac musculature. In some instances the long delay but ultimate lowering of venous pressure in the arm may conceivably be due to impeded flow of blood through the superior vena cava resulting from its incomplete decortication. If by chance the inferior vena cava in such a patient had been adequately liberated, the unimpeded flow of blood through it would, during succeeding months, encourage the development of a collateral venous bed by way of this unconstricted vessel which would be accompanied *pari passu* by a reduction of the venous pressure present in the arm.

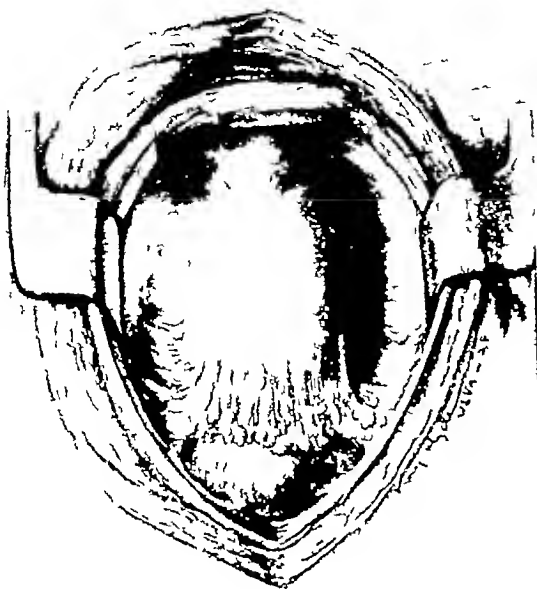


Fig 11 The 2 halves of sternum are separated by self retaining rib spreader applied after freeing mediastinal areolar tissue and right and left pleurae from undersurface of sternum and rib cage

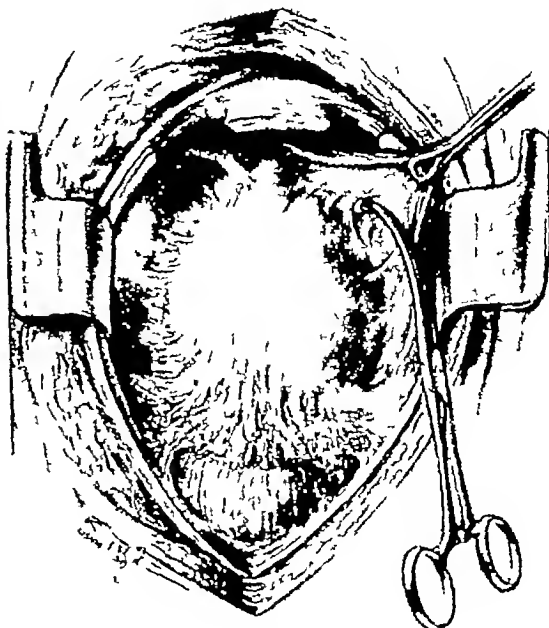


Fig 12 Pleura and lung are dissected free from anterolateral pericardium on both sides to permit excision of thickened pericardium as far, approximately, as the phrenic nerve, which however is not easily or always identifiable

regenerated and the patient remains perfectly well. In Case 4 roentgenograms taken since the median sternotomy was performed show a marked shift of the heart when the patient's position is changed from one side to the other indicating that it has not become rigidly fixed to the undersurface of the replaced sternum.

Because of the large area of denuded and traumatized tissue produced by pericardiectomy, sometimes performed in the presence of active tuberculous granulation tissue, there may be a considerable outpouring of wound fluid necessitating drainage of the operative site. This drainage has been effected by deliberately incising the right pleura along its mediastinal border where it has not already been opened and providing for removal of the fluid from the right chest either by repeated aspirations (Case 3) or by intercostal tube drainage (Cases 4 and 5). In the 3 cases in which median sternotomy was used, complete primary healing of the operative wound has occurred—even in the presence of an active tuberculous pericarditis as in Cases 4 and 5.

That such drainage from the large operative area is necessary is evident from our experiences. In Case 3 following operation on July 5, the right chest was aspirated 4 times in the period from July 7 to August 14 for a total of 1970 cubic centimeters of bloody fluid. In Case 4 only 100 cubic centimeters of serosanguineous fluid escaped from the intercostal catheter in the first 24 hours, and none thereafter, but on the second postoperative day 280 cubic centimeters of reddish fluid was aspirated from the right chest and none thereafter. In Case 5, 1,100 cubic centimeters of serosanguineous fluid escaped from the intercostal drainage tube in the first 24 hours, 400 cubic centimeters in the second 24 hours, and none thereafter. Several aspirations were performed subsequently with gradual reduction in the amount of fluid removed. Most writers do not advocate drainage of the wound, but it is instructive to note that in 15 of Heuer's 18 cases, none of which was drained, an accumulation of fluid occurred in the chest, for which aspiration was found necessary in 7 cases.

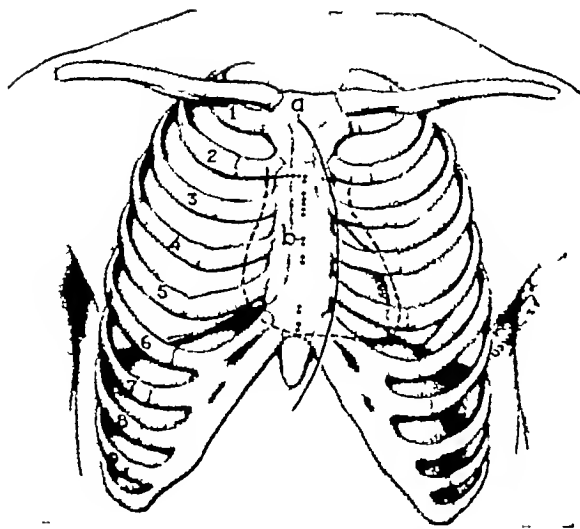


Fig. 10 Steps in pericardiectomy. *a*, Incision in skin is excentrically placed to avoid its lying directly over vertical incision, *b*, through midsternum. Xiphisternum is excised. Sternum is divided horizontally in 2d interspace.

itself from its investing pericardium, or that gradual and slow recession of the scar left around the heart results in decompressing critical areas.

Profiting by the experiences and suggestions of the surgeons quoted earlier in this paper (3, 5, 6, 8, 11, 14, 15, 18, 19, 20, 24, 28, 31, 32) and by our own observations in 9 clinical cases, confirmed by experiences in the experimental laboratory, the following plan of operative procedure is presented (Figs. 10 to 18).

#### TECHNIQUE

A median sternotomy is performed, with excision of the xiphisternum and horizontal division of the sternum in the second interspace. The use of the power saw in dividing the sternum or of the powerful long-handled Bethune bone-cutting forceps is to be preferred to the Lebsche "sternal knife" or chisel which necessitates pounding upon the chisel and indirectly upon the bone with a mallet. The latter technique must be condemned for its shocking effect upon an already seriously ill patient. It was noted in the old days of operations for now almost extinct chronic osteomyelitis that the hammer and chisel were lethal weapons to be avoided by surgeons in very ill patients.

The objection that in median sternotomy both thoracic cavities may be entered is no longer valid since intratracheal anesthesia is usually employed. A rent into the left pleural cavity can usually be avoided or can be closed successfully, but it is almost inevitable that the right thoracic cavity be entered if adequate liberation of the vena cava is to be achieved. Following careful displacement of the pleura lateralward on both sides, the pericardium is incised over the area of the left ventricle, and is cautiously mobilized beyond the left border of the heart as far laterally as the left phrenic nerve if it can be identified but which should not be injured, the pericardium over the right ventricle is then mobilized anteriorly, with excision of the pericardium overlying the pulmonary artery, the ascending aorta, and the superior vena cava. The right border of the heart is freed so as to yield a good view of the superior and inferior venae cavae. Inferiorly, the heavy, frequently calcified pericardium lying between the inferior border of the heart and the diaphragm is then excised from the inferior vena cava on the right border to the apex of the left ventricle on the left border. In this excision normal bundles of the diaphragm should be exposed.

The right auricle must be liberated with caution if direct removal of the overlying pericardium is attempted. That its removal is possible was proved by our experiences, but if this seems too hazardous, the pericardium may be incised, both along the auriculoventricular groove, and at the base of the heart leaving the intervening pericardium attached to the auricle. This maneuver has the effect of liberation and should permit the desired expansion of the auricle.

The closure of the median sternotomy is easily effected by the use of 2 or 3 No. stainless steel sutures applied not to cartilage but to the bony part of the sternum, a precaution designed to avert infection in such poorly vascularized tissue as cartilage.

We consider removal of the thoracic overlying the heart as unnecessary. In constrictive pericarditis the heart is limited not by the bony thorax but by the pericardium. In Case 2 the sternum and ribs have completely

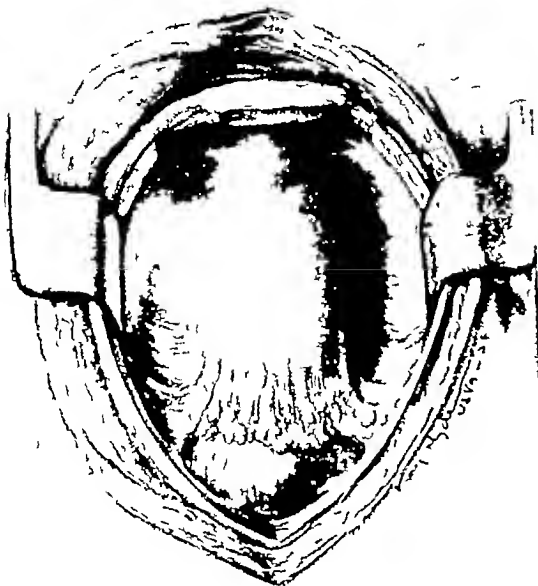


Fig 11 The 2 halves of sternum are separated by self retaining rib spreader applied after freeing mediastinal areolar tissue and right and left pleurae from undersurface of sternum and rib cage

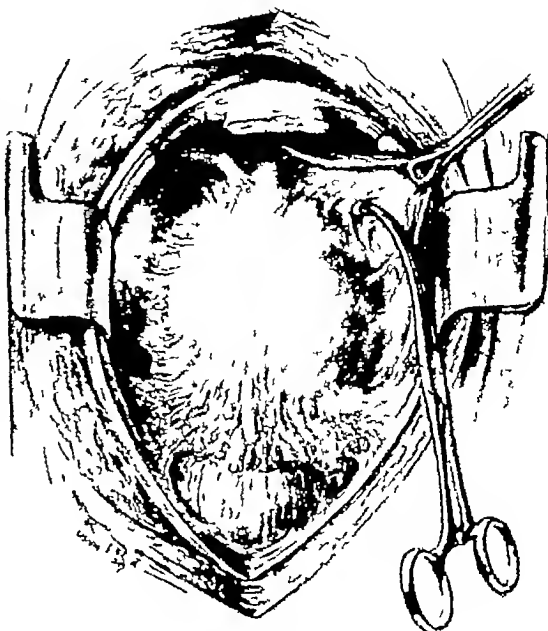


Fig 12 Pleura and lung are dissected free from anterolateral pericardium on both sides to permit excision of thickened pericardium as far, approximately, as the phrenic nerve, which however is not easily or always identifiable

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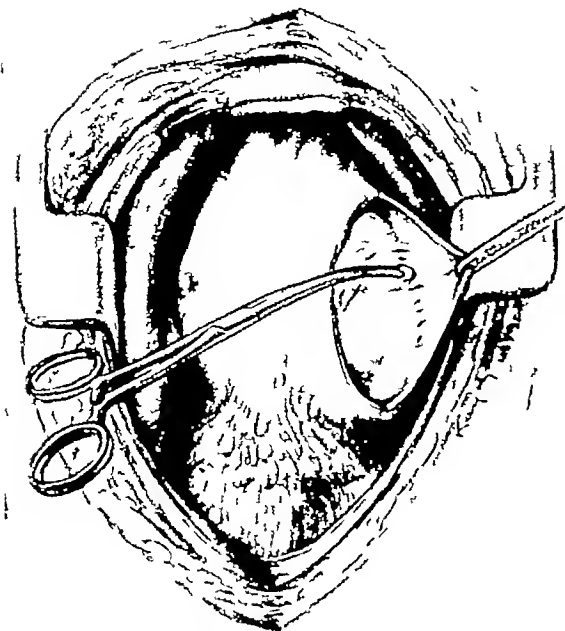


Fig 13

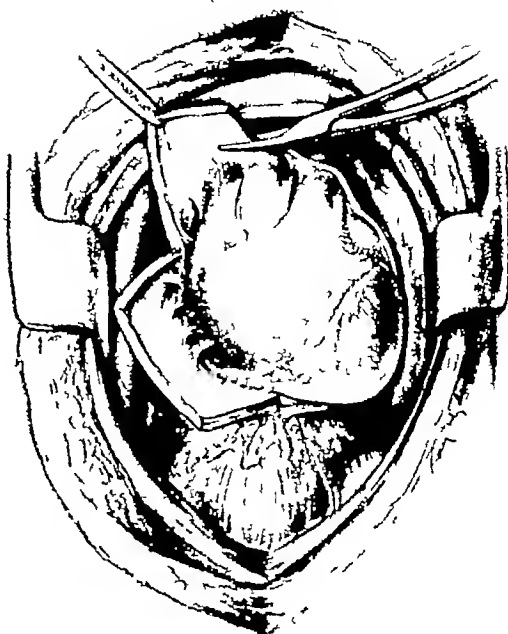


Fig 14

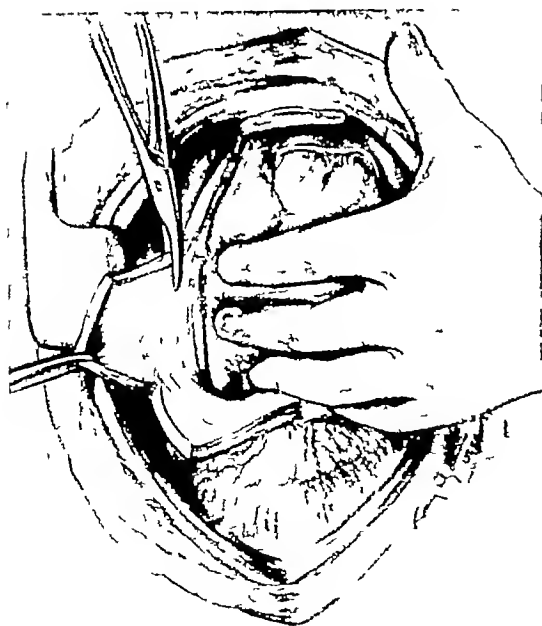


Fig 15

Fig 13 Incision is made in pericardium over the presumed site of the left ventricle and the left border and apex are dissected free first.

Fig 14 Anterior surface and base of heart are completely freed, if calcification permits, with excision of pericardium over pulmonary artery, aorta, and superior vena cava.

Fig 15 Right anterolateral border of heart is liberated by excision of pericardium overlying right auricle and inferior vena cava. Right pleural cavity is usually entered during this dissection. Right phrenic nerve should not be injured.

A useful tool in separating the heart from the pericardium is the so called "peanut" dissector, a small round pea-sized bit of gauze in a

curved clamp. By painstaking slow dissection, now blunt, now sharp, the proper cleavage plane can be maintained, but is easily lost



Fig 16

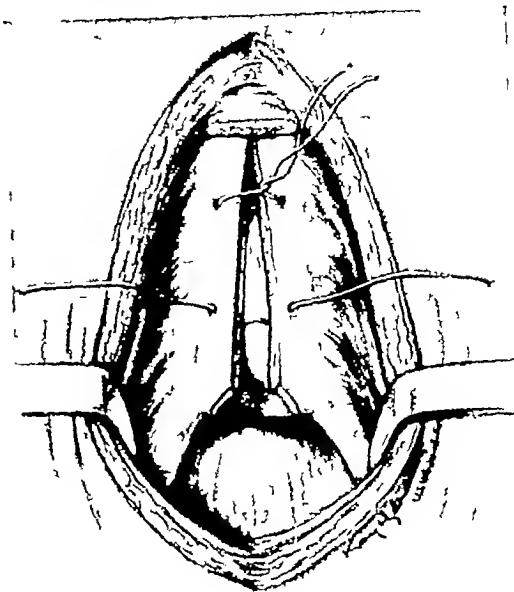


Fig 17

Fig 16 Decortication is completed by excision of pericardium, usually greatly thickened and calcified, lying between anteroinferior border of heart and the diaphragm. Normal muscle fibers of diaphragm may be brought to view during this dissection, which should run from inferior vena cava to apex of heart.

Fig 17 Sternum is reapproximated by 2 heavy steel wires placed in bony part of sternum—not in avascular cartilaginous part.

Fig 18 Fascia and deep subcutaneous tissue are reapproximated with interrupted silk or cotton sutures and skin is reapproximated with fine steel or silk sutures. Right pleural cavity may be deliberately connected with mediastinal space and drained by intercostal catheter in 5th or 6th interspace in nipple line.

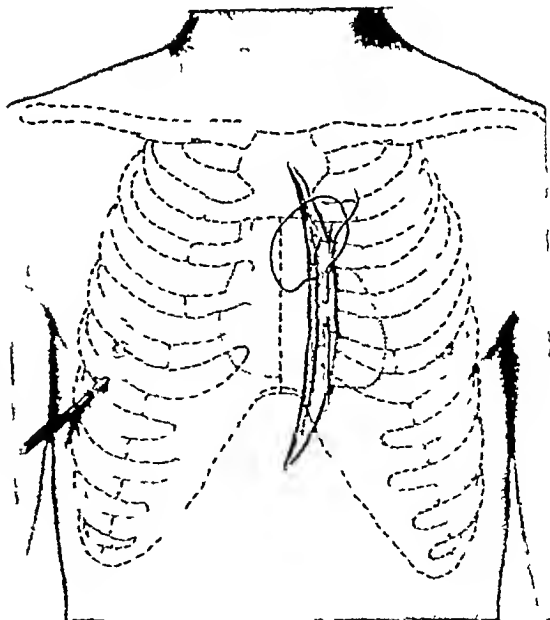


Fig 18

if speed is the watchword rather than safety. Bigger's suggestion to retain the pericardium back of the advancing edge of dissection be-

tween pericardium and myocardium may be lifesaving in case the myocardium wall is accidentally perforated, or excessive bleeding is



## MARTIN

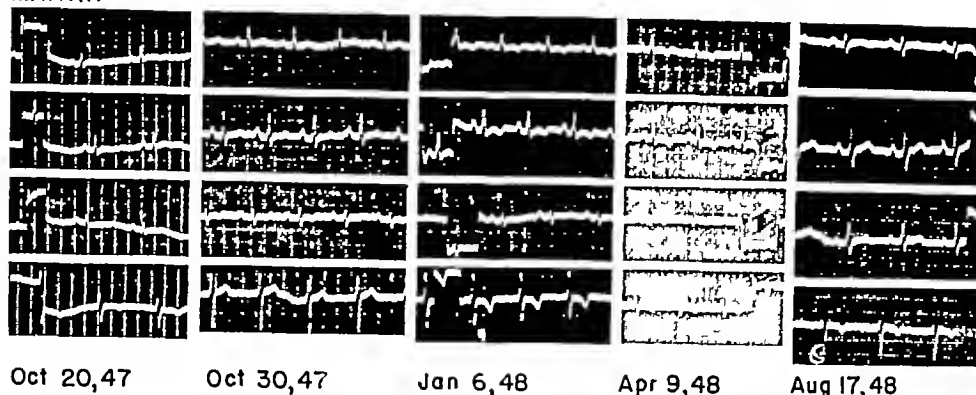


Fig 19 Case 4 October 20, electrocardiogram in the presence of a pericardial effusion showed low voltage in the *QRS* complex, and inverted *T*<sub>1</sub> and *T*<sub>4</sub> and flat *T*<sub>2</sub> and *T*<sub>3</sub> October 30, normal electrocardiogram with increased *QRS* voltage, and upright *T* waves accompanied the subsidence of effusion and reduction in cardiac shadow January 6 to April 9, the development of cardiac constriction was accompanied by decreased *QRS* voltage and by inverted *T* waves August 17, pericardiectomy May 12 was followed by marked improvement in *QRS* voltage and by normal upright *T* waves in leads 1, 2, and 3

encountered Resuturing the liberated but still attached pericardium to the myocardial surface may be an effective control

Klose's suggestion that the pericardial defect be repaired with a fat or fascial transplant may be cast into the limbo of unnecessary refinements as may also Beck's early suggestion that these patients be operated upon in a negative pressure chamber to avoid the ill effects of pneumocardiac tamponade

Selection of the optimum time for operation may be difficult, and must be determined by conditions present in the individual case In the absence of fever, and in the presence of calcification, which in itself is evidence of a long standing chronic state, the detrimental effects of the disease are wholly mechanical in origin and the operation may be done at any time following a period of bed rest, during which the elimination of tissue fluids is promoted by a low sodium diet and by chemically induced diuresis Optimum nutrition with supplementary vitamins should be stressed and the thoracic and abdominal cavities should be emptied of their fluid as completely as possible by aspiration just before operation

When the signs of compression are accompanied also by signs of acute inflammation, the problem becomes twofold control of infection, and correction of the mechanical obstruction to the normal circulation of the blood The immediate treatment of the in-

fection obviously requires rest in bed, optimum nutrition including supplementary vitamins, the administration of penicillin and streptomycin on the assumption of tuberculosis since tuberculosis usually cannot be proved or disproved until operation, and the correction of anemia Improvement will be apparent from the reduction in fever, lowering of pulse rate and decreased sedimentation rate Operation may be delayed until such improvement is manifested, but should not be delayed long if the mechanical disturbances of compression are prominent, incapacitating, and progressive Under these conditions, the sooner the compression is corrected the better will be the ultimate results In Case 4 only 7 months elapsed from the onset of symptoms due to acute pericarditis with effusion to pericardiectomy for constricting pericardium, in Case 5, 10½ months elapsed In both cases tubercle bacilli were demonstrated on culture of pericardial fluid removed at operation

The administration of streptomycin decreases the hazard of operating in the presence of active tuberculous pericarditis, as these cases illustrate In Case 4, streptomycin was reserved for the immediate postoperative period, since this was considered the crucial period of recovery, and its administration was continued for 3 months after the operation

In Case 5, on the assumption of an active tuberculous pericarditis, streptomycin, 1 gram

daily, was administered from November 27, 1947, to March 23, 1948. Pericardiectomy was performed May 15, 1948, and streptomycin, 2 grams daily, was again administered from May 10 to July 6, and 1 gram daily from July 6 to August 10, 1948.

The problem of early diagnosis, and the recognition of the disease, have been greatly clarified in the writings of White, Levine, Beck (1, 2), Burwell, and others. As Levine states, "it is amongst patients who are regarded as having heart failure, but in whom the ordinary causes are lacking, i.e., hypertension, coronary sclerosis, valvular disease, hyperthyroidism, or who are thought to have cirrhosis of the liver, in whom constrictive pericarditis will be found." Moreover, it is more commonly found in younger patients, the average age of 100 reported cases being only 25 years.

Any young patient, therefore, who presents symptoms suggestive of myocardial failure, but who has ascites or pleural effusion or peripheral edema associated with heart sounds that are quiet or muffled, and unaccompanied by a murmur, whose cardiac borders move but little under fluoroscopy, whose arterial pressure is low and pulse pressure small, and whose venous pressure is above 15 centimeters of water in the arm and 5 centimeters to 10 centimeters higher in the leg, should be strongly suspected of having constrictive pericarditis, and should be surveyed again with this diagnosis in mind. Particularly suspect should be the patient who has Beck's triad of a "small, quiet heart, ascites, and increased venous pressure," associated with the corroborative evidence of an electrocardiogram exhibiting low voltage in the QRS complex and inversion of the T waves (Fig. 19).

#### SUMMARY

In 265 recorded operations for constrictive pericarditis, 22 deaths occurred on the operating table, 48 deaths occurred in the early post-operative period, 118 cases were considered cured and 44 cases improved.

The following important factors contributed to the success of the operation: its application in young individuals in whom other organs were normal and in whom liberation of the

compressed heart or its vessels was the only correction necessary, the availability of intratracheal anesthesia, and of oxygen, transfusions and antibiotics, an adequate exposure of the heart permitting ready access to critical areas for the removal of the offending scar, the courage and technical skill of the operating surgeon which enabled him to pursue the operation until adequate decompression of all critical areas had been achieved.

Factors contributing to poor results were such considerations as the etiology of the primary pericarditis, whether tuberculous or pyogenic, the selection for operation of exceedingly ill patients, technical difficulties such as tears in the thin-walled auricle or in the myocardium of the right ventricle, inability to remove the scar because of penetration of cardiac musculature by calcium deposits, failure to remove scar over critical areas such as the inferior and superior vena cava, technical difficulties imposed by inadequate exposure of the heart, and lastly, the postponement of a correct diagnosis until the liberation of attenuated and atrophied myocardium resulted only in circulatory failure.

A satisfactory and adequate pericardiectomy must include liberation of all borders of the heart, and of both venae cavae. The inferior cardiac border must be liberated by excision of the pericardium lying between the heart and the diaphragm.

Persistence of ascites following pericardiectomy is evidence of an inadequate decortication and demands reoperation and removal of more scar, rather than an omentopexy or Talma operation.

The best evidence of an adequate operation is prompt and permanent lowering of venous pressure.

To achieve the exposure necessary for an adequate inspection and decortication of the heart, a median sternotomy with transverse division of the sternum in the second interspace is recommended. Reapproximation is by several stainless steel sutures inserted through bone, not through avascular cartilage.

The wound should be drained, preferably into the right pleural space from which the fluid can be removed either by aspiration or by intercostal drainage.

In cases suspected of having tuberculosis or in which evidence of active inflammation is present, the preoperative preparation should include a prolonged period of bed rest with optimum nutrition, and the administration of penicillin and streptomycin. Operation should not, however, be deferred unduly, if the symptoms of compression are incapacitating, unaffected by therapy, and progressive.

Nine patients have been operated upon: 5 of unknown etiology, with 1 dead, 3 cured, 1 improved, and 4 of active tuberculous pericarditis, with 2 cured, 1 markedly improved, 1 improved.

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# BRONCHIECTASIS

## A Study of the Segmental Distribution of the Pathologic Lesions

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WITHIN recent years, interest has been manifested in the possibility of resecting lung segments in bronchiectasis as opposed to performing lobectomies. The principles underlying the procedure of segmental lung resection are several.

The first and most important assumption is that bronchiectasis is not a progressive disease, or at least that the disease has progressed as far as it will by the time diagnosis is made (1), and thus that extension from one segment to another is not by spread of the bronchiectatic process from the affected segment but by involvement of the unaffected segment by an acute pulmonary infection. Such a view, of course, may be colored by an individual's underlying concept of the disease. It is an open question at the present time whether bronchial ectasia (from which the disease is named) is a primary phenomenon or merely secondary to parenchymatous disease. Certainly, it seems reasonable to suppose that an infected segment could, by overflow into another suitably situated segmental bronchus, produce infection of that segment (2). In reviewing his cases of segmental resection, Pilcher states, "It appears on review of these cases that in some the interval between bronchogram and operation has been too long, and there may have developed in the interval areas of disease which were not present before."

The second assumption is based on the consideration that bronchiectasis is primarily a segmental disease (1, 3, 7), even though it is very frequently multilobar (80 per cent in Churchill's series). We have seen no detailed pathologic study to confirm this, though in a general way, it appears to be correct, for example the lingular segment of the left

upper lobe is usually the only segment of this lobe involved.

The third consideration involved is the obvious advantage of preserving as much healthy lung tissue as possible for the patient's benefit, especially in bilateral and extensive disease. There is, of course, no criticism of this thought.

If these assumptions are correct, there should be no histopathologic changes present in segments which are normal bronchographically and grossly. Therefore, such segments may be saved for the patient's benefit.

With these points in mind, we thought it worthwhile to make a pathologic study of bronchiectatic lung tissue by examining each segment in detail. Only 7 cases have been studied over a 6 month period but it was thought that a report of even a limited study might emphasize the importance of detailed examination of the lungs in a problem which is still controversial.

The material consists of 7 cases of fairly early bronchiectasis in children, for which lobectomy, and in 1 case pneumonectomy, was performed by Dr Dudley E. Ross. As lingulectomy was the only form of segmental resection used, it was possible for us to study the gross and microscopic lesions in a number of segments, some of which were normal roentgenographically and some of which were diseased.

Examination of the lungs was carried out as soon as the specimens were brought from the operating room. They were dissected segmentally. The nomenclature is that used by Foster-Carter. Careful observations were made on the gross specimens, both before and after fixation of the specimen in 10 per cent formol saline. Depending on the size of the lung, one, two, or three sections were taken from each segment for histological examination. These were stained by modifications of Masson's trichrome technique, Weigert's stain

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TABLE I

Case No	Age years	Sex	Symptoms	Duration of symptoms	Illnesses prior to onset of symptoms	Illnesses after onset of symptoms
1	11	F	Cough nonproductive intermittent fever	8 yrs	Repeated upper bilateral bronchopneumonia acute otitis media (right)	9 hospital admissions pneumonia whooping cough (2 yrs) measles (2 yrs)
2	3	M	Cough no mention of sputum intermittent fever	2 yrs 1 mo	Bronchopneumonia nephritis	
3	8	F	Cough moderate amount of sputum	5 yrs	Bilateral pneumonia	Frequent "colds" nasal discharge cough measles chicken pox mumps
4	2	M	Cough with considerable greenish sputum anorexia failure to grow pallor	1 yr	Measles pneumonia	Frequent "colds"
5	10	F	Cough moderate productive frequent fever nasal discharge	3 mos. 3 mos. 3 mos	Pneumonia chronic pansinusitis chicken pox measles whooping cough bronchopneumonia	
6	9	F	Cough productive	6 yrs	Bronchitis mumps	Measles whooping cough
7	9	F	Cough no mention of sputum failure to gain weight anorexia	Since infancy		Chronic bronchitis polypoid bar palisade

for the elastic tissue, and hematoxylin and eosin

#### GENERAL DESCRIPTION OF THE CASES

The patients, of whom 2 were males and the remainder females, varied in age from 2 to 11 years. The symptoms dated from 1 to 8 years prior to the operation. Further details are given in Table I.

Lipiodol installation was the most important diagnostic procedure used to determine the presence and distribution of bronchiectasis and was carried out in all cases (Table II). The roentgenographic distribution of the lesions is clearly indicated in Table II. The implications will be discussed later. Except in 2 instances (i.e. Case 5, in which pus was seen in the bronchus to the posterior basic segment and Case 4 in which all segments of the right side were involved) bronchoscopic examinations were not helpful in the localization of the disease according to segments.

#### GROSS APPEARANCE OF SPECIMENS

The lung parenchyma in all cases presented a uniform type of change. It was moderately collapsed and soft to doughy on palpation. Aeration was minimal and the cut surface was jelly-like to gelatinous as seen under the hand lens. No gross scarring was seen. There was no striking difference in the parenchyma between involved and uninvolved segments. In Case 4, the major bronchi were nodular

In Cases 1, 2, and 3 no bronchial ectasia; only questionable bronchial wall thickening were noted. Gross changes of the bronchi: the dorsal segment in Case 4 were present while in Case 7 there was slight ectasia without thickening. In the remainder of the cases no gross lesion was apparent in the dorsal segment bronchi. In Case 5 the lingular bronchi showed slight thickening of the wall while the basilar bronchi showed moderate changes of the same type. The lingular bronchi in Case 7 showed somewhat more marked changes than the basic segments. In Case 4 the middle lobe bronchi showed somewhat more marked gross changes than the basic segments.

The distribution of bronchial contents did not always correspond to the degree of ectasia. Except in Case 4, the bronchial contents were more mucoid than purulent and were relatively scanty.

#### HISTOPATHOLOGY

Before dealing in some detail with the lesions of the segments which on bronchographic and gross examination were involved, a consideration of the overall picture in these cases will be made. The lesions were inflammatory in nature with the lymphocyte and monocyte as the predominant cells but a few neutrophils were present as well. The cellular infiltrate and fibrosis varied considerably from case to case and segment to segment. The bronchial wall

TABLE II — BRONCHIECTATIC INVOLVEMENT

Case No	Bronchographic findings		Microscopic degree of involvement				Musculoelastic lesions	Extent of operation
			Segments	Lobe	Inflammatory	Fibrosis		
1 199	A B	Mild	D	Lower	+	+	o	Right lower lobe
			A B		++	+	o	
			M B		++	o	o	
			P B		++	o	o	
2 224	D	Not filled	D	Lower	+++	++	o	Right lower lobe
	A B	Minimal	A B		++++	++++	+	
	M B		M B		++++	++++	+	
	P B		P B		++++	++++	+	
3 235	A M	? No dilatation	A M	Lower	++	+	o	Left lower lobe and lingula
	L M	? No dilatation	L M		++	+	o	
	A B	Very minimal	D		++	++	o	
	A B		A B		+++	++	o	
	M B		M B		++++	+++	o	
	P B		P B		++++	o	o	
4 253	A	Quite marked	A	Upper	+	o	o	Pneumonectomy right
	P L		P L		++	+	o	
	A L		A L		+++	++	+	
	A M		A M	Middle	+++	+++	+	
	L M		L M		+++	+++	+	
	D	(Cylindrical and saccular)	D	Lower	++++	+++	++	
	A B		A B		++++	+++	++	
	M B		M B		++++	+++	++	
	P B		P B		++++	+++	++	
5 254	A M	Slight	A M	Lingula	+++	++	+	Left lower lobe and lingula
	L M		L M		+++	++	+	
	A B	Moderate	D	Lower	++	+	o	
	M B		A B		++++	++	+	
	P B		M B		++++	+++	++	
6 281	A M	Slight	A M	Lingula	++++	+++	++	Right lower and middle lobes
	L M		L M		++++	+++	++	
	A B	Minimal	D	Lower	+	o	o	
	M B		A B		++	++	o	
	P B		M B		++	++	o	
7 281	A M	Moderate	A M	Lingula	++	++	o	Left lower lobe and lingula
	L M		L M		++++	++	++	
	D	Moderate	D	Lower	+	+	o	
	A B		A B		+++	+	o	
	M B		M B		+++	++	o	
	P B		P B		+++	++	o	
	P B		P B		+++	++	o	

+ Very slight ++ slight +++ moderate ++++ marked

A Apical A L anterolateral L M lateral middle A B anterior basic P B posterior basic P L posterolateral A M anterior middle D dorsal M B middle basic

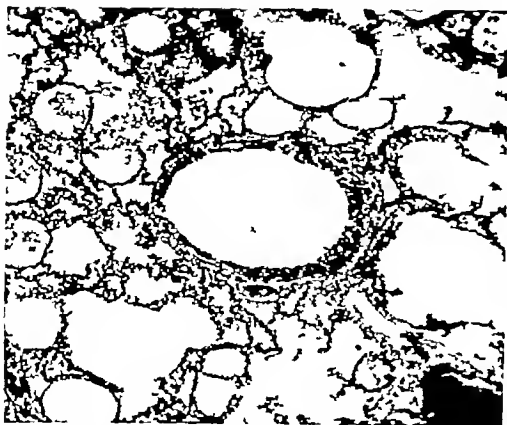


Fig 1 Photomicrograph of a normal bronchiole and adjoining alveoli of a 9½ year old child. For comparison with the other photomicrographs presented in this contribution.  $\times 65$

matory lesions in our opinion became more and more marked as the bronchi became smaller. The major bronchi showed lesions which were not so severe as were those in the small bronchi and the bronchioles. Scarring also was more marked peripherally than centrally.

Lesions of the parenchyma (including respiratory or transitional bronchioles and alveoli) were common. The alveolar lesions were often focal and seemed to be related to



Fig 3 Photomicrograph of respiratory bronchiole of left anterior middle segment in Case 3. Just above the center of the field is a tiny lymphatic surrounded by a collar of lymphocytes and neutrophils. A similar infiltrate is present in the alveolar wall in the lower right hand corner, as well as an area just above it. Bronchographically, there was no dilatation demonstrable in either of the lingular segments.  $\times 125$

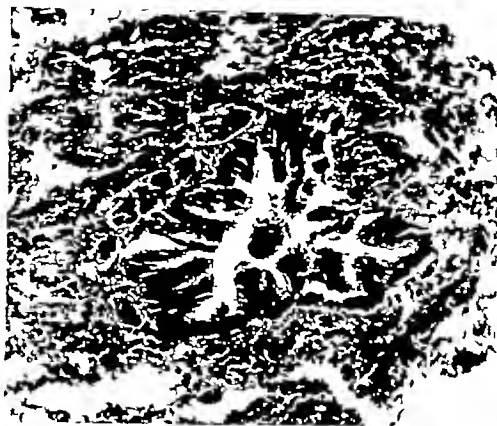


Fig 2 Photomicrograph of dorsal segment bronchiole in Case 1. Small subepithelial granulation tissue mass in right upper area of bronchiole. Focal adventitial inflammatory infiltrate. Segment normal bronchographically.  $\times 135$

involved respiratory and terminal bronchioles, as well as to small bronchi. The lesions were those of inflammation with scarring. Probably alveolar fibrosis predominated over interstitial alveolar wall inflammation. Alveolar exudates were uncommon over a large area but occasional foci involving several alveolar lumens were found (except in Cases 1, 4 and 7). Traces of previous alveolar inflammation, as indicated by fibrous polyps occupying the lumens, were found in Cases 2, 3, and 5. Tiny subepithelial fibrous or granulation tissue masses were found projecting into the lumens.



Fig 4 Photomicrograph of dorsal segment bronchiole in Case 2. There is moderate subepithelial fibrosis and muscle fibers at lower right hand corner of bronchiole. There is alveolar fibrosis below the bronchiole. Segment not filled bronchographically.  $\times 50$

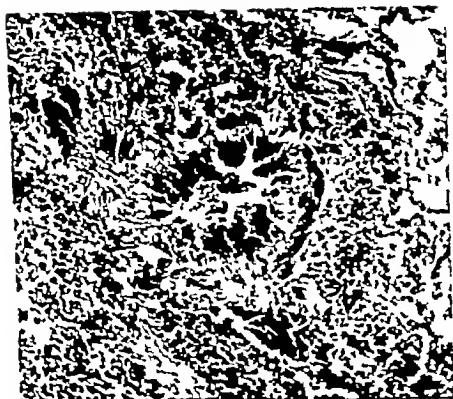


Fig 5 Photomicrograph of dorsal segment bronchiole in Case 3. Slight diffuse adventitial inflammatory infiltrate. At bottom of photograph, note the exudate lying in the tissues parallel to a small lymphatic vessel. Segment normal bronchographically  $\times 125$ .

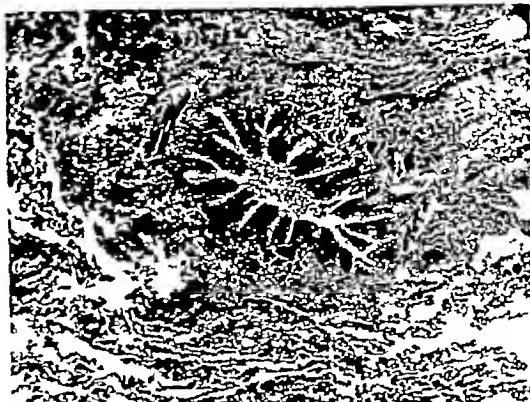


Fig 7 Photomicrograph of small dorsal segment bronchus in Case 5. Moderate adventitial inflammatory infiltrate and fibrosis. At the bottom of photograph, note the irregular scar extending into the parenchyma. Segment normal bronchographically  $\times 65$ .

of the terminal and respiratory bronchioles in all cases. Partially collapsed alveoli were prominent.

Mucosal ulceration was rare and when present was focal in character. The epithelium was essentially normal with normal cilia in all cases, except Case 4, where a slight degree of focal metaplasia existed. Destruction of the elastic and muscle coats was far from striking, as can be seen from Table II, and was mainly focal in character. There was no correlation between ectasia, as demonstrated by bronchogram, and loss of these coats. In all instances, except those segments

showing marked inflammation, normal bronchi and bronchioles existed side by side with involved tubes. As the blocks were not serial sectioned, it is difficult to say whether such normal bronchi were uninvolved in their entire length. Focal and diffuse scars were found in some, either in the submucosa, the adventitia, or both.

Lymph follicle formation in the bronchial walls was not as marked a feature in most of these cases, as compared to the number present in well marked chronic bronchiectasis. Endarteritis obliterans of the pulmonary arteries was present only in those segments which



Fig 6 Photomicrograph of dorsal segment bronchus in Case 4. Marked inflammatory lesions with slight fibrosis. Quite marked ectasia is demonstrated bronchographically  $\times 65$ .

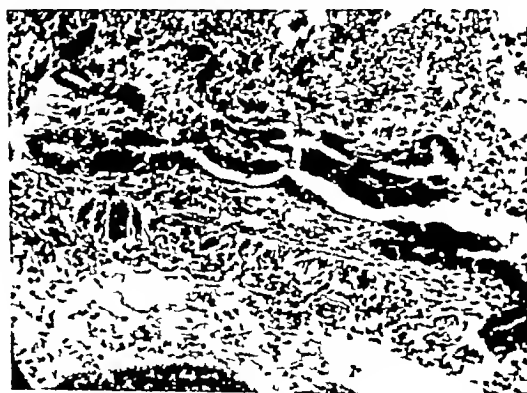


Fig 8 Photomicrograph of dorsal segment bronchiole in Case 6. This shows a slight inflammatory infiltrate of the submucosa and adventitia. Segment normal bronchographically  $\times 125$ .



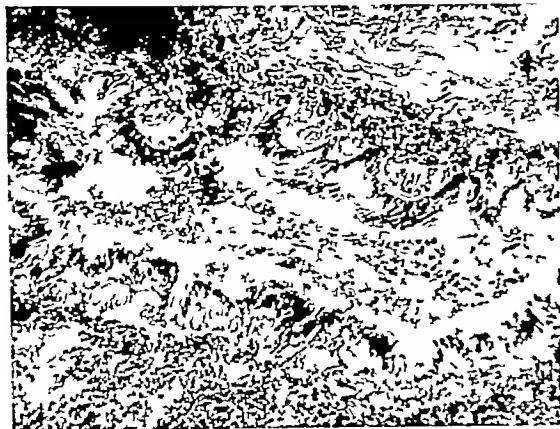


Fig 9 Photomicrograph of small dorsal segment bronchus in Case 7. This segment showed very slight microscopic lesions, yet bronchographically there was moderate ectasia. Here there is seen a very slight peribronchiolar invasion by inflammatory cells.  $\times 65$



Fig 10 Photomicrograph of small bronchus of mid basic segment in Case 1. Moderate inflammatory exudate of submucosa and adventitia similar in degree to the roentgenographically dilated anterior basic bronchi. Segment normal bronchographically.  $\times 65$

were severely involved and was not a marked feature.

The lesions of the segments which were uninvolved on bronchographic and gross examination were on the whole similar in type but quantitatively less. These lesions are of the greatest interest in view of the inference in the surgical literature on segmental resection that bronchographically normal segments, found to be grossly normal at operation, can be safely left behind. Such seem to apply in the main to the dorsal segment of the lower

lobes as it is admitted that in nearly all cases the three basic segments and the lingular segments are usually involved. Churchill and Belsey do state, however, that commonly only the posteromedial (anterior middle branch in our terminology as far as could be determined) branch of the lingula is involved and it is a rare occurrence for both of the segments to be diseased.

In these 7 cases the microscopic involvement varied somewhat in different cases but in none of the supposedly normal segments were the lesions marked. In those noted as "very slight" in the table, the lesions were focal and were minimal in degree. They are perhaps colored by individual interpretation; nevertheless, we consider that such lesions are not present in normal lungs at this age. Those cases marked as "slight" in the table were minimal in degree but were fairly diffusely scattered throughout the segment and there is no doubt that these changes are abnormal.

The lesions were those of inflammation and its sequelae. The bronchial lesions consisted of thin infiltrations of lymphocytes with occasional neutrophils in the submucosa or adventitia. These tended to be focal rather than diffuse and were found in some bronchi but were absent in others. Small submucosal masses of granulation tissue or focal areas of scarring were sometimes found (Fig 2).



Fig 11 Photomicrograph of bronchiole in posterior basic segment in Case 1. Moderate inflammatory exudate involving whole thickness of wall with slight fibrosis. This was equal in degree to that of the anterior basic segment which alone was dilated bronchographically.  $\times 65$



Fig 12 Photomicrograph of respiratory bronchiole of posterior basic segment in Case 1. Note infiltrate of the wall with extension into the contiguous alveolar walls. This lesion is a typical example of those found at this site in all bronchographically normal and diseased segments. Segment normal bronchographically.  $\times 135$



Fig 13 Photomicrograph of respiratory bronchiole of left anterior middle segment in Case 3. Lymphoid collection present outside muscular coat of bronchiole. Inflammatory cells extending out along interstitial tissue (below and to right and left of bronchiole). Bronchography showed doubtful ectasia.  $\times 138$

Lymphocytic infiltration of the adventitia or adventitial scarring was comparatively common. Nevertheless, the bronchial lesions were minimal in degree.

The bronchioles presented the relatively most marked lesions. The bronchioles were more widely involved by the chronic inflammatory infiltrates and the degree of infiltration appeared slightly more intense. Lymph follicle formation was present and was particularly striking in Case 1. We consider that the amount present was abnormal but have not laid stress on this finding. Submucosal fibrosis of slight to moderate degree was more common than in the bronchi. Thin collars of lymphocytes and neutrophils were present in scattered areas about tiny lymphatics (Fig 3). The alveolar walls contiguous to involved bronchioles showed variable changes, consisting of focal interstitial pneumonia or fibrosis with epithelization of the lumens. Occasionally one or several alveolar lumens contained a mixed exudate of macrophages and neutrophils. Alveolar expansion as a whole was poor and scattered foci of alveolar wall fibrosis were evident. Intra-alveolar fibrous polyps were occasionally found and in Case 5 they were relatively numerous.

It is useless to speculate on the origin and outcome of these lesions from the histopatho-

logic point of view. It is merely possible to state that definite, if minimal, inflammatory lesions were present.

#### DISCUSSION

From the clinical point of view, the roentgenologic diagnosis of bronchiectasis is the most reliable guide to the extent of the lesions. For all practical purposes, especially segmental surgery, it is the bronchographic appearance, coupled with examination by the surgeon at the time of operation, which determines the extent of the operative procedure. However, as Pilcher says, the exact value of palpation of the lung at operation has yet to be proved.

Bronchographic diagnosis of bronchiectasis was made in the segments as shown in Table II. The gross and microscopic findings are represented in parallel columns. It is evident that there are segments showing histopathologic inflammatory lesions in which no change was demonstrated by bronchography or by gross examination. The microscopic changes were similar in type to those seen in the segments which showed roentgenographic change but less in degree. The dorsal segments showed histopathologic involvement in every case, minimal in Cases 1, 6, and 7 (Figs 2, 4, 5, 6, 7, 8, and 9). In only 2 cases, Nos 4 and

7, was definite involvement demonstrated by bronchography. Case 7 was the converse of the others in that the lesions were minimal while the bronchographic examination showed moderate involvement. In 1 case, No. 2, the bronchus to the dorsal segment was not filled and here the microscopic changes were fairly marked with several minute healing abscesses. The difference between the lesions of the dorsal segments and those of the basic segments appeared to be quantitative only.

That extreme care must be exercised in the interpretation of the roentgenographic appearance in the selection of the segments for resection, is illustrated by the fact that even the more advanced lesions, on occasion, are not accompanied by changes in the roentgenographic appearance. In Case 1, only the bronchi to the anterior basic segment were abnormal, roentgenologically, whereas microscopic examination revealed lesions, as well marked as those of the anterior basic, in the bronchi to the other two basic segments (Figs 10, 11, and 12). Similarly, in Case 3, only the basic segment bronchi showed dilatation roentgenographically while the anterior middle and lateral middle segments of the lingula were definitely abnormal (Figs 3 and 13). It may be noted at this point that all the lingular segments were involved to an equal degree. In Case 6 the middle lobe bronchi were only slightly dilated bronchographically, while microscopically the lesions were severe.

It would appear from the foregoing that when disease is present to such a degree as to be visible roentgenographically, the adjacent segments are usually involved by inflammation, though to a lesser degree. It is possible nonetheless that these are early lesions, capable of progressing to either full blown bronchiectasis with permanent dilatation or to temporary dilatation of the reversible type (4, 6), and by the same token it seems equally reasonable to suppose that those inflammatory lesions may regress without the development of bronchial ectasia if the major focus of infection is removed. The relationship between duration of symptoms and the degree of this minimal involvement of segments unaffected grossly could not be determined in this group of cases.

From a purely histopathological viewpoint it is impossible to state whether the lesions were progressive or not. In the segments with very slight involvement, the possibility seemed remote but in the slightly involved segments one could speculate on the possibility of progression. If these lesions were secondary to extension from the involved segments, they might have cleared completely, following segmental resection. On the other hand, it is possible that they represent a persistent low grade inflammatory process following a pneumonitis.

In basic segments, however, where bronchography has not demonstrated dilatation, we have observed lesions as marked as those in segments in which involvement had been shown by roentgenographic examination. Therefore, we believe that extreme caution is necessary in evaluating the extent of the lesions. Correlation with bronchographic changes in these few cases has not been entirely consistent. This perhaps is comprehensible if one accepts the theory that ectasia is a secondary phenomenon depending on the degree of atelectasis and parenchymatous involvement.

#### SUMMARY

1 The various lobes from relatively early cases of bronchiectasis in children, for which lobectomy (and in 1 case pneumonectomy) had been performed, were dissected segmentally. The distribution of the lesions, as seen roentgenographically, is compared with the gross and microscopic findings.

2 Destructive lesions of bronchi, such as epithelial ulceration and destruction of muscle and elastica, were not a predominant feature.

3 Detailed microscopic examination showed definite if minimal inflammatory lesions of the segments which by bronchographic and gross examination appeared unaffected. These lesions are essentially similar to those found in the affected segments but it is impossible to draw any conclusions as to whether they are progressive or not.

4 The pathologic findings in this small series of cases have not been entirely consistent with the bronchographic appearance. This

understandable if ectasia is considered as a secondary phenomenon and if visible and definite involvement is not immediately present

5 Such findings point to the necessity of further detailed study of the various lung segments in bronchiectasis from the clinical, roentgenological, surgical, and pathological aspects

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## VAGOVAGAL REFLEXES

## Electrocardiographic Changes During Vagotomy

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CASES of sudden death due to cardiac or respiratory arrest coincident with manipulation of a vagus nerve or its branches during surgery in the neck or thorax have been reported (3). While direct stimulation of cardiac vagal fibers may have occurred, it is the opinion of some (22) that the majority of vagal stimuli, even those arising above the cardiac branches, result in an impulse which takes an afferent path to the medulla. An efferent impulse, completing a reflex, may then return over vagal fibers causing cardiac inhibition. This may be considered an example of a true vagovagal reflex in contrast to some partially nonvagal reflex arcs in which the impulse traverses other than vagus pathways for a portion of the arc.

Operations in which the procedure traumatizes the vagi between the pulmonary plexus and the stomach have increased with the revival of vagotomy for the surgical therapy of duodenal ulcer. To date only 1 apparently authentic case of a vagovagal reflex resulting in cardiac arrest and death during vagotomy has been reported (21). A previous incident in which vagovagal reflexes may have initiated an unfavorable postoperative course which shortly terminated in death has been recorded by Moore and associates.

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Development of the various types of anesthesia in use today has necessitated an evaluation of the effects of preanesthetic and anesthetic medications on cardiac function. These alterations have frequently been conveniently recorded by means of the electrocardiogram. The difficulty of dissociating the effects of surgical manipulation from those specifically resulting from the anesthetic itself have been commented on in these reports, and the predominant role of the vagus nerves in the transmission of the afferent or efferent impulse, or both, has been emphasized.

Electrocardiographic alterations in specific relation to the operation of vagotomy for duodenal ulcer are of interest in further investigation of this problem. These changes would be expected to be subclinical in nature, but might indicate, to some extent, the possibility of more serious sequelae to a vagovagal reflex.

ELECTROCARDIOGRAPHIC OBSERVATIONS  
DURING VAGOTOMY

Bilateral vagotomy between the pulmonary plexus and the stomach, by a left transthoracic approach, was done on 10 dogs. Another procedure to be described later, which also involved the vagus nerves, was performed on 3 additional animals. No premedication was given and endotracheal ether anesthesia was employed. Anesthesia was maintained at an even depth throughout operation. Standard

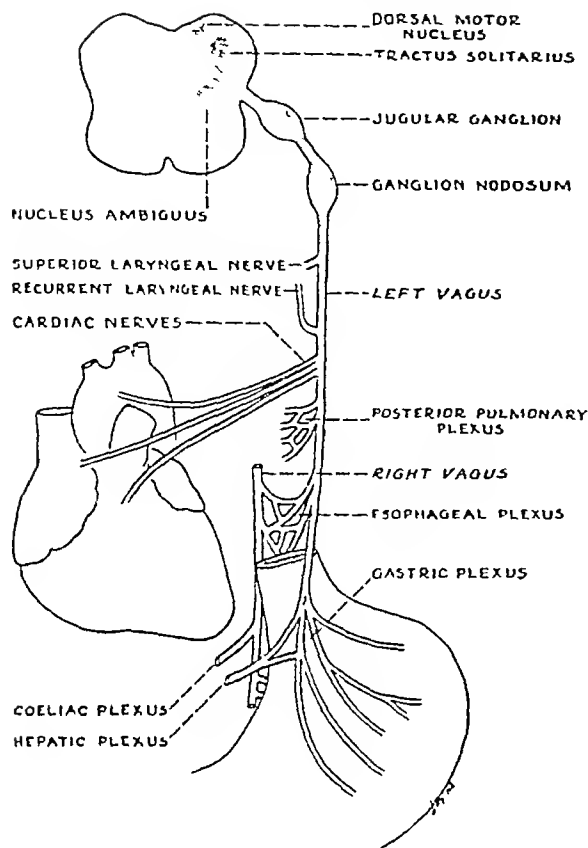


Fig. 1 Diagrammatic sketch of principal vagus pathways

lead II was utilized in all cases, with the dogs in the right lateral position. Tracings were taken almost constantly, and always during manipulations involving viscera or vagus nerve trunks.

Electrocardiograms were also taken in the cases of 10 humans before, during, and after bilateral vagotomy for duodenal or marginal ulcer. In 4 of these the electrocardiographic tracings during portions of the operative procedure were not entirely satisfactory, and the possibility of transient changes of undetermined type was present. In 6 cases records were complete in every respect. In 5 of these transabdominal operations were performed and in 1 transthoracic was carried out. The usual preanesthetic medications were given, since they do not entirely abolish subclinical changes in cardiac function which occur during surgery and anesthesia.

TABLE I—ELECTROCARDIOGRAPHIC CHANGES OBSERVED IN 13 DOGS AND 6 HUMANS DURING OPERATIONS INVOLVING SECTION (10 ANIMALS AND 6 HUMANS) OR ISOLATION (3 ANIMALS) OF THE GASTRIC VAGI

Types of electrocardiographic changes observed	No animal		No human	
	Total No each change noted	No related to vagal stimulus	Total No each change noted	No related to vagal stimulus
Decrease in heart rate	1	1		
Decrease in amplitude, notch, or inversion of P wave	1			
Increase or decrease in amplitude of R wave	1			
Prolongation of P-R interval	0	1	1	1
Dissociation phenomena		1	1	1
Nodal rhythm			1	
Sino auricular pause	1	1		
Sinus arrhythmia	6	1	1	
Premature beats	2		1	
Flattening or inversion of T waves	3			

All electrocardiographic records taken in the period after induction of anesthesia and before beginning the operative procedure were normal. On 11 occasions during the operative procedures on 5 animals, decreases in rate, changes in amplitude or inversion of the P wave, variations of the P-R interval, dissociation phenomena, or sinus arrhythmia at sino-auricular block, were thought to have been specifically related to manipulation of the vagus. Similar and other changes also occurred without relation to visceral or vagal stimulation. All changes observed during operation without exception reverted to normal simultaneously with or shortly after closing the chest. Factors such as artificial respiration, direct stimulation of the heart, endotracheal intubation, and irritant effects of anesthetic vapors cannot be entirely eliminated.

Changes apparently related to handling of the vagus nerve occurred in 2 human cases. The changes consisted of a lengthening of the P interval. Other electrocardiographic abnormalities seen in the humans are not related to a specific mechanical stimulus. In only 1 human case did any electrocardiographic

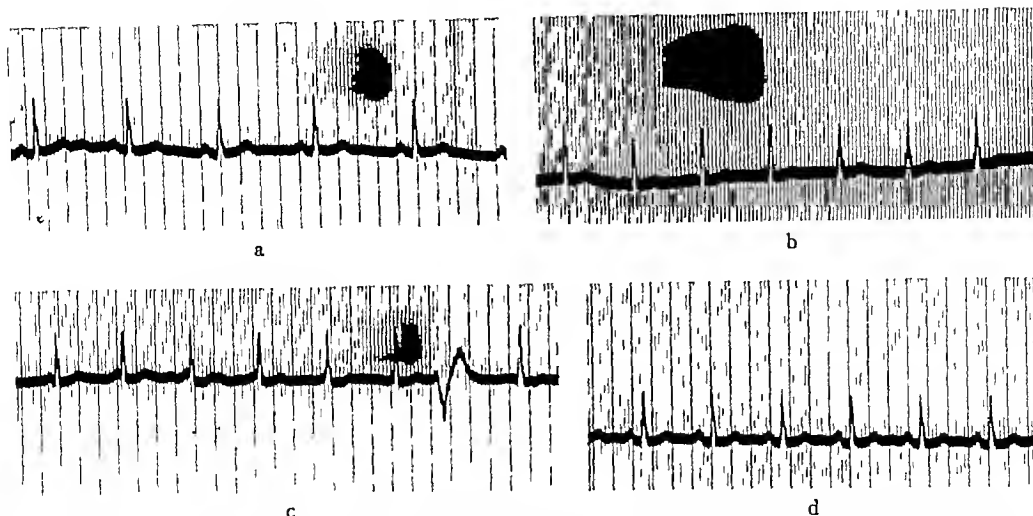


Fig 2 S W, 50 year old white male Transabdominal vagotomy for peptic ulcer Standard lead II a, Patient under ether anesthesia prior to surgery, sinus rhythm b, During manipulations of esophagus preparatory to isolation of vagi Middle nodal rhythm The fifth complex is suggestive of a low nodal beat with inverted *P* wave superimposed on *T* wave c, Recorded shortly after b Interference dissociation with 1 ventricular premature beat d, Immediately postoperative, sinus rhythm

show in the postoperative tracings. This patient had a normal preoperative electrocardiogram, but demonstrated an inverted *P* wave during most of the time that a vagotomy was being done. This reverted to normal before the patient left the operating table, and remained so the next day. Electrocardiograms taken on the second, third, fourth, and fifth postoperative days showed a reappearance of the inverted *P* wave. Explanation of this single instance of change in the postoperative tracings would be purely speculative.

If electrocardiographic abnormalities were noted they usually occurred early in the operation about the time that the first exploratory movements for the nerves were being made. Opening of the chest in the animals was never immediately followed by change in the electrocardiogram. When major changes in cardiac rhythm appeared they exhibited a definite tendency to persist throughout the remainder of the operation, and additional manipulation of viscera or nerve trunks failed to induce further change. There was no apparent relation to duration or depth of anesthesia.

In 3 animals bipolar electrodes attached to insulated wires leading from the chest were secured to one of the vagal trunks along the lower esophagus. Electrocardiographic trac-

ings were taken during surgery while the animals were under endotracheal ether anesthesia and repeated 24 hours later without anesthesia. Two animals showed no significant electrocardiographic change either during the operative procedure or during mechanical and faradic stimulation of the vagus 24 hours later. The third animal showed nodal rhythm and dissociation phenomena when traction was applied to the left vagus and this abnormality persisted until shortly after the chest was closed. Twenty-four hours later, without anesthesia, mechanical and faradic stimulation of the vagus caused a slight decrease in the amplitude of the *P* wave, occasional premature beats, sinus arrhythmia, and a brief sinoauricular pause. Conclusive evidence that cardiac effects will usually follow stimulation of the gastric vagi in the absence of anesthesia was not obtained from these experiments.

#### DISCUSSION

The numerous electrocardiographic studies which have been recorded during surgery and anesthesia are in some disagreement concerning the relative importance of visceral stimulation and that of the anesthetic in initiating these alterations. Some have felt that the anesthetic was the predominant fac-

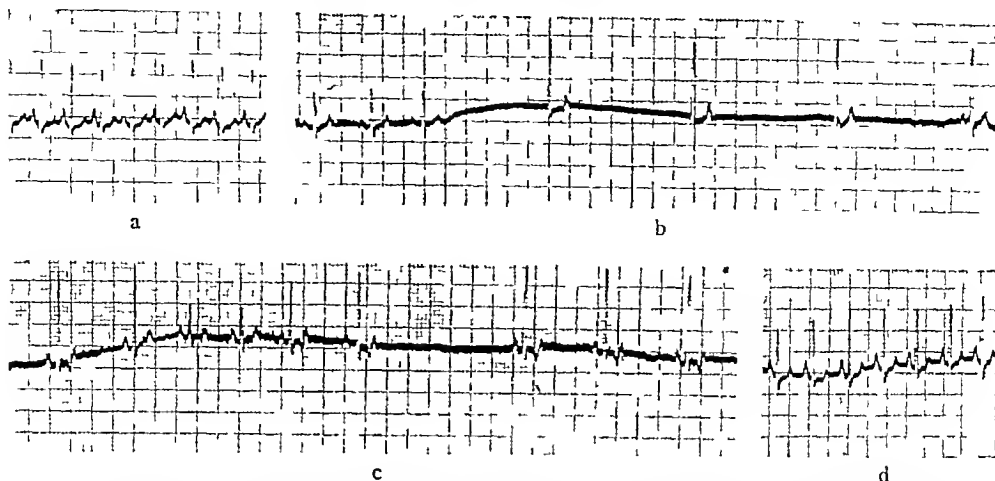


Fig 3 Dog No 5 Endotracheal ether anesthesia Standard lead II Dog in right lateral position a, Surgical anesthesia prior to surgery, sinus rhythm, rate approximately 215 b, Changes occurring during manipulation of esophagus preparatory to isolation of the nerves (left thoracic incision, positive pressure anesthesia) *P* wave changes in first three complexes suggest shift in sino-auricular pacemaker followed by a middle nodal escape and midnodal rhythm for 2 beats The sixth complex is a lower nodal beat The impulse for the last complex arose in the sino-auricular node Rate decreased from approximately 104 to 42 These changes persisted throughout surgery and were not influenced by actual clamping or traction of vagi c, Vagotomy completed, chest still open Variation in shape of *P* waves indicates shifting pacemaker in sino-auricular node There is a period of sino-auricular block after the sixth complex followed by return to sinus rhythm Variations in height of *R* waves may be attributed to respiratory effect d, Chest closed, surgical anesthesia maintained, sinus rhythm, rate approximately 166

tor (12), while others have indicated the frequent relation of the electrocardiographic changes to operative manipulation (10) The occurrence of cardiac abnormalities with anesthesia only, during anesthesia before beginning an operative procedure, and after conclusion of an operation, indicates that manipulation is not a prerequisite However, in many instances, there undoubtedly is a relationship between the manipulation and the cardiac changes The results in this series emphasize the etiological importance of mechanical stimuli occurring during surgery It is also probable that the anesthetic sensitizes certain tissues, and the result is a response to stimuli which would otherwise be ineffective (14)

The fact that in a few instances stimulation of the gastric vagi seemed directly to initiate alterations in cardiac rhythm suggests that the vagi serve as the afferent path for some viscerocardiac reflexes Such reflexes are more frequently associated with surgery in the upper abdomen, where vagal endings are more numerous than in the lower abdomen It has been shown experimentally that cardiac inhibition produced by stimulation of exposed

viscera can be prevented by section of the gastric vagi (5), but confirmation is lacking in man That afferent pathways other than vagal may be utilized is demonstrated by the association of viscerocardiac reflexes with stimulation of areas in which there are no vagal endings (10, 12)

The similarity of the electrocardiographic changes which occurred during this series of vagotomies to those resulting from vagal stimulation proximal to the heart is striking Proximal vagal stimulation has been known to cause sinus arrhythmia, bradycardia, cardiac arrest, changes in the *P* wave, such as flattening, notching, and inversion, prolongation of the *P-R* interval, dissociation phenomena, nodal rhythm, complete auriculoventricular block, premature contractions, variations in the amplitude of the *R* wave, and flattening to the *T* wave All operative procedures in this series interrupted the vagi distal to the pulmonary plexus, and no specific vagal stimulation other than that usually incident to a vagotomy was done Nevertheless, all the changes, without exception, which were cited previously as occurring after stimulation of



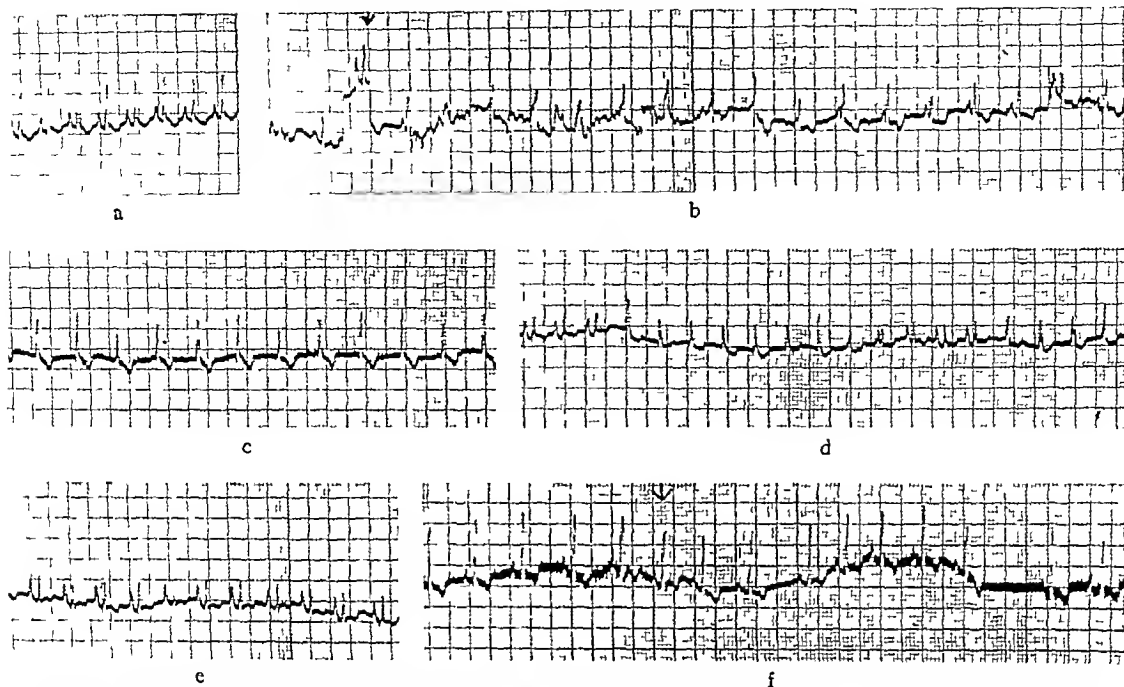


Fig 4 Dog No 10 Endotracheal ether anesthesia Dog in right lateral position Standard lead II a, Dog anesthetized prior to surgery, sinus rhythm, rate approximately 214 b, Left thoracic incision, positive pressure anesthesia The first two complexes represent sinus beats At point indicated by arrow left vagus nerve traction was applied Immediately thereafter numerous artifacts are recorded but interference dissociation is noted to be present c, Recorded several minutes after b Middle nodal rhythm with phasic respiratory variations in QRS voltage d,

Wiring of vagi completed Sinus rhythm (3 beats) Sino-auricular block followed by nodal escape with middle nodal rhythm for 7 beats and subsequent interference dissociation e, Chest closed but surgical anesthesia maintained, sinus rhythm f, Recorded 2 days later, dog unanesthetized Traction put on vagi by pulling previously placed wires at point indicated by arrow Marked sinus arrhythmia with 1 short period of sino-auricular block (just preceding last two complexes)

the proximal portion of the vagus, were seen at least once in this series of electrocardiographic tracings

The clinical importance of these electrocardiographic changes should not be overestimated Alterations in cardiac rhythm have been seen following gaseous eructations, nausea and vomiting, passage of gastric tubes, bronchoscopes, and endotracheal tubes, and deep respirations

Cardiac abnormalities resulting from anesthesia are not only due to the direct effects of the anesthetic on the heart In addition to increased sensitivity and irritability of cardiac tissue, changes in the physiologic efficiency of the conduction mechanism and alterations in vagal tone are conditions resulting from anesthesia which render the vagi and the heart more receptive to a given stimulus Recep-

tivity also varies among individuals, and in each individual at different times Since the type of anesthesia and preanesthetic medication chosen can usually be to some degree elective, it is of advantage to examine the experimental and clinical experience indicating that some anesthetic and preanesthetic medications have selective actions on the vagus mechanism and cardiac tissue, while others are less likely to be productive of cardiac abnormalities

Of the agents most frequently used in inhalation anesthesia, cyclopropane is well known as the chief offender in the production of cardiac irregularities While vagotomy did not abolish all such irregularities under cyclopropane anesthesia, an absence of increase in the *P-R* interval suggested that there was no disturbance in conduction (17) Few signifi-



cant electrocardiographic changes have been observed with the use of ethylene (10) or nitrous oxide, except for those associated with anoxia (20). Ether, a sympathomimetic agent, depresses vagal conduction (9, 19), but sensitizes the auriculo-ventricular node relatively more than the sino-auricular node, resulting in escape phenomena and shifting of the pacemaker (15).

Barbiturates decreased response to vagal stimulation but sodium pentothal (a thio-barbiturate) failed to demonstrate such a protective action (7). Though morphine has been said to increase vagal tone (17, 18), in the usual clinical dosage it may not be apparent (1). Any bradycardia resulting from the administration of morphine probably is a result of blocked cortical impulses which normally inhibit the vagal medullary center (2).

The effects of atropine in depressing the response to ordinary vagal stimuli are well known, but Lennox and Levine found that the usual doses only decreased electrocardiographic changes by one-half. Small doses are ineffective in achieving complete vagal paralysis and if this drug is being used to afford protection from the effects of vagal stimulation, a combined total of preanesthetic and intravenous doses should be 15 to 20 milligrams. Actual stimulation of the vagus center may be the initial result of small doses of atropine.

Experimentally, curare rendered the heart unresponsive to vagal stimulation (4), though ineffective in the presence of asphyxia (13).

An immense number of gastric resections and numerous experimental procedures requiring section of the gastric vagi have been done. The rarity of reports of clinically apparent cardiac derangements immediately resulting from these procedures makes the danger of a vagovagal reflex seem slight indeed. It is possible that vagovagal reflexes of a serious nature occur more often with surgery involving the more proximal portions of the vagi.

If precautions to avoid an occasional mishap during vagotomy are to be taken, certain recommendations can be made. These are selected after a consideration of some known specific actions, some of which are described

in the preceding paragraphs, of the agent's common use during surgery. The effects of these drugs on vagal conduction would seem relatively more important than their action on the intrinsic tissue of the heart, in evaluating their worth in the prevention of vagal reflexes.

1 Barbiturates and atropine are indicated for preanesthetic medication. Morphine probably best omitted.

2 Ether is the anesthetic of choice.

3 If curare is employed during the operative procedure it can be counted on to afford additional protection.

4 Good oxygenation is imperative.

5 Atropine, in adequate dosage, should be administered intravenously before search for the vagi is begun.

6 Procainization of the vagal trunks necessarily preceded by mechanical stimulation incident to isolation of the nerves and is of little prophylactic value.

7 A section of the nerves should be carried out with a minimum of traction or other trauma.

8 Ligation of the central ends of the nerves should not be done routinely. It has been noted that ligation (6) and pinching the nerves with forceps (8) effectively initiated afferent stimuli.

#### CONCLUSIONS AND SUMMARY

1 Numerous reports indicate that subclinical changes in cardiac function, as determined by electrocardiography, frequently occur during surgery and anesthesia.

2 Observations on a small series of clinical and experimental cases during section of the gastric vagi demonstrated that electrocardiographic changes similar to those previously observed during other surgical procedures are not uncommon.

3 The comparative frequency of the subclinical derangements in cardiac rhythm is not a true indication of the relative incidence of vagovagal reflexes which would result in serious cardiac disturbances. The danger of such an occurrence during vagotomy for peptic ulcer is remote.

4 If the maximum precautions available are desired, recommendations concerning pre-

medication, anesthesia, and avoidable mechanical stimuli during operation have been made

5 The preceding conclusions and recommendations may only be applicable to cases in which the vagal stimulus arises below the pulmonary plexus

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# EFFECT OF PANCREATIC JUICE ON THE GALL BLADDER

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SINCE the main pancreatic duct empties into the duodenum in conjunction with the common bile duct, an ampulla of variable length is formed. Conceivably, conditions are present for an obstruction of the ampulla to create a continuous pathway between the biliary system and the pancreas (Fig. 1). The causes of obstruction have been listed as resulting from stones (24), spasm of the sphincter of Oddi (3), and acute edema of duodenal mucosa in the region of the ampulla (5). A continuous pathway can be demonstrated clinically by cholangiography. Dye injected into a T tube will sometimes fill the main pancreatic duct when the ampulla is obstructed.

## DIRECTION OF FLOW

If a common channel of the biliary tract and pancreas is formed, the question arises: Will pancreatic juice reach the gall bladder? The pressure in the two systems has been measured in the experimental animal by many investigators (18, 19, 21, 27, 17, 14, 28), and the secretory pressure of the liver was found to equal that in the pancreas. These changed with the varied stages of digestion. Wolfer (36) introduced India ink into the terminal end of the common bile duct and found that at times it reached the gall bladder.

Clinically there is evidence to show that pancreatic juice can reach the gall bladder. Seifert observed diastase in bile in a clinical case. Walters and Marshall reported 4 cases in which pancreatic juice drained from a T tube, with resulting skin digestion. Popper (25) reported an analysis of bile for pancreatic ferments in 219 operative cases. Seventeen per cent showed increased diastase values, but 7 per cent were in cases of pancreatitis. In 36 of the cases bile was obtained by puncture of the gall bladder in the course of operations for conditions unrelated to the biliary tract or pancreas. In 3 of these, pancreatic ferments were obtained.

## PATHOLOGY

If it is assumed, then, that pancreatic juice does reach the gall bladder, will pathologic changes result? It is known that active pancreatic juice can digest living tissue, as is demonstrated in the skin surrounding a high intestinal fistula. One would expect the gall bladder to be attacked by these enzymes, since this viscus is a very delicate structure. Schonbauer reported a case of gangrenous cholecystitis with biliary exudate in the peritoneal cavity. Trypsin was present in the bile. Westphal introduced duodenal secretions into the gall bladder in dogs and produced changes which in some approached necrosis. Wolfer (37) introduced pancreatic juice into gall bladder in dogs in a variety of ways and produced a pathologic condition in all instances, ranging from inflammatory cells, focal areas of necrosis with some evidence of regeneration to completely gangrenous structures. Andrews and his associates (2) tested the effect of pancreatic juice on the absorptive mechanism of the gall bladder. They used 19 dogs and injected pancreatic juice, either into the gall bladder directly with a needle or via a ureteral catheter up the common bile duct. All the gall bladders showed mild pathologic changes. Some of the juice was Berkefeld filtered, and less changes were produced in these instances than in those injected with unfiltered juice. Brackertz studied the effect of pancreatic juice on rabbits' gall bladders. He concluded that active sterile pancreatic extract alone had no effect on biliary passages within 12 hours. When colon bacilli were introduced with the pancreatic extract and when the common duct was ligated, digestive necrosis of the gall-bladder wall developed in every case within 12 hours. This necrosis was followed invariably by biliary peritonitis without macroscopic evidence of perforation. The extent of necrosis depended upon the activity of the pancreatic extract. The mucous membrane was attacked first. When pancreatic extract and colon bacilli were injected into the

biliary passages of rabbits without stasis, no change was noted in the gall bladder

Stulz and Bauer injected active pancreatic juice directly into the gall bladder in dogs and produced pathologic changes. They concluded that chronic changes occur when large amounts of pancreatic juice are injected into the gall bladder, but not necrosis. It must be assumed that the injection of large amounts of ferment means increased pressure within the gall bladder. This may, in itself, cause traumatic changes. Colp and his associates (13) reported 3 cases of free bile in the peritoneal cavity, with fat necrosis in 1. The gall-bladder bile was definitely alkaline in all 3. Diastase was present in large amounts in the bile aspirated from the 3 cases. They concluded that the pancreatic enzymes get to the gall bladder by reflux. The gall bladders showed acute ulcerative changes in the mucosa, and to a less extent throughout the wall. No actual perforation could be identified. They concluded that, if pancreatic juice is found in the gall bladder in such amounts as to change the pH to alkaline, digestion of gall bladder occurs.

Bigard and Baker reported 2 cases of acute nonperforating gangrenous cholecystitis with regional bile peritonitis. Cultures from the abdominal fluid, bile, and gall-bladder contents were sterile, but the gall-bladder bile in both cases contained amylase and trypsin. The peritoneal fluid was not examined for enzymes. They experimented on goats, and temporarily or permanently obstructed the common bile duct at various levels, either distal to the cystic duct or distal to the cystic and pancreatic ducts. The duct arrangement in goats is particularly well adapted to the experiment. It was concluded that neither stasis of bile nor reflux of pancreatic juice as a single factor was productive of cholecystitis, but when they were combined they produced permanent pathologic changes in the gall bladder. Their combination produced a complete or partial necrosis of the gall-bladder wall which was chemical and not infectious. In several goats there was a nonperforating biliary peritonitis. They concluded that filtered bile does not activate pancreatic enzymes.

Arnonson anastomosed the pancreatic duct to the gall bladder in 4 dogs. All remained

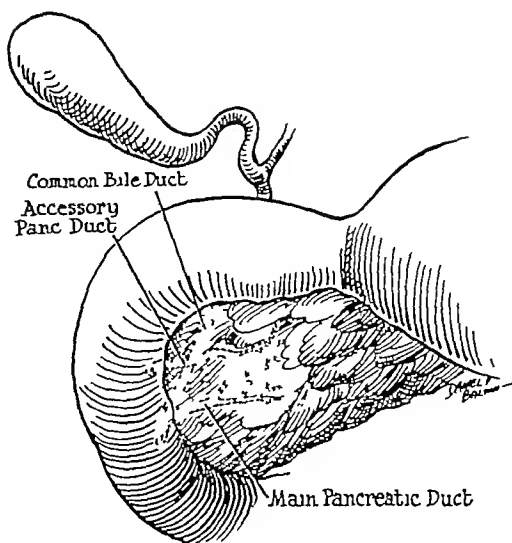


Fig. 1 The ampulla in the human—formed by the junction of the common bile duct and the main pancreatic duct.

well for 2 years. They were then sacrificed, and it was found that in 3 the anastomosis had scarred over, and in 1 the anastomosis was open. There were extensive adhesions between the gall bladder, pancreas, and duodenum. The gall bladder was dilated and contained 25 cubic centimeters of a grayish-brown cloudy fluid and 3 stones. Cultures of bile revealed *Staphylococcus aureus* and *Clostridium welchii*. Only slight changes were found in the gall-bladder wall, and the author concluded that this was because the pancreatic juice was very considerably diluted with bile. Gatch and his associates injected activated pancreatic juice into the ampulla of Vater in 3 dogs. In 1 the injection was under considerable force, and the dog died in 15 minutes. Beginning necrosis around the bile ducts in the liver was found. In the remaining 2 animals, the injection was made with moderate pressure, and only minor changes in the bile ducts resulted. The writers concluded that the pancreatic juice acted for only a short time and that great damage would result if stasis of bile had prolonged the action of the pancreatic juice. The mechanical effect of the increased intraductal pressure is a factor that must be reckoned with in this experiment.

Nonperforating biliary peritonitis, mentioned previously, is undoubtedly a definite





Fig 4 Dog No 54 Gall bladder 190 times Showing scattered polymorphs in stroma of mucosa

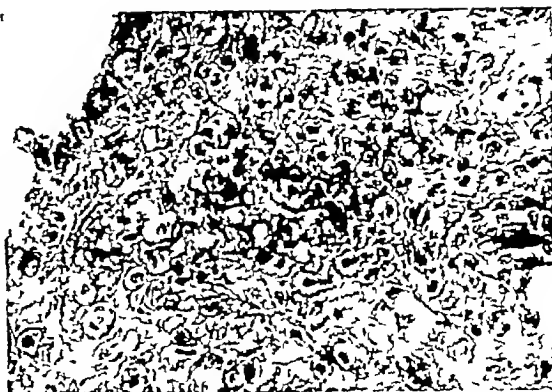


Fig 5 Dog No 60 Gall bladder 190 times Many acute inflammatory cells are seen

# EXPERIMENT

An experimental procedure was designed to show the effect of pancreatic enzymes on the gall bladder under as nearly physiologic conditions as possible. Dr Andrew C Ivy suggested the procedure, which was followed throughout the experiment.

Average sized mongrel dogs were used. The abdomen was aseptically entered, the duodenum was brought out on the abdomen and the lesser pancreatic duct identified without jeopardizing the blood supply. The location of the papilla of Vater was estimated. Midway between the pancreatic duct and the papilla the duodenum was transected, the gastroduodenal vessels being avoided. About 3 centimeters distal to this point of section, the duodenum was again sectioned, and a short segment of bowel containing the pancreatic duct with the pancreas and blood supply intact was isolated (Fig 2). One end of this duodenal pouch was closed and the other was anastomosed to the fundus of the gall bladder. The continuity of the duodenum was then re-established. By this procedure the pancreatic juice entered the duodenal pouch in the normal manner, flowed over the gall-bladder mucosa and drained from the cystic duct into the duodenum. The duct of Wirsung in the dog plays a very minor role.

Dogs recovered and remained well. About 3 weeks later the cystic duct was cannulated and secretin was injected intravenously. The contents of the gall bladder were collected

and assayed for pancreatic juice. Sections of the liver, gall bladder, and pancreas were taken and the patency of the pancreatic duct was demonstrated (Fig 3). *No pathologic condition was found in the gall bladder in the 10 dogs in this first series.*

Another group of 10 dogs were subjected to the same preliminary procedures, but 3 weeks later the cystic duct was ligated. The animals became moribund within 100 hours. The contents of the gall bladder were assayed for pancreatic enzymes, the same sections were taken and the patency of the pancreatic duct was again demonstrated.

*Results.* Six dogs showed an acute reaction of the gall bladder (Figs 4 and 5), one having complete necrosis (Fig 6). Two dogs

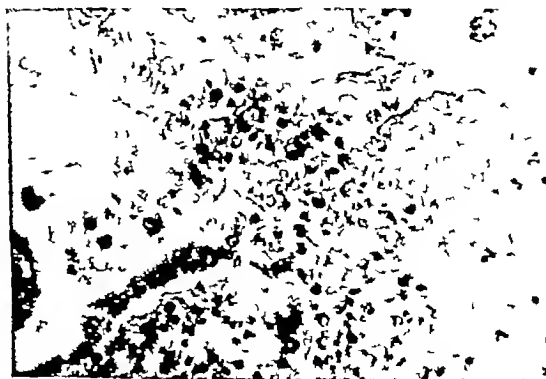


Fig 6 Dog No 57 Gall bladder 190 times Showing ulceration of the mucosa with acute inflammatory and ghost cells



# MORBID FACTORS IN EXPERIMENTAL APPENDICITIS

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TO gain a more fundamental concept of the basic pathogenic pattern of appendicitis and its chief complicating factor, peritonitis, we have produced this disease experimentally in the dog with the purpose of analyzing those factors which play a role in the production of the morbid process. We have endeavored to evaluate the relative importance of various generalized and local elements associated with appendicitis. The ultimate aim has been to obtain sound experimental data which will be of value to the clinical surgeon in his understanding and treatment of appendicitis and peritonitis. The role of the sulfonamides, penicillin, and other antibiotics has not been considered. Our effort has been directed toward the underlying pathological pattern of the disease process in order to formulate certain principles upon which a rational use of these drugs may be based.

Although considerable experimental work on appendicitis has been undertaken, only a few examples need be cited as representative of two main theories which have evolved regarding the cause of death and pathogenesis of the disease. The first of these general concepts proposes that the local site of infection, the gangrenous appendix, is the focus from which the whole morbid process arises and any systemic alterations are the result, or reflection, of factors which have their origin at this point. The bacteria associated with this gangrenous process have been held responsible for the death of the animal because of a fulminating infection or toxemia. Those workers who have endeavored to show that bacterial toxins are of prime importance have produced only indirect evidence, by means of animal immunization and inoculation of the material in question. An equal number of workers have presented data to show that the products of autolytic digestion are of primary importance.

Regardless, however, of the factor, or combination of factors, which bring about the death of the animal, this general concept presents the local site of infection as the initiating factor in the disease mechanism.

The second hypothesis which has been presented as an explanation for the morbidity or mortality in appendicitis and peritonitis places the emphasis on generalized systemic alterations in the animal, factors which are either already present prior to the disease, or which are activated early in the process. The dys-equilibrium of circulating enzyme systems, or the depression of various hepatic functions, has been held responsible. When a sufficient alteration of the systemic processes has occurred, the animal is said to be in a morbid or moribund state.

Although no clear cut differentiation of these two general hypotheses has ever been presented, almost all the work which has been done on this subject can be placed in one or the other categories.

Our present study has been undertaken in an effort to obtain a clearer concept of which of these hypotheses is the more important and which factor, or factors, of that hypothesis are the most significant.

## THE EXPERIMENTAL DISEASE

Any study of an experimental disease necessitates a careful observation of the normal progress of the disease in the animal used in the study. Since it was our objective to study those factors associated with morbidity or death arising from appendicitis, we endeavored to produce this disease as consistently as was possible in the dog.

In 1938, Bower and his co-workers (2) found that 50 per cent of dogs will recover spontaneously, with no treatment whatsoever, after the appendiceal blood supply and the base of the appendix have been ligated. In every case of recovery, a walled-off appendiceal abscess was found when the dog was sacrificed. Further investigation by the same

From the Department of Surgery, Northwestern University Medical School. Aided by a grant from the Crumney Surgical Fund. Chicago Surgical Society prize essay, 1940.



TABLE I — DISTRIBUTION OF DEATH IN SERIES I DOGS—CONTROL

Mortality, 75%, Average duration of life, 68 hours			
Survived— hours	No of dogs	Survived— hours	No of dogs
0 to 24	2	72 to 96	3
24 to 48	8	Over 96 hours	2
48 to 72	3	Lived	6

workers showed that by giving 54 cubic centimeters of castor oil immediately after operation the mortality rate was increased to 91.7 per cent, and in every case the animal died of a spreading peritonitis.

Twenty-four animals served as our control series. The dogs were given morphine followed by intravenous nembutal as an anesthetic agent. The abdomen was shaved clean and then painted with 1 per cent iodine followed by 70 per cent alcohol. Strict asepsis was followed throughout except that rubber gloves were not worn by the surgeon. A lower midline, or right rectus incision was made and the cecum and appendix mobilized (Fig 1). All vessels of the appendix were clamped and ligated and a heavy cotton ligature was placed about the base of the organ. Care was taken not to rupture the serosa, and no further crushing of the appendix was done (Fig 2). The abdomen was then closed in three layers with fine black silk. A gastric tube was placed in the stomach and 50 cubic centimeters of castor oil were given the dog immediately before returning him to the cage. No supportive treatment of any kind was given to the animals and they were disturbed only once a day during the morning when blood samples were drawn. Food and fluid were offered freely following surgery.

The mortality rate for this control series (series I dogs) was 75 per cent and the average duration of life of those animals which died was 68 hours (Table I).

By performing careful postmortem examination on all dead animals and by sacrificing others at appropriate times we were able to follow closely the progress of the pathological process.

Following recovery from the initial shock of the anesthesia and surgery the animals appeared to go into a lethargic state which slowly progressed until the animal eventually suc-

cumbed. This lethargy was associated with a gradually increasing tachycardia and, in many cases, a mild hyperpnea.

Pathologically, within 24 hours the appendix had become a loosely hanging, yellowish grey necrotic sac with little or no walling-off by the surrounding viscera or omentum. The abdominal cavity contained a small amount of bloody fluid but the abdominal viscera still had a normal glistening appearance (Figs 3, 4). In this series of 18 control deaths, only two animals deviated from this pattern. One died after 25 hours and another after 26 hours. Both animals had ruptured appendices and peritonitis.

From 24 to 48 hours, the dogs entered the critical period of the disease and at that time the natural body defense mechanisms were brought into play. Early in this period the omentum and loops of bowel began to wall off the necrotic appendix and a thin layer of fibrin was laid down. A moderate amount of bloody gray fluid was present in the peritoneal cavity (Fig 5).

The fate of the dog depended on a balance of factors operating during this period. If complete walling-off occurred at this stage the dog began to recover and survival resulted. If rupture of the appendix occurred before any significant walling-off had taken place, the animal died within 12 hours of a fulminating peritonitis. When a partial walling-off occurred, so as to prevent a rapid dissemination of the gangrenous material into the abdominal cavity, the dog continued to live past the 48 hour period and the eventual length of the survival appeared to be the reflection of the severity of those elements which operated during this stage. Eight of the control animals died during the period between 24 and 48 hours.

All of the animals which managed to survive beyond the 48 hours but then succumbed showed the same pathological picture. The peritonitis increased in severity and no further walling-off of the gangrenous area was seen as compared with the period up to 48 hours. The omentum was slimy and necrotic, the exudate darkly hemolytic and foul smelling, and the bowel was injected and dull in appearance (Fig 6). Six of the control animals



Fig 1



Fig 2



Fig 3



Fig 4



Fig 5



Fig 6

Fig 1 Normal abdomen of the dog showing cecum, terminal ileum, and appendix

Fig 2 The appendix as it is ligated to produce experimental appendicitis in the dog

Fig 3 The ligated appendix and peritoneal cavity after 16 hours. This appendix appears as a black gangrenous sac. This type of necrosis is often seen in early stages of the disease

Fig 4 The ligated appendix and peritoneal cavity after 26 hours. The loosely hanging, yellowish gray necrotic sac has been walled-off very little by the surrounding viscera and omentum. There is a minimal amount of thin bloody

exudate in the peritoneal cavity. The bowel has a normal glistening appearance

Fig 5 The ligated appendix and peritoneal cavity after 48 hours. The omentum is injected and has been partly dissected away from the gangrenous appendix. The abdominal cavity contains a considerable amount of reddish brown exudate

Fig 6 The necrotic appendix and abdominal cavity 72 hours after the disease was produced. The shmy injected omentum has been partly dissected away from the appendix. The abdominal cavity contains considerable dark, hemolytic, foul smelling exudate

died during the period from 48 to 96 hours. Only 2 lived beyond this time, 1 of which died after 104 hours and the other after 168 hours.

With this pathological pattern of response to the experimental disease as a background, the specific evaluation of generalized and local factors was undertaken.

#### GENERALIZED FACTORS IN EXPERIMENTAL APPENDICEAL PERITONITIS

In 1946, Kay and Lockwood (12, 13) made a careful study of various systemic alterations

occurring in experimental appendicitis in the dog. They concluded that this disease, "culminates in an acute toxemia characterized by profound disturbances in hemodynamic equilibrium and in impaired function of the liver, lungs and other vital organs." They also suggested that, "the outcome of the disease, regarding death or survival appears to be related more to factors inherent in the condition of the animal prior to the experiment than to any demonstrable bacteriologic or anatomic variation in the local lesions as between dying and surviving animals."



TABLE III — PLASMA PROTHROMBIN ALTERATIONS IN SERIES I

Dying Animals							Fibrinolysis at time of lowest prothrombin
Dog	Death	Pre operative %	24 hr %	48 hr %	72 hr %	96 hr %	
1	25 hrs	133	60.8	Dead			Negative
2	96 hrs	143	55.3	133.0	173.0	87.8	Negative
3	48 hrs	62.4	42.0	58.1	Dead		Negative
14	48 hrs	163.0	151.0	Dead			Negative
20	50 hrs	79.6	61.3	41.6	Dead		Negative
21	104 hrs	78.6	50.6	43.0	48.4	72.7	Negative
23	26 hrs	141.7	81.3	Dead			Positive
26	72 hrs	67.2	37.2	45.3	Dead		Negative
28	72 hrs	70.0	24.7	29.6	Dead		Positive
0 Average 104.4 62.7 prothrombin							
Living Animals							Fibrinolysis at time of lowest prothrombin
Dog	Death	Pre operative %	24 hr %	48 hr %	72 hr %	96 hr %	
15	Lived	100	110	66.0	80		Negative
16	Lived	202.0	180.0	103.0	125.0		Negative
17	Lived	84.7	44.0	48.5			Negative
30	Lived	200.0	71.3	77.0	222.0		Negative
4 Average 146.0 101.3 prothrombin							



Fig 7 Technique used in measuring fibrinolysis. These tubes contain the fibrin clot of the dogs' plasma and have been incubated for 24 hours. Tube 1 contains 1 drop of saline. No fibrinolysis has occurred. This is a negative determination. Tube 2 contains 3 drops of saline. No fibrinolysis has occurred. This is also a negative determination. Tube 3 contains 1 drop of sac fluid. Partial lysis of the clot has occurred. Tube 4 contains 2 drops of a sac fluid. Partial lysis of the clot has occurred. Tube 5 contains 3 drops of sac fluid. Complete lysis of the clot has occurred. This is a positive determination.

ity was determined. Originally, we used the technique of Kay and Lockwood (12, 13) but found that consistent, similar results were obtained when using 0.5 cubic centimeter of oxalated plasma (1 part 0.1 molar sodium oxalate to 9 parts whole blood) and 0.5 cubic centimeter of 0.025 molar calcium chloride. The latter technique fitted our purpose better because the same reagents were also standardized for use in prothrombin determinations.

The clot thus formed was placed in a water bath at 37 degrees and observed for 48 hours. Determinations were not made past this period because the possibility of bacterial contamination might alter the interpretation.

If breaking up of the clot (lysis) occurred during this period, it was considered a positive result. If no lysis of the clot occurred it was recorded as negative (Fig 7).

The 24 dogs used in the control series were studied in this phase of the problem (Table II).

Of the 18 dogs which expired in the control series, only 7 (38.8%) showed fibrinolysis at some period postoperatively and 11 showed no lysis. Of the 7 dogs showing fibrinolysis, 3 showed spontaneous lysis prior to surgery. One other dog displayed spontaneous lysis prior to surgery but showed none postoperatively. These 3 dogs died at an earlier period (37 hours) than the remainder (71.3 hours).

Of the 6 dogs which survived, 1 showed fibrinolysis in the postoperative period.

**Prothrombin** Prothrombin determinations were made on 13 of the control animals according to the technique of Tanturi and Banfi.

the activation of an enzyme precursor, present in normal plasma, by filtrates of streptococci, and have proved that this enzyme so activated (activated lysin factor), although proteolytic, is not trypsin. Goodpasture found that specimens of blood from patients with atrophic hepatic cirrhosis possess the property of completely digesting their clot within a few hours at room temperature. Macfarlane's work (16) on fibrinolysis has shown that this phenomenon occurs after surgical operations, exercise, and adrenalin injection.

Since it was our purpose in this portion of the study to evaluate the importance of generalized factors relative to the mortality of the disease, we studied the possible alterations in prothrombin and fibrinolysis as a manifestation of systemic changes of the animal. One other criterion was added, the direct microscopic examination of the liver of the animals. Thus, any direct injury could be detected even in the event that functional derangement was not reflected.

**Fibrinolysis** Prior to surgery and every 24 hours thereafter until the dog either expired or recovered, plasma fibrinolytic activ-

TABLE IV —CHLOROFORM TREATED DOGS, PLASMA PROTHROMBIN AND FIBRINOGEN  
SERIES II DOGS

Fibrinolysis							
Dog	Death	Prior to surgery	24 hr	48 hr	72 hr	96 hr	
22	D 32hr	Positive at 48 hrs	Negative				
24	D 48hr	Positive	Positive at 48 hrs				
27	Lived	Negative	Negative	Negative	Positive	Positive	1 1/2
31	D 72hr	Positive at 48 hrs	Negative	Negative			
33	D 40hr	Negative	Negative				
37	D 30hr	Negative	Negative				
38	D 30hr	Negative	Negative				
43	Lived	Negative	Negative	Negative	Negative		
44	D 24hr	Negative	Negative				
45	D 5 hr	Negative	Negative	Negative			
10	41 hr	3	1	0	1		

Prothrombin							
Dog	Death	Prior to surgery — %	24 hr %	48 hr %	72 hr %	96 hr %	
22	D 32hr	53.8	5.6				
4	D 48hr	101.3	81.3				
2	Lived	31	10.7	26.5	3.2	11.2	6
31	D 72hr	16.7	87.5	63.0			
33	D 40hr	87.6	56.4				
37	D 30hr	95.4	79.1				
38	D 30hr	93.4	7.5				
43	Lived	13.6	70.4	50.6	12.0	6.1	10
44	D 4hr		91.4				
45	D 52hr		118.0	60.2			
Average	41hr	91.0	69.7				

Average prothrombin prior to surgery — 99.5 per cent in dying animals  
 Average prothrombin at 24 hrs — 74.4 per cent in dying animals  
 D death

The prothrombin concentration was reduced postoperatively in all 13 animals (Table III)

Nine of the dogs which expired were in this group of 13 animals. In 2 of these dogs the lowest prothrombin was recorded at 48 hours and 1 of them died at 50 hours. In 7 instances it was lowest at 24 hours and in 3 of the dogs this was a single determination because the animals had expired before 48 hours. However, in 53.3 per cent of the animals studied beyond 48 hours the lowest prothrombin was not seen at the time of death.

The possible correlation between plasma fibrinolytic activity and hypoprothrombinemia

was checked on these 13 animals. In only 4 cases (30.8%) did fibrinolysis occur at the time of lowest prothrombin level recorded.

The average drop in prothrombin at 48 hours was higher in those animals which died (49.8%) than in those which survived (14.2%), but in none of the dogs did the hypoprothrombinemia ever reach hemorrhagic levels.

*Liver studies.* The third factor studied as a means of determining systemic alteration in the disease was the direct microscopic examination of liver sections taken from dogs at various periods postoperatively. In the 13 animals whose autopsies were performed



Fig 8 Photomicrograph of a section taken from the liver of a dog dying of appendicitis with peritonitis at 26 hours. Section removed within 30 minutes of dog's death. No evidence of acute degeneration in liver. Some dilatation of the hepatic sinusoids, with an active congestion is seen.



Fig 9 Photomicrograph of a section taken from the liver of a dog dying of appendicitis with peritonitis at 54 hours. The histological picture of this section differs in no respect from that seen in the section taken from the dog dying at 26 hours.

formed shortly after death were considered. In no case could the amount of liver injury observed be considered as sufficient to cause the death of the animal. The general picture was that of an active congestion, dilatation of the sinusoids, and microvacuolation of the hepatic cells. The nuclei of the cells were normal and no type of acute degenerative process was identified (Figs 8, 9, 10a and b).

**Chloroform intoxication.** In an attempt to alter the fibrinolytic-antifibrinolytic equilibrium and prothrombin values in a group of animals at the time of surgery, 15 minutes of intratracheal chloroform was given to 10 dogs immediately following the procedure (series II dogs). This hepatic damage was produced in order to handicap the animals as they entered

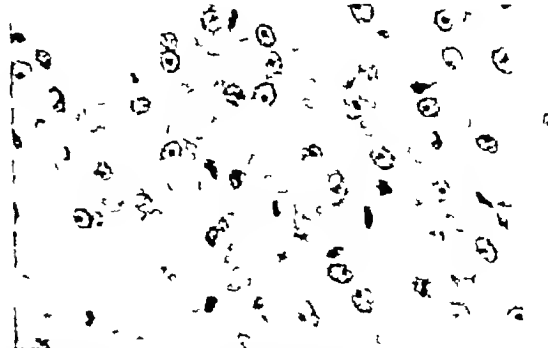
the crisis of the disease. Thus, early manifestations of derangement of the prothrombin and fibrinolytic values could be expected.

Eight of the 10 animals expired, a mortality of 80 per cent as compared with our control mortality of 75 per cent. However, the average duration of life was 42 hours, as compared with the average of 68 hours in our control series (Table IV).

Spontaneous fibrinolysis was seen prior to surgery in 3 animals, but only one of these showed lysis in the postoperative period and this animal died. The only other animal showing any fibrinolysis in the postoperative period survived. These figures show no significant deviation from those seen in the control animals.



Fig 10 a, left Photomicrograph of a section taken from the liver of a dog dying of appendicitis with peritonitis at 104 hours. There is some microvacuolation of the hepatic cells in this section but the general histological picture does



not differ from that seen in the liver of dogs dying at an earlier period. b, High power magnification of the same section as Figure 10a. There is no evidence of nuclear change in this section.

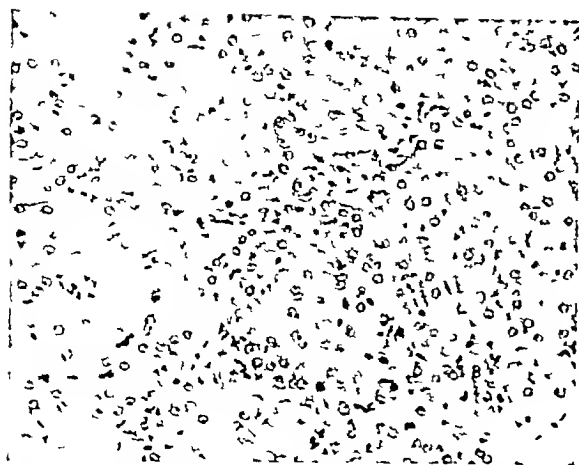
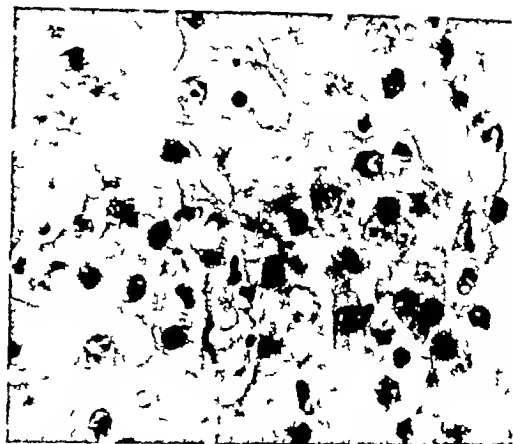


Fig. 11 a, left Photomicrograph of a section taken from the liver of a dog dying of appendicitis with peritonitis at 30 hours. This dog was subjected to 15 minutes of intratracheal chloroform during the production of the



disease. There is no evidence of acute degeneration of this liver. b, High power magnification of the same section as Figure 11a. There is no evidence of nuclear change in this liver.

Twenty-four hours after surgery the average prothrombin level in the dying chloroform treated animals was 74.4 per cent, as compared with a figure of 59.9 per cent in the control group.

It appears that the added effect of chloroform inhalation for 15 minutes to the intoxication of appendicitis does not produce liver injury. As the maximum reduction in prothrombin due to chloroform intoxication in normal animals is reflected at 48 hours, the shorter survival produced by chloroform in the appendiceal peritonitis dogs is due to factors not reflected in variation in prothrombin. The animals die in a period too early for this reflection to be identified.

Liver studies on sections taken from these chloroform treated animals did not differ from the histological picture of the control dogs, since death intervened before any significant necrosis due to the chloroform had occurred (Figs. 11a and b).

#### LOCAL FACTORS IN EXPERIMENTAL APPENDICEAL PERITONITIS

Among those workers who have stressed the importance of the local gangrenous process in the mortality of this disease, there is no agreement as to what factor, or combination of factors, is of the most importance. In 1938 Bower and his co-workers (1, 10, 11) published several reports on experimental appendicitis

in the dog and their conclusions pointed to the organisms of the clostridium group as being of significance. The mortality of the disease was reduced from 74.2 per cent in the control groups to 33.3 per cent in groups which had been given a commercial preparation of gangrene antitoxin therapeutically. They were also able to reduce the mortality in pigeons inoculated with *Clostridium welchii* extracts after they had been given injections of lyophilized convalescent serum of their recovered experimental dogs.

In past years other workers have approached the problem of the cause of death from gangrenous intraperitoneal lesions in a variety of ways. Some claim that a bacterial toxin is the chief offender (21, 22, 27), others place the emphasis on products of protein digestion or tissue autolysis (4, 26). All the investigators have substantial indirect evidence to support their claims.

From the pathological studies on the control animals, one fact remained very consistent. Those animals which were able to wall off the gangrenous appendix early in the disease process survived, whereas those animals unable to do this at an early period eventually expired. This pointed out the necessity of studying carefully that material whatever it be which was produced by the appendiceal appendage as it passed through the stages of necrosis and gangrene. Perhaps



Fig 12, left The polythene sac as it is placed over the ligated appendix and sutured to the cecum



Fig 13 The same polythene sac as shown in Figure 12, 72 hours later. The dark gangrenous material in the sac was the object of the analysis of local factors associated with appendicitis

in this material lay the key to an understanding of why some animals could wall-off the appendix and others could present no barrier to the process

Although the placing of various types of bags over strangulated portions of intestine have been carried out by several workers (1, 14), a new technique was devised by us in order to wall-off artificially the gangrenous appendix and study the material produced in the process. Polythene (polyethylene) sheeting was vulcanized into a small water tight sac, and after ligation of the appendix in the same manner as was done in the control series, this sac was placed over the appendix and sutured snugly to the cecum (Fig 12). The omentum was then tacked down about the base of this sac in order to prevent any possible leakage. Fifty cubic centimeters of castor oil were given to the dog, exactly as was done in the control group. The dogs were then reoperated upon at appropriate periods. The sac was removed and the gangrenous stump or fecal fistula, whichever the case, was closed with black silk. The omentum was again tacked down over this area. No antibiotics or supportive therapy of any kind were given. The sac fluid was then analyzed according to the technique described below.

This group (series III dogs) consisted of 12 control animals which were reoperated upon at 72 hours. This hour was chosen so as to correspond as closely as was practical with the average life span in our control series.

Of the 12 dogs subjected to this procedure, 1 died prior to the second operation presenting a mortality of only 8.3 per cent.

Among the 11 animals which underwent the second procedure, there were no postoperative deaths. Thus, 11 of 12 animals were saved by the simple expedient of artificially walling-off the local inflammatory process.

None of the dogs with the sac-covered, gangrenous appendix which had undergone the second procedure showed any evidence of generalized peritonitis. The sac, however, invariably contained from 25 to 50 cubic centimeters of dark, hemolytic, foul-smelling fluid along with the slimy, necrotic appendix (Fig 13). In most cases a substantial layer of fibrin had been laid down about the suture line at the base of the sac. Occasionally, the omentum appeared friable near its proximity to the suture line.

The fluid contained in the sac was measured into a series of centrifuge tubes and turned at 1500 r.p.m. for about 10 minutes to remove most of the particulate matter. The supernatant fluid was then passed through a Seitz filter, and the bacteria-free residue was the object of our investigation.

**Fibrinolysis** Since it was not our purpose in this phase of the experiment to repeat any controversial work in order to add further evidence to one side or the other we approached the analysis of this fluid from another direction. Our investigations had shown that the production of fibrin about the local area



TABLE V —SAC FLUID AND  
ABDOMINAL EXUDATE DETERMINATIONS  
Series III Polythene Sac Dogs

Dog	Outcome of operation	Fibrinolysis		Hyaluronidase	Lecithinase
		Plasma	Sac		
54	Lived	Negative	3 plus		
56	Lived	Negative	Negative		
57	Lived	Partial	3 plus		
59	Lived	Negative	3 plus		
60	Lived	Negative	Negative		
6	Lived	Negative	3 plus	5 plus	Negative
63	Lived	Negative	1 plus	5 plus	Negative
65	Lived	Negative	plus	4 plus	Negative
66	Lived	Negative	3 plus	1 plus	Negative
67	Died		3 plus	5 plus	Negative
69	Lived	Negative	2 plus	5 plus	Negative

Series IV Plain Appendicitis. —Reoperated Dogs

Dog	Time and outcome of second operation	Fibrinolysis		Hyaluronidase	Lecithinase
		Plasma	Abdominal fluid		
68	24 hr Recovered	Negative	Negative	Negative	Negative
70	24 hr Recovered	Negative	Positive	3 plus	Negative
71	44 hr Died		Negative	4 plus	Negative
7	44 hr Died	Negative	Negative	4 plus	Negative
73	48 hr Died	Negative	1 plus	Negative	Negative
74	48 hr Died		1 plus	Negative	Negative
75	42 hr Died	Negative	Negative	Negative	Negative
76	43 hr Died		Negative	Negative	Negative
77	43 hr Died		1 plus	Negative	Negative
78	44 hr Died	Negative	Negative	Negative	Negative
79	30 hr Died	Negative	3 plus	Negative	Negative

was one of the important factors associated with ability to wall-off the gangrenous appendix. The inability of the animal to present a fibrin barrier, or the dissolution of any fibrin produced about the gangrenous appendix, meant certain death for the dog. Our first analysis, therefore, involved the attempt to identify the presence of a fibrinolysin in the local fluid.

The method of detecting an activator of the lysis factor involved setting up a series of 3 tubes for each animal.

*Tube 1*—0.5 cubic centimeter of plasma plus 0.5 cubic centimeter of calcium chloride plus 3 drops of saline.

*Tube 2*—0.5 cubic centimeter of plasma plus 0.5 cubic centimeter of calcium chloride plus 1 drop sac fluid, plus 2 drops saline.

*Tube 3*—0.5 cubic centimeter of plasma plus 0.5 cubic centimeter of calcium chloride plus 3 drops sac fluid.

These were incubated for 24 hours and lysis was recorded as follows: lysis in Tube 2 equals 2 plus, lysis in both tubes equals 3 plus, partial lysis in either tube equals 1 plus. Lysis in control tubes was also noted, but in every case this corresponded with the activity of the dog's serum at the time of surgery (Fig. 7).

Eleven animals were studied in this way (Table V). Eight (72.7%) showed lysis in one or both tubes, 1 (9.1%) showed only partial lysis, and 2 (18.1%) showed no lysis. Only 1 of the dogs in this series of 11 showed partial lysis in the plasma at the time the sac was removed.

Samples of peritoneal exudate from 11 dogs in a plain appendicitis series which had been reoperated upon at various periods following production of the disease (series IV) were also studied for fibrinolysis. Six of these fluids showed no fibrinolysis, 4 showed partial lysis, and 1 showed complete lysis of the clot. The plasma of none of the animals showed spontaneous lysis in the control tube (Table V).

*Hyaluronidase*. The basis for our second analysis arose from a study of the pathogenesis of the local process. Unless the animal can naturally wall-off the area of gangrenous appendix early in the disease, a steady progression of events takes place which eventually ends in the death of the animal. This would indicate that some product relentlessly breaks down all natural barriers once it is present in sufficient amounts. Such a spreading factor has been identified in many types of infection (5, 8), and recently (11, 17) the enzyme hyaluronidase has been named as one of the chief components of this spreading factor in streptococcus, staphylococcus, and clostridium.



Fig 14 The mucin clot prevention method of determining presence of hyaluronidase. Increasing amounts of the exudate from 0.31 cubic centimeter in tube 1 to 0.5 cubic centimeter in tube 5 have been added to the potassium hyaluronate solutions and incubated 20 minutes. The absence of the mucin clot in the tubes of higher concentration of the exudate indicates that digestion by the enzyme has occurred.

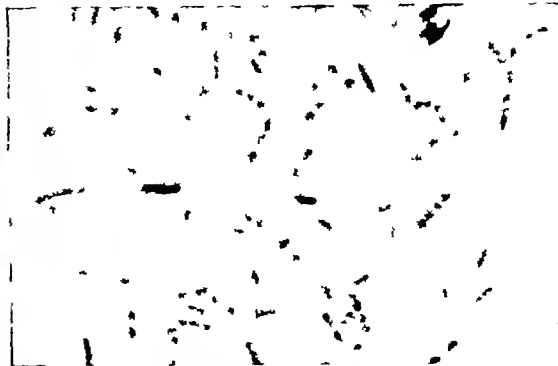


Fig 15 Photomicrograph of a smear taken from the sac fluid at 72 hours and stained by the Gram technique.

rum infections. The identification of this enzyme in the products of a gangrenous appendix was, therefore, the object of the second analysis.

Hyaluronidase determinations were done by mucin clot prevention method of McClean (18) serial dilutions of the material from 1:2 to 1:32 in 5 tubes being used. Values were recorded as units corresponding to the number of the tube of highest dilution in which the enzyme appeared, 5 being the highest figure (Fig 14).

The sac fluid from 6 dogs was studied in this phase of the work. All of the fluid contained the enzyme, 5 (83.3%) of them in amounts detectable in 0.31 cubic centimeter of the exudate (Table V).

To compare the amount of hyaluronidase present in the localized process with that found in the abdominal cavity during generalized peritonitis, samples of exudate from dogs in series IV (plain appendicitis reoperated upon) were studied for the enzyme. Eleven such exudates were analyzed and in only 3 cases was any enzyme detected. These figures are stated in Table V.

**Lecithinase.** Our third investigation was undertaken because of our interpretation of the clinical picture and pathological state in the dying animals, plus the examination of smears taken from the gangrenous exudate. The tachycardia, hyperpnea, and weakness seen in the moribund animals plus the severe, hemolytic type of peritonitis, the slimy gangrenous omentum and presence of gas in the

peritoneal cavity combined with the presence in almost every instance of a gram positive rod-shaped bacillus on smears (Fig 15) led us to the belief that a toxin, probably that elaborated by one of the anaerobic bacilli, was of significant importance.

Although many workers have been in accord with this theory, their evidence has been based on observations dependent on the protection of small animals with commercial or prepared gas gangrene antitoxin before or after the gangrenous material had been injected. Such a technique, although very accurately and skilfully done, presents many variables which may alter the evidence and is, in a fundamental sense, only indirect proof of the existence of a specific toxin.

In order to avoid these factors, our experiment was aimed at a direct titration of the toxin of *Clostridium welchii* from the gangrenous material. Recently, several workers (15, 25) have identified the enzyme lecithinase as being the lethal toxin (alpha toxin) of the type A-*Clostridium welchii* organism. Our third analysis, therefore, was an attempt directly to identify this toxin in the gangrenous material.

McClean's original technique for the detection of the toxin of *Clostridium welchii* (18) was modified somewhat by us and applied to the study of the appendiceal exudate. This procedure is based on the ability of lecithinase to produce a turbidity in a dilute egg yolk solution in the presence of calcium ions and is very specific and sensitive. Control tubes

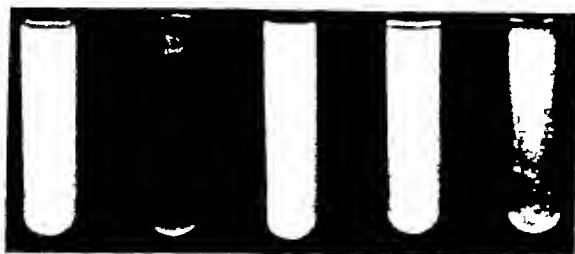


Fig 16 Technique used in lecithinase determinations. These tubes have been incubated for 2 hours at 37 degrees Centigrade. Tube 1 contains 0.5 cubic centimeter of sac fluid. Turbidity is evident, proving the presence of clostridium toxin. Tube 2 contains 0.5 cubic centimeter of sac fluid plus 1.0 cubic centimeter of convalescent dog serum. No turbidity is seen, indicating that this serum inhibits the toxin. Tube 3 contains 0.5 cubic centimeter of sac fluid plus 1.0 cubic centimeter of commercial polyvalent gas gangrene antitoxin. Turbidity is seen, indicating that this type of antiserum does not inhibit the toxin produced in the dog. Tube 4 contains 6 minimum lethal doses of *Clostridium welchii* toxin. Turbidity is apparent. Tube 5 contains 6 minimum lethal doses of *Clostridium welchii* toxin plus 1.0 cubic centimeter of commercial polyvalent gas gangrene antitoxin. No turbidity is seen, indicating that this antitoxin inhibits the commercially prepared toxin.

were set up with antitoxin and comparisons were made on a Coleman universal spectrophotometer using a monochromatic beam of 560 gamma.

Six sac fluids and 11 samples of peritoneal exudate in generalized peritonitis (series IV dogs) were analyzed in the original experiment. Standard polyvalent gas gangrene antitoxin was employed for the control standard in each of these experiments. Although turbidity appeared in several of these analyses the turbidimetric differences recorded in the control and unknown tubes was of no significance, therefore we assumed that this turbidity was a constant factor and our results were recorded as negative in all 17 determinations (Table V).

Since several dogs which had recovered from the experimental diseases were available for further study it was decided to titrate the antitoxic properties of their serum against the exudate and compare these results with those obtained with the commercial gas gangrene antitoxin.

The results in this experiment were quite different. It was found that although the commercial antitoxin had little or no effect in preventing turbidity, our dogs' convalescent

serum inhibited the toxin to such an extent that significant spectrophotometric differences were recorded (Fig. 16).

Experimental appendicitis was then produced in another series of 16 dogs (series V). Polythene sacs were placed over the ligated appendix in 10 of these animals. One of these dogs died of pneumonia within 24 hours of the first procedure and was therefore discounted. Only 1 of the 9 animals subjected to the second procedure died.

The toxin of *Clostridium* was identified in 8 of the 9 sac fluids analyzed (88.8%) and the average turbidimetric reading was 60.1 per cent. Hyaluronidase was found in every fluid analyzed and in 5 instances (55.5%) was detected in less than 0.31 cubic centimeter. Streptokinase appeared in significant concentrations in 7 of the 9 sac fluids (77.7%). The figures are recorded in Table VI.

The general peritoneal exudate in 6 dogs of this series was also analyzed. Lecithinase was detected in 5 of the 6 animals (83.3%) and the average turbidimetric reading was 71 per cent. Hyaluronidase was detected in only 3 fluids. Of 5 exudates studied for fibrinolysin 3 contained the enzyme in small amounts (Table VI).

**Histamine studies.** In an effort to evaluate the role of histamine shock as a factor in the death of the experimental animal and to compare the relative toxicity of sac fluid and known *Clostridium welchii* toxin several dogs were subjected to injections of these fluids.

The general peritoneal exudate from 5 dogs with appendicitis was analyzed as to its histamine content, isolated guinea pigs being used as a method of assay. Only one fluid of this group was shown to contain an appreciable amount of histamine or histamine-like substances.

Random samples of two of these fluids containing minimal amounts of histamine were then injected intravenously into 2 dogs and histamine release into the dogs' plasma was assayed. A significant release was observed in both animals.

Two animals were then selected for injections of *Clostridium welchii* alpha toxin intravenously. Histamine release was studied. A significant increase in plasma histamine

TABLE VI —PERITONEAL AND SAC FLUID DETERMINATIONS, SERIES V DOGS

## A. Peritoneal exudate

Dog	Time	Fibrinolysis		Hyalu- ronidase	Leci- thinase %	Outcome
		Plasma	Exudate			
80	30 hr		1 plus	5 plus	28	Died
82	30 hr	1 plus	1 plus	3 plus	83	Survived
84	43 hr	Negative	Negative	0	0	Sacrificed
85	22 hr	Negative	1 plus	0	68	Sacrificed
86	48 hr	Negative	Negative	0	92	Sacrificed
87	48 hr			3 plus	84	Sacrificed

## B. Sac fluid

Dog	Time	Fibrinolysis		Hyalu- ronidase	Leci- thinase %	Outcome
		Plasma	Exudate			
81	48 hr	Negative	1 plus	5 plus	30	Survived
83	72 hr	Negative	1 plus	4 plus	42	Survived
88	72 hr	Negative	2 plus	3 plus	0	Died in 24 hrs
89	72 hr	Partial	3 plus	3 plus	76	Survived
90	72 hr	Negative	3 plus	5 plus	91	Survived
91	72 hr	Negative	3 plus	5 plus	81	Survived
92	48 hr	Partial	3 plus	5 plus	55	Survived
93	Pneumonia—Died in less than 24 hr					
94	30 hr	Negative	3 plus	5 plus	77	Survived
95	24 hr	Negative	2 plus	4 plus	92	Survived

TABLE VII —CONTROL STUDIES ON FECAL SUSPENSIONS PREPARED FROM RANDOM SAMPLES OF DOG FECAL MATTER

## Lecithinase

Fecal suspension	Result	
1	Negative	
2	Negative	
3	Negative	
4	Negative	
5	Negative	
6	Negative	

## Hyaluronidase

Fecal suspension	Result	Amount detected	
1	Negative		
2	Negative		
3	Positive	0.25 cc. (2 plus)	
4	Positive	0.20 cc. (2 plus)	
5	Negative		
6	Negative		
7	Negative		
8	Negative		
9	Positive	0.063 cc. (4 plus)	
10	Negative		

## Fibrinolysis

Fecal suspension	Control 3 drops saline	1 Drop fecal suspension	3 Drops fecal suspension
1	Negative	Negative	Negative
2	Negative	Negative	Partial
3	Negative	Negative	Partial
4	Negative	Negative	Negative
5	Negative	Partial	Complete
6	Negative	Negative	Negative
7	Partial	Negative	Partial
8	Negative	Negative	Negative
9	Negative	Negative	Partial
10	Negative	Negative	Negative

found in either case. In one of these animals careful blood studies were carried out. Blood was drawn from the heart just before the animal died. This blood failed to show any lysis in 48 hours. Prothrombin level at death was decreased, but this decrease was due to actual liver injury, as titration of the plasma against protamine showed no heparin release. Similar studies on a dog injected with sac fluid have shown lysis to occur and decrease in prothrombin in presence of heparin release.

Control studies on standard *Clostridium welchii* toxin and samples of fecal matter were carried out in order to evaluate the results of this experiment. No variation in these control analyses could be held responsible for the results in the experimental animals (Table VII).

## DISCUSSION

Although the wide clinical use of the sulfonamides and antibiotic drugs has reduced the annual mortality of appendicitis and peritoni-

tis to less than 4 deaths in 100,000, a basic knowledge of the pathogenesis of this disease is an essential aid to the surgeon. The indiscriminate use of these powerful weapons will never supplant sound surgical judgment based on a true understanding of the disease mechanism.

The complexity of factors associated with this disease has warranted considerable ex-

perimental work, and from this work has come a vast amount of knowledge concerning alterations in many of the physiological mechanisms of the experimental animal. Our present study has been undertaken in an effort to direct the attention of both the clinical and research surgeons to those factors which we believe are the most significant in the morbid process of appendicitis and peritonitis.

The systemic alterations seen in our experimental animals did not appear to be either of a severe enough degree, or consistently present, to designate such derangements as fundamental mechanisms in the morbid process.

The decrease in prothrombin seen in every animal postoperatively certainly points out some degree of liver injury. The greatest drop appeared in 24 hours in 55.5 per cent of the dying animals and in only 44.4 per cent of the animals did the lowest prothrombin concentration appear near the time of death. From these figures it cannot be said that alteration in prothrombin concentration is a predisposing factor in the death mechanism. It is more likely that a mild degree of liver injury manifested by prothrombin decrease is a reflection of some primary etiological factor.

There was no correlation between plasma fibrinolysis and death in our animals. Only 38.8 per cent of the dying animals showed any fibrinolysis postoperatively and 16.6 per cent of the living animals also displayed this phenomenon. The importance of such a factor necessarily must be secondary when its presence is identified in less than one-half of the dying animals.

The small percentage of animals (15.4%) showing fibrinolysis at the time of the lowest prothrombin level does not substantiate the theory that fibrinolytic enzymes in the blood destroy circulating prothrombin.

Microscopic examination of the liver in dying animals gave us no indication that hepatic damage could account for death. Nuclear disintegration or parenchymal injury were absent or minimal in every specimen studied. The congestion, dilatation of the sinusoids and microvacuolation, however, could very well be the response to a generalized toxemia. This amount of hepatic cellular damage probably

accounts for the decrease in circulating prothrombin, but cannot be held responsible for the mortality.

The earlier death in that group of animals subjected to chloroform intoxication cannot be attributed to any alteration in fibrinolytic antifibrinolytic equilibrium, or decrease in circulating prothrombin, since these phenomena were not in evidence at the time of the animals' deaths. Perhaps some synergistic action of the liposolvent properties of chloroform and lecithinase tend rapidly to overcome the natural defense of the animal. This question bears further investigation.

The importance of the local factors as initiating mechanisms for the production of death is emphasized since recovery can be obtained in more than 90 per cent of animals by artificially walling-off the local gangrenous process. In the natural course of the disease process, the animal would be faced with the problem of combating those factors which we have studied, thus the local area of gangrene assumes the importance of a battle ground on which the invasive forces and natural body defenses strive for survival or death.

The invasive and lethal properties of the local exudate are probably dependent on the synergy of the bacterial flora of the bowel when a suitable medium for growth is presented, namely, the gangrenous appendix. Synergism of the bacteria, we believe, is necessary for proper metabolic processes which eventuate in an increased toxicity of the local fluid (19).

The identification of an activator of the lysin factor in 80 per cent of the sac fluids suggests that this element of the local process may be significant. This enzyme is probably a product of streptococcal growth, streptokinase, and its ability to produce fibrinolytic properties in the local exudate indicates that a natural walling-off of the area by deposition of fibrin, may be a difficult thing for the host to accomplish. Then, too, the experimental studies of Grob have demonstrated that the products of protein digestion, present when fibrinolysis occurs, in addition to inhibiting the bacteriostatic action of sulfa drugs, also directly promotes bacterial growth. This fact may account not only for the inability of 73

# BLOOD AND "AVAILABLE FLUID" (THIOCYANATE) VOLUME STUDIES IN SURGICAL PATIENTS

## Part II Operative and Postoperative Blood Loss with Particular Emphasis Upon Uncompensated Red Cell Loss

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IT is the responsibility of the surgeon to know the amount of blood a patient may lose as a result of an operative procedure. Studies of blood loss reported in the literature (1, 3, 13, 21, 22, 23, 25, 33-36) have been made by colorimetric or gravimetric measurement of the blood removed from the wound on towels and sponges and in the irrigating fluid during the operation. Such studies have led to the compilation of tables of average operative blood loss for different procedures (3, 5). It is the purpose of the present report to suggest that these figures may have given surgeons an unwarranted sense of security for two reasons: (1) the amount of blood removed from the wound at the time of operation may not represent the actual amount of blood lost to the circulation, and (2) postoperative blood loss may occur in amounts greater than the actual operative blood loss. This loss not infrequently results in uncompensated red cell loss.

In previous studies (12, 19) from this laboratory describing serial changes in the blood volume and available fluid in the postoperative surgical patient, large decreases in the postoperative red cell volume and hematocrit were not infrequently noted. These were of sufficient magnitude to lead us to question whether they could be accounted for by operative blood loss. Thomas, Adams, and Thornton, also utilizing the blood volume method in 5 patients undergoing thoracic

surgery, likewise noted decreases in the red cell volume even when adequate amounts of blood had been given by transfusion to replace the blood removed from the wound at operation. Thornton, Adams, and Schaefer and Lord and Hinton have noted that large amounts of plasma and red cells may be lost from and into the chest postoperatively. That the postoperative decreases in the red cell volume noted in this laboratory and by others might be accounted for by postoperative blood loss was deemed probable. It seemed desirable to reinvestigate the problem of blood loss, both that occurring during, as well as following, various operative procedures.

### MATERIAL AND METHODS

The subjects of this study were a group of patients from the ward and private surgical services of the Massachusetts Memorial Hospitals.

*Blood loss at operation* (a) Gravimetric method. Gravimetric determinations of the blood lost in the packs and sponges were carried out according to the method described by Wangenstein. Where possible double layers of packs were sewed to the margin of the wound to prevent blood being absorbed on the drapes or towels. Blood on the gloves and instruments was removed as rapidly as accumulated by dry sponges. No saline irrigations or wet packs were used whenever this was feasible. When large walling off packs were moistened with saline they were discarded. The scales which were used in the weighing process read to an accuracy of 0.1 gram.

(b) Colorimetric method. The colorimetric determinations reported here were based on

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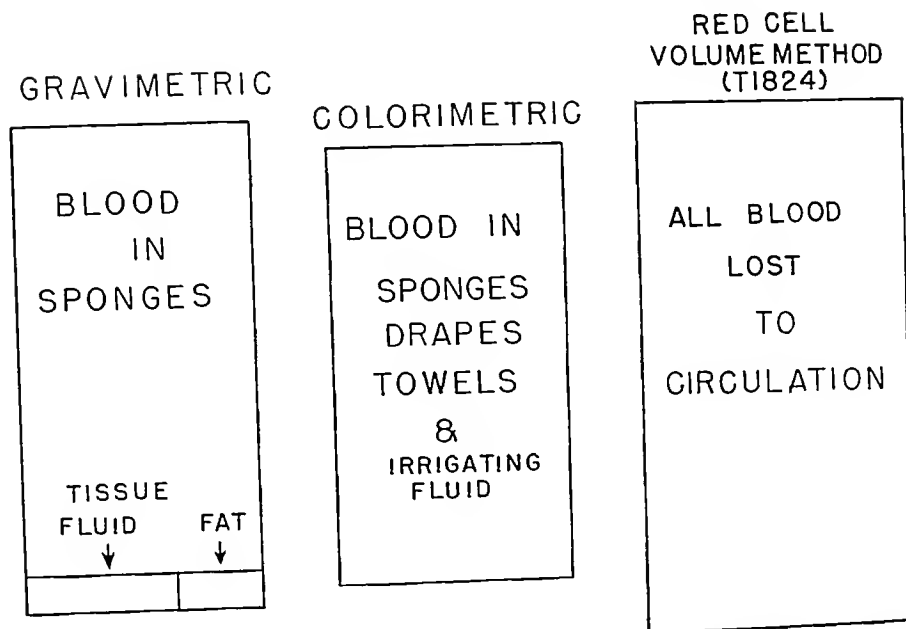


Fig 1 Graphic representation of results of three methods of studying blood loss at operation

a procedure modified from the acid hematin method of Gatch and Little. Oxyhemoglobin determinations were carried out on the Coleman junior spectrophotometer(2). A sample of 5 cubic centimeters of the patient's blood drawn preoperatively was diluted to 1000 cubic centimeters with distilled water and, upon being cleared with dilute ammonium hydroxide and filtered, was read on the log scale at a wave length of 540 millimicrons against distilled water. Properly diluted samples of the hemoglobin extracted from the sponges and towels were treated and read in the same fashion. With corrections for dilution the amount of blood lost was calculated by the following modification of the Lambert Beer law for spectrophotometric differences in optical density

$$C_2 = \frac{C_1 \times D_2}{D_1} \quad \text{where } \begin{array}{l} C_2 = \text{concentration of unknown} \\ C_1 = \text{concentration of standard} \\ D_1 = \text{optical density of standard} \\ D_2 = \text{optical density of the unknown} \end{array}$$

(c) Red cell volume method. In all cases serial blood volume studies were carried out in the preoperative and postoperative periods as detailed in the first paper of this series (19)

Total blood volume and red cell volume were determined from the plasma volume and hematocrit (14). In this paper all references to red cell volume refer to the red cell volume as determined by this method. All measurements of plasma volume were carried out in the basal postabsorptive state with the patient resting supine in bed for at least 2 hours prior to the test.

On experimental grounds (11, 15, 29) the objection may be raised that the red cell volume as measured by this method is about 15 per cent higher than the absolute red cell volume. Nonetheless, the same error is present in all determinations both preoperatively and postoperatively so that repeated determinations in the same patient should yield reliable information as to red cells lost or gained by the circulation.

In selected cases the plasma volume was determined in the preoperative and immediate postoperative periods. Since the plasma volume may change relatively rapidly in response to intravenous infusions or acute severe blood loss and thus alter the total blood volume, neither plasma volume nor total blood volume changes can be used as a reliable index of

TABLE I—BLOOD LOSS AT OPERATION IN 20 CASES, DETERMINED BY COLORIMETRIC OR GRAVIMETRIC METHODS

Case	Age	Sex	Operation	Operative blood loss cc
1	56	M	Subtotal gastrectomy	480*
2	52	M	Subtotal gastrectomy	100
3	50	M	Exploratory thoracotomy	1600
4	36	M	Thoracotomy and lingulectomy	650
5	50	M	Exploratory thoracotomy	450
6	38	M	Trans thoracic vagotomy	250*
7	52	M	Cholecystectomy exploration of common bile duct appendectomy	185*
8	45	F	Cholecystectomy, exploration of common bile duct, appendectomy	195*
9	42	F	Subtotal thyroidectomy	143*
10	50	F	Hysterectomy	445*
11	42	M	Hernioplasty	152*
12	17	M	Hernioplasty	92*
13	66	M	Transurethral prostatectomy	193
14	68	M	Transurethral prostatectomy	110
15	59	M	Total cystectomy with implantation of ureters into colon (one stage)	477
16	40	M	Lumbodorsal splanchnicectomy	310*
17	39	M	Lumbodorsal splanchnicectomy	140*
18	32	M	Lumbodorsal splanchnicectomy	167*
19	38	M	Lumbodorsal splanchnicectomy	285
20	40	M	Lumbodorsal splanchnicectomy	105*

\*Gravimetric determinations

blood loss. Because the total red cell volume is resistant to changes resulting from hydrating or dehydrating procedures, this fraction of the blood volume was used to compute the amount of blood lost from the circulation as a consequence of the operative procedure. Similarly, postoperative blood loss was computed from the successive postoperative red cell volumes. In this manner blood lost at operation and blood lost postoperatively could be individually assayed.

## RESULTS—OPERATIVE BLOOD LOSS

Table I illustrates the blood loss at operation in a series of 20 patients as determined

Blood on sponges  
 Blood on drapes  
 Blood on towels  
 Blood on gloves  
 Blood on gowns  
 Blood on instruments  
 Blood in surgical specimen  
 Blood in wound not absorbed by sponges  
 Blood lost to circulation through ligatures e g

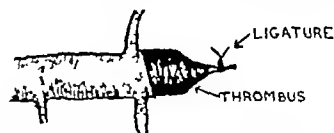


Fig 2 Details of sources of loss measured by the red cell volume (Tr824) method of studying operative blood loss

by the usual gravimetric or colorimetric methods. Although this series is relatively small the values for operative blood loss as measured by the classical methods do not differ significantly from those reported for comparable procedures in the literature. The operative blood loss in 5 cases undergoing lumbodorsal splanchnicectomy as described by Smithwick averaged 201 cubic centimeters at each stage.

The colorimetric method of determining blood loss contains a source of error in that it is based on hemoglobin determinations. Even using the photoelectric colorimeter Evelyn has reported an error of  $\pm 2$  per cent. More important than this are multiple other errors introduced by incomplete extraction of the hemoglobin from the sponges, by contamination of sponges with bile or iodine, and errors in the process of dilution which though small may greatly alter the final value.

In comparing the colorimetric and gravimetric methods for the measurement of the blood removed from the wound the gravimetric procedure yielded the more reliable results. However, this method also is subject to certain errors. Baronofsky and associates noted that small increments in weight may be due to tissue fluid absorbed by the sponge. In our experience with colorimetric studies on material which had previously been measured gravimetrically we were repeatedly impressed



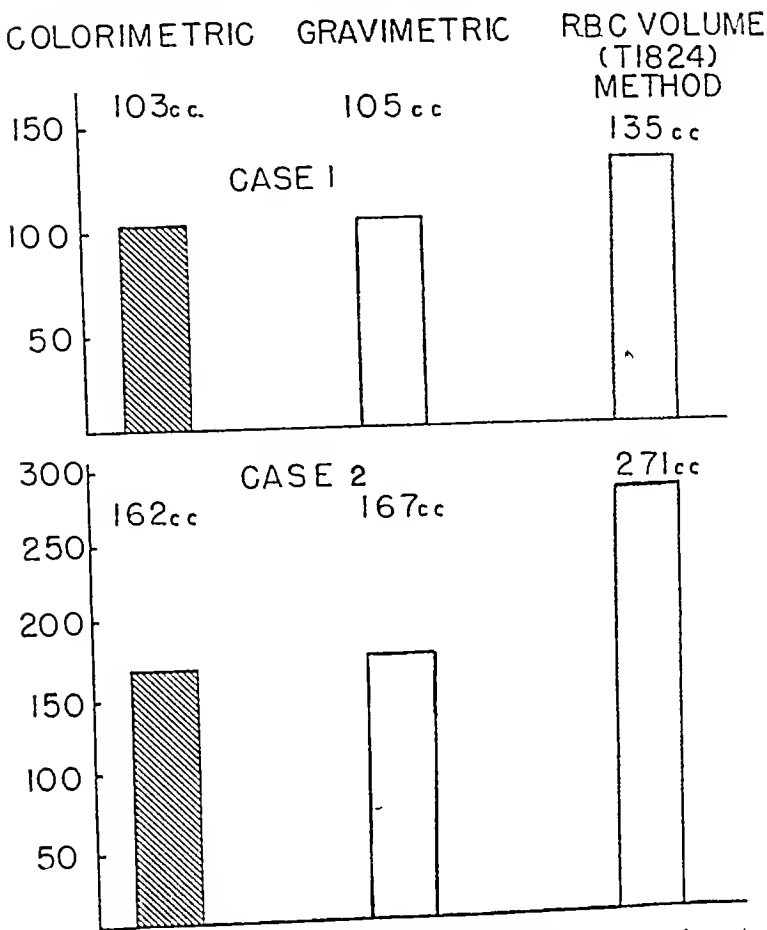


Fig 3 Comparison of operative blood loss as studied by the colorimetric, gravimetric, and red cell volume methods in 2 cases

by the heavy layer of fat that rose to the top during the extraction process. This may be of importance in carrying out gravimetric blood loss studies in the obese patients in whom extensive dissection is carried out through fatty layers.

The question of errors due to evaporation also was investigated. In 4 experiments where 50 cubic centimeters of blood was placed on sponges and exposed to the air in the laboratory for 1 hour, the loss of weight by evaporation of water averaged 2.88 grams. Thus it may be assumed that in the operating room which maintains a relatively high humidity, errors from loss of weight by evaporation will be kept at a minimum if sponges are weighed within 15 minutes of the time of discard from the table.

In contrast to the colorimetric and gravimetric methods, the red cell volume method based on the principle of dilution of injected dye, measures the total volume of blood in the circulation. Inasmuch as there are no significant storehouses of red cells in the human body, serial measurements by this method reveal the total amounts of blood lost from the circulation as a result of the operative procedure (Figs. 1, 2). This includes not only the blood removed from the wound but in addition all blood lost in the surgical men, infiltrated into the wound and surrounding tissue spaces and not absorbed by coagulation or immobilized in vessels proximal to the incisions. It is evident that this method will yield higher values for the amount of blood lost than can be measured by either the colorimetric or gravimetric methods.

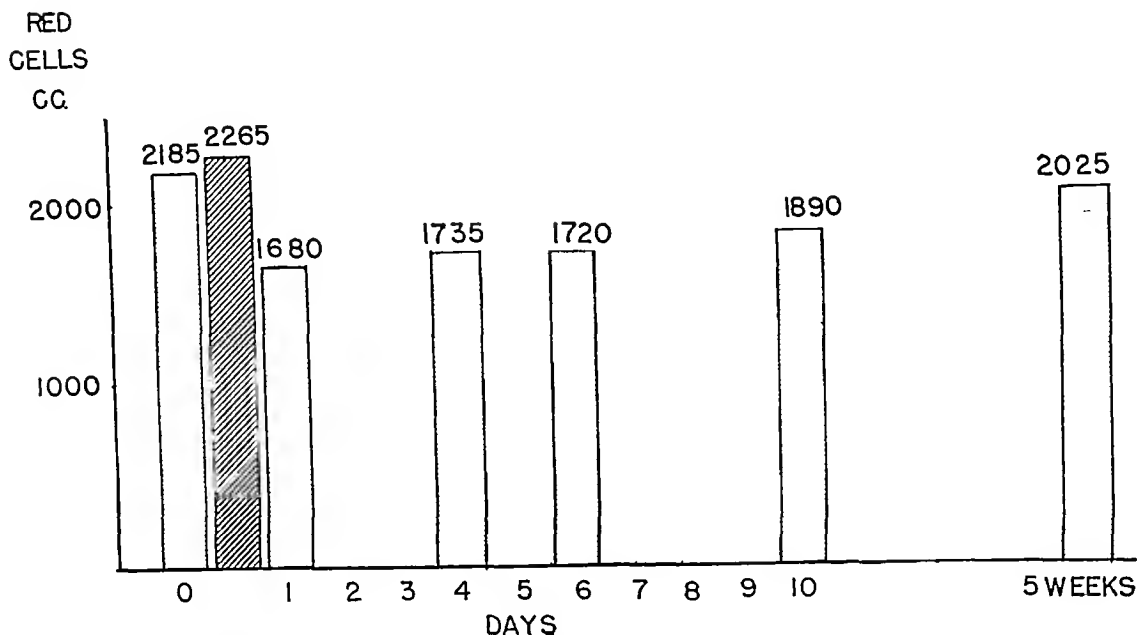


Fig 4 Thoracotomy with resection of lingular bronchus, postoperative blood loss, 1200 cubic centimeters. The difference between actual and theoretical red cell volumes on first postoperative day is 585 cubic centimeters of red cells or 1280 cubic centimeters of whole blood

Theoretical red cell volume, which is indicated by the diagonally lined column, was computed in the manner which is described in the text. Note that the red cell volume has not returned to the preoperative levels at the end of 5 weeks' time.

imetric or gravimetric methods which measure only the blood removed from the wound on the sponges and towels.

Figure 3 represents a comparison of the three methods of studying blood loss in 2 cases. In both instances there was close agreement between the colorimetric and gravimetric methods which measure only the blood removed from the wound. The red cell volume method, which measures the blood lost to the circulation, yielded significantly higher values.

The method is particularly satisfactory where large amounts of blood are lost. It is useful both in measuring progressive loss and total depletions of the red cell volume and in evaluating replacement therapy. The chief difficulty with the red cell volume method is that it requires special apparatus and meticulous technique. While yielding satisfactory results as a clinical research method, it is at the present time too difficult technically to be considered practical for routine clinical use.

#### RESULTS—POSTOPERATIVE BLOOD LOSS

The red cell volumes studied serially in 4 cases at various intervals during the preoperative and postoperative periods are illustrated in Figures 4, 5, 6, and 7. It will be observed in Figures 4, 6, and 7 that striking diminutions in the red cell volume occurred. Blood loss at operation was studied in all cases by the gravimetric and colorimetric methods. On the basis of the total blood loss at operation multiplied by the preoperative hematocrit, the number of cubic centimeters of red cells lost at operation was computed.

The lightly stippled areas in each figure represent the actual red cell volume. The heavily lined column in each figure represents the theoretical red cell volume, i.e., the preoperative red cell volume (at 0 day) plus the red cell gain by transfusion and minus the red cell loss at operation computed from the colorimetric or gravimetric operative blood loss and the hematocrit. More specifically, in each case the theoretical red cell volume represents that which should have been present if

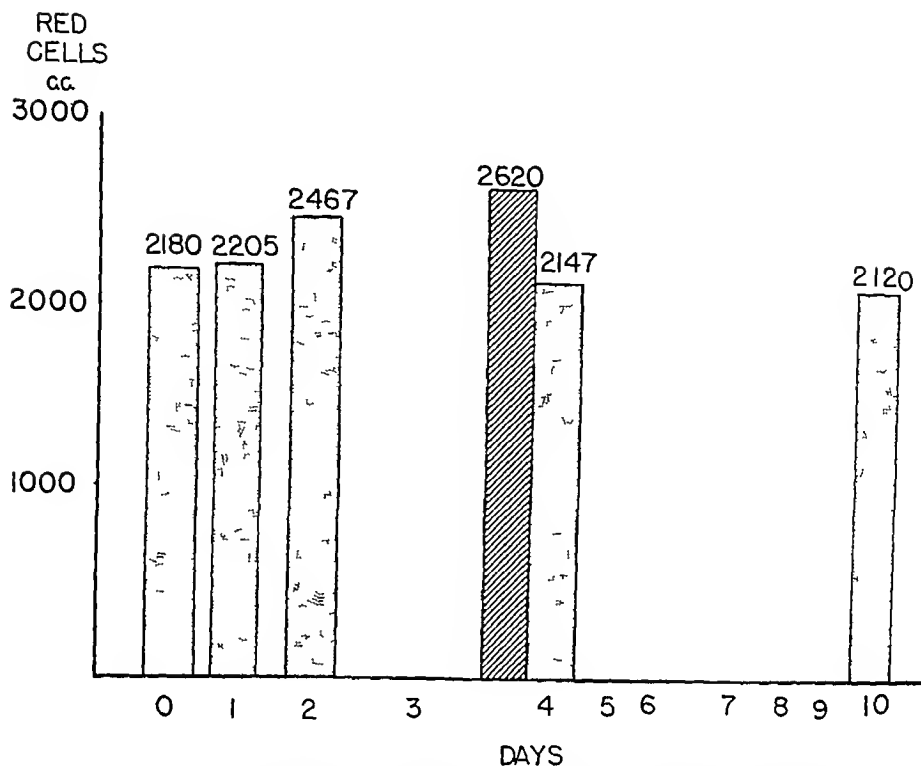


Fig 5 Cystectomy with ureteral implantation in the colon, postoperative blood loss, 1070 cubic centimeters. The difference between theoretical and measured red cell volumes on the fourth postoperative day is 473 cubic centimeters of red cells or 1070 cubic centimeters of whole blood. Operative and postoperative loss in this case were compensated for by early and adequate transfusion (1500 cubic centimeters).

no blood were lost other than that removed from the wound at the time of operation. The postoperative loss of whole blood is listed in the legend accompanying each figure and was computed from the difference between the theoretical red cell volume and the red cell volume actually measured by the dye method.

The first portion of this report introduced evidence to support the concept that the classical gravimetric and colorimetric methods do not measure all blood lost from the circulation at operation. It must be recognized, therefore, that a portion of the figure given as postoperative loss may represent additional operative loss not detected by the classical methods. However, as presented later, clinical evidence and autopsy findings support the statement that at least the major portion of the difference between the theoretical and actually determined red cell volume represents the previously unquantitated phenomenon of postoperative red cell loss.

Figure 4 illustrates a thoracotomy with resection of the lingular bronchus. Operative blood loss was 670 cubic centimeters of whole blood replaced with 1000 cubic centimeters by transfusion. Replacement therapy should have been more than adequate. The theoretical red cell volume of approximately 2265 cubic centimeters differs from the actual by 585 cubic centimeters of red cells or approximately 1280 cubic centimeters of whole blood. In this case the patient lost 1200 cubic centimeters of blood more than that actually measured at operation. The major portion of this was postoperative blood loss and occurred within 24 hours after the patient left the table. Clinical evidence supporting this observation was the large amount of bloody drainage postoperatively in the underwater seal drainage bottle. It is significant that even at the end of 5 weeks the red cell volume had not returned to those levels present before operation.

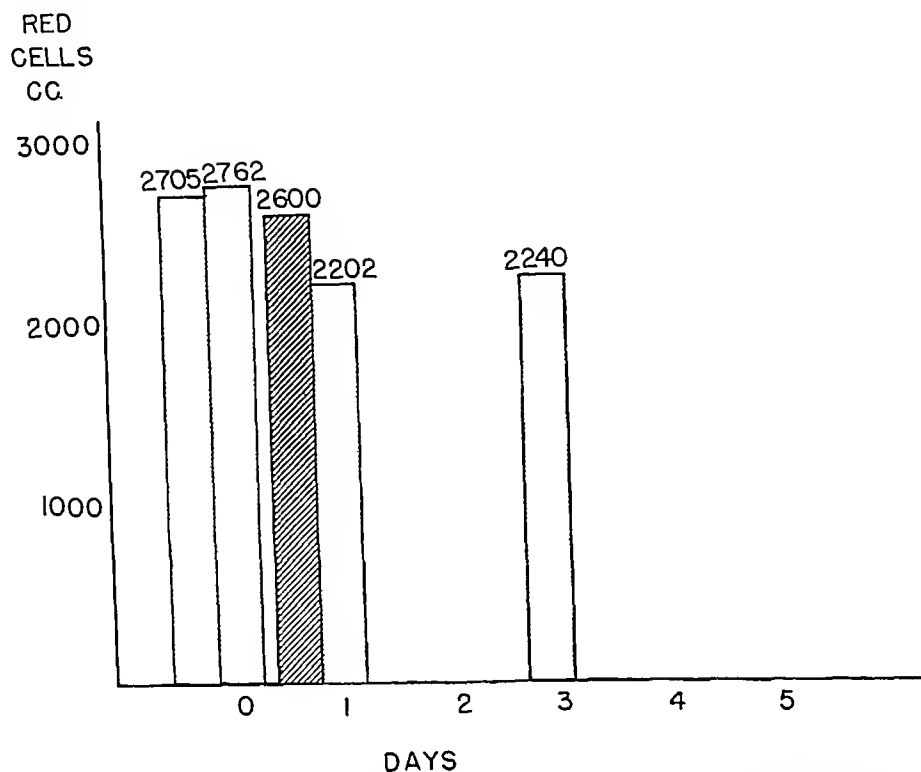


Fig 6 Splanchnicectomy, postoperative blood loss, 865 cubic centimeters. Illustrates difference between theoretical and measured red cell volumes on first postoperative day. Difference is 398 cubic centimeters of red cells or 865 cubic centimeters of whole blood.

Figure 5 is the case of a cystectomy with ureteral implantation in the colon. The operative blood loss was 477 cubic centimeters of whole blood with replacement by 1000 cubic centimeters of whole blood at operation plus 500 cubic centimeters in the next 24 hours. The difference between the theoretical and actual red cell volumes was 473 cubic centimeters of red cells or 1070 cubic centimeters of whole blood. In this patient the postoperative loss of approximately 2 pints of whole blood occurred over a period of 4 days. The increase in red cell volume on the second postoperative day is due to transfusion therapy. The recognition and treatment of postoperative blood loss in this patient illustrates the manner in which studies of the nature described in this paper may be used to prevent uncompensated red cell loss.

Figure 6 represents a splanchnicectomy where the difference between the theoretical

and actual red cell volumes was 398 cubic centimeters of red cells, a postoperative whole blood loss of approximately 865 cubic centimeters. This patient died on the seventh postoperative day of a massive coronary thrombosis. At autopsy a retropleural collection of blood estimated at 900 to 1000 cubic centimeters was observed by the pathologist. The operation was not attended by unusual blood loss, and hemostasis appeared complete at the time of closure. The major portion of the blood loss measured by the red cell volumes and found post mortem must have occurred, therefore, in the period after the patient left the operating table. According to the red cell volume determinations it occurred in the first 24 hour period. The report of Lord and Hinton offers suggestive evidence that this type of postoperative loss may be a not infrequent occurrence after lumbodorsal splanchnicectomy.

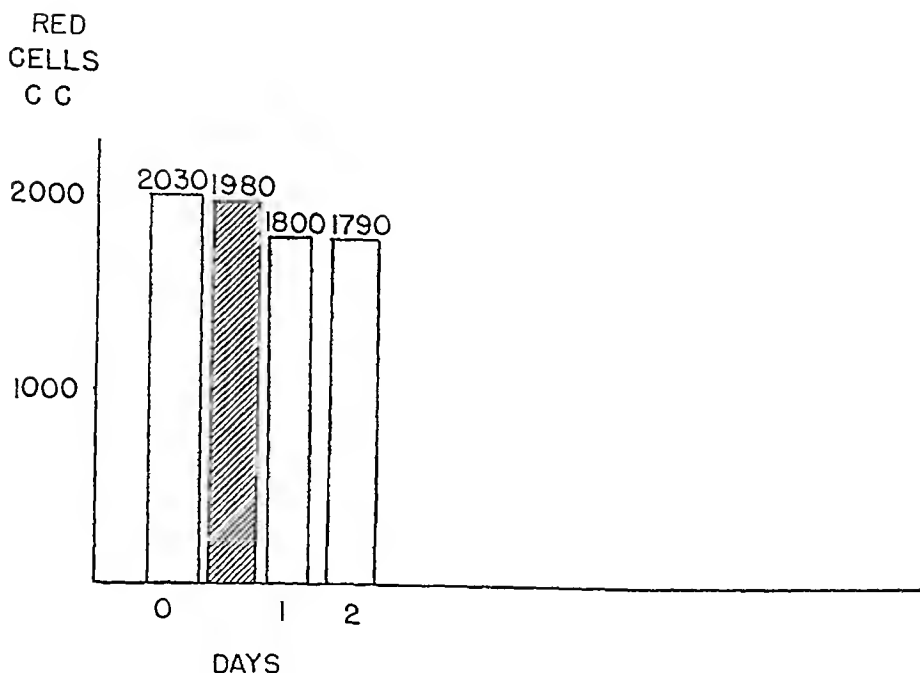


Fig 7 Prostatectomy, postoperative blood loss, 500 cubic centimeters. Illustrates difference between theoretical and measured red cell volumes on first postoperative day. Difference is 190 cubic centimeters of red cells or in this case 500 cubic centimeters of whole blood.

Figure 7 illustrates the red cell volume changes following a transurethral prostatic resection. Operative blood loss was 110 cubic centimeters of whole blood. No transfusions were given. The difference between the theoretical and actual red cell volumes was 198 cubic centimeters which represents 500 cubic centimeters of whole blood lost over and above that measured as operative blood loss by the usual methods.

#### DISCUSSION

Serial red cell volume studies reported in this paper show that the operative blood loss is greater than that measured by older methods, in addition, further blood loss may occur in the postoperative period and exceed the actual operative blood loss by 100 to 200 per cent. The phenomenon of postoperative blood loss receives additional confirmation from the frequent clinical observations of the bloody drainage or thoracentesis fluid in cases undergoing intrathoracic or transthoracic procedures, the guaiac (+) stools after major gastrointestinal resections, the sanguineous drainage in the postoperative urologic case

or from the perineal wound following the Miles procedure as well as autopsy findings in several cases (28). Neither excessive compensatory plasma dilution nor changes in the mean corpuscular volume of the red cell (3, 5, 24) can adequately explain the observed postoperative decreases in red cell volume or hematocrit. Increased or abnormally rapid destruction of transfused cells ordinarily does not occur (7), nor could excessive blood destruction or decreased blood formation be incriminated, for these were ruled out in this series by appropriate studies including icteric indices, bilirubin studies, and reticulocyte counts.

Due to the insidious nature of postoperative blood loss, the clinical signs customarily observed following acute blood loss may be absent. Emerson and Ebert showed that blood pressure and pulse rate need not be related necessarily to the extent of depletion of the blood volume. Similarly in this series, although postoperative blood loss amounted to as much as 1200 cubic centimeters, the concomitant alteration of blood pressure or pulse rate which might have been expected had it

loss been due to acute hemorrhage did not occur

The available evidence suggests a parallelism between uncompensated depletions of the red cell volume and the hematocrit. Figure 8 represents changes in hematocrit observed in five patients with and without major uncompensated blood loss. Serial determinations of the hematocrit value during the preoperative and postoperative periods afford a simple laboratory test for establishing the presence of uncompensated blood loss. Although further definition of the relationship between a decreased hematocrit and the depleted red cell volume is desirable, in our experience if the hematocrit on the third postoperative day was 5 millimeters or more lower than the preoperative hematocrit, uncompensated whole blood loss in excess of 500 cubic centimeters was invariably present. It is to be emphasized that the blood sample must be drawn under standard basal conditions if the hematocrit is to be used as a simple laboratory test in establishing the presence of uncompensated blood loss. Standard basal conditions imply that the patient be fasting, flat in bed for a minimum of 1 hour, and that sampling be accomplished without prolonged venous stasis.

Severe uncompensated depletions of the red cell volume resulting from operation are replaced only over a period of weeks (12, 19, 31, 32). This is in contrast to the rapid restoration of the plasma volume and total circulating protein, which, although not restored immediately following depletion (9, 30, 36) in the adequately hydrated patient, may be restored to or above control values within 1 to 3 days (4, 19). Therefore, since plasma and cells are lost in the same proportion as they are present in the blood at operation, the hematocrit drawn immediately following surgery may be essentially unchanged from the preoperative hematocrit. However, following the restoration of plasma volume the actual red cell loss becomes fully apparent in the hematocrit decrease on the third postoperative day. Large hematocrit decreases at this time serve as a rough index of the extent of depletion of red cell volume.

Reports in the literature (16, 17, 20, 26) on the effects of massive gastrointestinal hem-

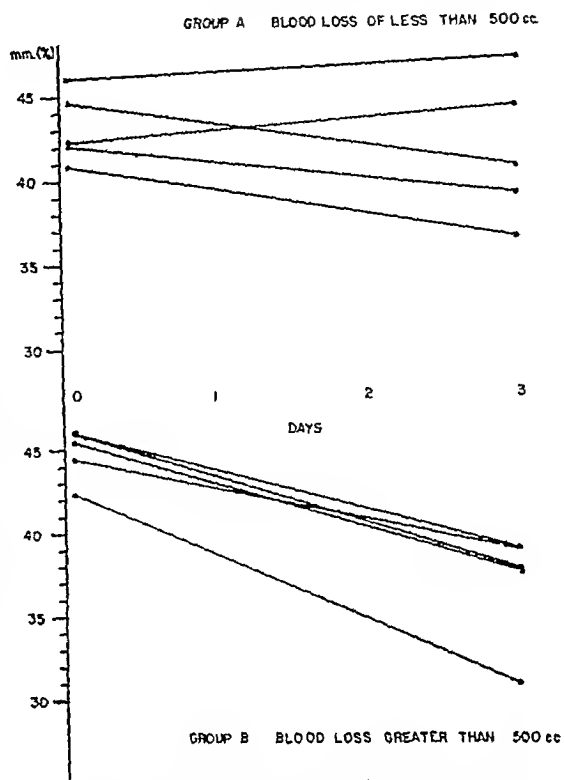


Fig 8 Hematocrit differences observed postoperatively in compensated and uncompensated blood loss as studied by the red cell volume method. Note consistent pattern where uncompensated blood loss of 500 cubic centimeters or more is present.

orrhage record changes in the electrocardiogram, the development of cardiac failure, instances of coronary thrombosis and myocardial infarction and transient or persistent amaurosis following acute blood loss. Though much further investigation is required before relating any of these complications directly to uncompensated red cell loss either as complications or sequelae, it may be significant that in specific instances where we have observed major uncompensated red cell loss we have concurrently observed (1) coronary thrombosis and myocardial infarction, (2) vague central nervous system disorders including disorientation, air hunger, and coma, (3) transient amaurosis, (4) oliguria, and (5) unexplained retardation of convalescence.

Because the body unaided cannot repair rapidly severe depletions of the red cell volume the major role of blood replacement therapy

in the postoperative period is to replenish the depleted red cell volume. The surgeon aware of the phenomenon of postoperative red cell loss by attention to changes in the basal hematocrit may recognize and take the steps necessary to replenish the red cell volume depleted through uncompensated operative or postoperative blood loss.

#### SUMMARY AND CONCLUSIONS

1 Blood loss resulting from various surgical procedures was measured in the same patients by the standard colorimetric and gravimetric methods and compared with results obtained from repeated preoperative and postoperative red cell volumes. Red cell volumes were computed from the plasma volume (T-1824 method) and hematocrit.

2 Operative blood loss measured by the red cell volume method may be considerably higher than that obtained by the classical colorimetric or gravimetric procedures. The reasons for this discrepancy are discussed, and evidence is presented which suggests that the amount of blood removed from the wound at operation may be less than the actual amount of blood lost from the circulation at operation.

3 Observations in postoperative surgical patients are reported which suggest that postoperative blood loss may be an important complication of major surgical procedures. Even though blood lost at operation may be adequately replaced, a further insidious blood loss may occur after operation. This may be considerably larger in amount than the operative loss.

4 Extensive compensatory mechanisms operate in the human to restore a depleted plasma volume. By contrast, the ability of the body to restore a depleted red cell volume is limited. The need for recognizing and correcting a red cell volume depleted through either operative or postoperative red cell loss is emphasized.

5 It is suggested that in the adequately hydrated patient, the hematocrit value on the third postoperative day is a useful index of uncompensated red cell loss and may serve as a guide for replacement therapy.

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# VAGINAL HYSTERECTOMY

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THE increasing incidence of vaginal hysterectomies performed at St Luke's Hospital, Chicago, since 1939 warrants an evaluation of the operative procedure and the results obtained

There is considerable variation in the attitude of gynecologists toward vaginal hysterectomy Heaney (5, 6) has stated that vaginal hysterectomy is the operation of choice in his hands for removal of the uterus except in those cases in which it seems impossible to complete because of fixation of the uterus or because of an unusually large tumor TeLinde (8, 9) holds that in uterine prolapse the uterus should be removed vaginally if it is diseased, either completely, or in part as in the Spaulding-Richardson operation For uterine prolapse without uterine disease he prefers the Watkins transposition or a Manchester operation W C Danforth (3) feels that vaginal removal of the uterus for prolapse is preferable to the Manchester operation

## MATERIAL

The series reported by us includes 570 vaginal hysterectomies performed at St Luke's Hospital Chicago, from January 1, 1939 to January 1, 1947

## PATHOLOGY

*Body of the uterus* Of the 570 cases, uterine pathology was present in 295, fibromyomas were present in 234 Of these, 198 uteri were the size of a 2 to 2½ month pregnant uterus, 24 were the size of a 3 to 3½ month pregnant uterus, and 12 were the size of a 4 month pregnant uterus Adenomyosis was encountered 33 times as the only pathologic finding and 18 times in association with fibromyomas Endometrial polyps were found in 29 uteri and in 13 they were in association with fibromyomas Pregnancy was present in 6 patients, carcinoma of the endometrium

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in 3 cases and sarcoma in a uterine fibroid was diagnosed microscopically in 3 cases

*Cervix* Early carcinoma of the cervix was encountered once There was no gross evidence of the lesion Small cervical polyps were present in 6 patients

*Fallopian tubes* Chronic salpingitis with adhesions was present in 3 patients

*Ovaries* Endometrial cysts were found in 6 patients Corpora lutea, some of which were cystic and as large as 5 centimeters in diameter, were removed in 13 instances Benign serous cystadenomas were present in 4 patients One of the serous cysts was too large to deliver through the vagina and was removed abdominally after completion of the vaginal hysterectomy The others were removed vaginally

*Other pelvic pathology* Endometriosis was present in 29 patients, cystourethrocele in 405 patients, rectocele in 413, and enterocele in 55 Complete uterine prolapse was present in 69 patients Descensus of varying degree was present in 124 patients

*Normal uteri according to microscopic examination* There were 242 uteri removed that were diagnosed as normal by the pathology department Associated pelvic pathology, as above, or altered physiology with pelvic symptoms was present in all of these patients in whom the uterus was removed Of the 242 cases, 193 had relaxations of the anterior and posterior vaginal wall and uterine descensus Abnormal uterine bleeding was present in 49 patients as the sole indication for removal of an otherwise normal uterus In an additional 21 patients bleeding was in association with relaxation of the vaginal wall and descensus

*Bleeding* Abnormal uterine bleeding as the chief symptom or in association with other symptoms was present in 300 patients 115 had menorrhagia, 27 had metrorrhagia, 110 had menometrorrhagia, and 48 had postmenopausal bleeding

*Previous surgery* Fifty-eight patients had had previous pelvic operations Thirty-nine



had been operated upon abdominally. Of these 15 had had uterine suspensions, 8 cesarean sections, 14 ovarian cysts removed, 1 a tubal pregnancy with removal of the affected tube and ovary, and in 1 a tumor of the uterus was removed. Thirty additional patients had had appendectomies. Five of these were associated with peritonitis and adhesions. Nineteen of the 58 patients had been operated upon vaginally, and of these, 17 had had plastic operations on the cervix or vagina, and 2 had had transposition operations.

*Associated medical problems.* Blood pressure of 150/90 or higher was present in 129 patients. In 12, the systolic pressure was over 200 and in 36, the diastolic was over 100 millimeters mercury. Organic heart disease was present in 29 patients. Two patients had pulmonary tuberculosis and 1 patient had bilateral chronic pyelonephritis. Five patients had a history of previous thrombophlebitis, 1 of whom had had a pulmonary embolism. Obesity was noted in 109 patients.

*Operation performed.* Repair of the vaginal wall in conjunction with vaginal hysterectomy was done in 450 of the 570 patients. Cystourethrocele and rectocele repair was performed upon 368 patients. Enterocoele repair was done on 55 patients, 45 had rectocele repair only, and 37 had cystourethrocele repair only. The adnexa were removed in part, or *in toto*, in 23 patients. Resection of the ovary was done once. Morcellation of fibromyomas was necessary in 42 instances.

#### POSTOPERATIVE COMPLICATIONS

Postoperative complications occurred in 95 of the 570 cases in this series. This represents the number of lesions diagnosed. Other patients had slight elevations in temperature and in accordance with the obstetrical standard of morbidity would have to be considered morbid. The accepted standard is a temperature of 100.4 degrees Fahrenheit (oral) on any 2 days postoperatively excluding the first 24 hours. However, in these patients there were no symptoms or findings from which one could make a diagnosis of a morbid state, therefore they are not con-

sidered instances of morbidity by us. Rather, they are within the limits of the usual or average postoperative reaction observed in patients upon whom vaginal hysterectomy, with repair procedures have been performed.

*Patients ability to void.* Of the 405 patients with anterior vaginal wall repair, 26 (7 per cent) had indwelling catheters placed in the urinary bladder. Of the 379 remaining patients, 37 (10 per cent) voided immediately and were not catheterized at all. Two hundred (53 per cent) voided during the 1st postoperative day, 129 (34 per cent) voided between the 1st and 7th postoperative day, and the remaining 13 (3 per cent) voided by the 14th postoperative day. Of the 165 patients without anterior vaginal wall repair, 5 (3 per cent) had indwelling catheters placed in the urinary bladder. Of the remaining 160 patients, 50 (32 per cent) were not catheterized at all, 101 (63 per cent) voided by the 1st postoperative day, and the remaining 9 patients (5 per cent) voided by the 5th postoperative day.

*Catheterization.* Of the patients with anterior vaginal wall repair, 37 (10 per cent) were not catheterized, 12 (4 per cent) were catheterized on the operative day only, 6 (17 per cent) required catheterization between the 1st and 3rd postoperative day, 9 (25 per cent) were catheterized between the 4th and 7th postoperative day, and 174 (44 per cent) required catheterization between the 8th and 23rd postoperative day. The longest period of catheterization was 23 days in a patient who developed a urinary tract infection. In the group without anterior vaginal wall repair, 50 (32 per cent) were not catheterized, 10 (6 per cent) were catheterized on the operative day only, 58 (33 per cent) were catheterized between the 1st and 3rd postoperative day, 28 (18 per cent) were catheterized between the 4th and 7th postoperative day, and 14 (9 per cent) required catheterization between the 8th and 14th postoperative day.

*Indwelling catheters.* Postoperative indwelling catheters are not routinely used on our service. However, in 31 patients they were indicated. In five instances the urinary bladder had been entered at the time of

operation (2 with and 3 without anterior vaginal wall repair) In the other cases an indwelling catheter was used to prevent possible trauma to the urethra from intermittent catheterization where the dissection had been extensive or where the urethral meatus was not plainly visible The average length of time the indwelling catheter remained in the urinary bladder was 4 days, and the longest period of time was 14 days Of the 31 patients, 8 (26 per cent) were not catheterized after removal of the indwelling catheter, 7 (23 per cent) required catheterization for 2 days only, 9 (29 per cent) required catheterization from 3 to 7 days after removal of the catheter, and 6 (22 per cent) patients required catheterization from 8 to 10 days after removal of the indwelling catheter One patient required catheterization 16 days after removal of the catheter

*Urinary tract infection* Our criteria for the diagnosis of cystitis are a catheterized urine specimen containing 20 milligrams of albumin or more and 10 white blood cells per high power field or more on any 2 consecutive days postoperatively Clinical symptoms are usually present Pyelitis is evidenced by clinical extension to the kidney region Forty-nine patients developed urinary tract infection, 42 had cystitis and 7 had pyelitis also Forty-one of the 49 patients had had anterior vaginal wall repair The onset of the symptoms occurred about the 4th postoperative day on an average The symptoms and infection subsided on an average of 8 days after onset The average hospital stay of these patients was 16 days The treatment used was chemotherapy, antibiotics, and general supportive measures In this group of 49 patients, 3 had indwelling catheters in the urinary bladder Of the remaining 46 patients, 5 (11 per cent) voided on the operative day, 11 (24 per cent) voided by the 3rd postoperative day, and 20 (43 per cent) voided by the 7th postoperative day and 10 voided between the 8th and 23rd postoperative day All of these patients required catheterization

*Hemorrhage* Postoperative hemorrhage occurred in 9 patients The source of bleeding was from vessels in the tissue of the vaginal

vault at the operative site which had not healed by primary union Five of these patients had had no more than the usual postoperative reaction following vaginal hysterectomy Four of the 9 patients had a high febrile course prior to and after the hemorrhage occurred One patient hemorrhaged on the 6th postoperative day, 2 on the 9th, 2 on the 10th, 1 on the 12th, and 1 on the 15th postoperative day Two hemorrhaged on the 18th postoperative day requiring readmission to the hospital Frank hemorrhage was present in 6 patients and moderate bleeding occurred in 3 patients The vaginal vault was resutured in 5 patients, they received chemotherapy and blood transfusion The hospital stay averaged 20 days All of these patients recovered and at no time was their condition critical

*Shock* Moderately severe shock was present in 4 patients This occurred at the end of difficult surgical procedures in which there was excessive blood loss during the operation All of these patients responded to treatment for shock due to hemorrhage and their condition was stabilized within 6 to 8 hours postoperatively

*Thrombophlebitis* There was a localized phlebitis in a varicosity of the lower saphenous vein in 1 patient that occurred on the 13th postoperative day This was treated with an ace bandage and the patient was not kept in bed The symptoms subsided in 3 days There was no instance of pulmonary embolism in this series

*Infection in the vaginal vault* Localized extraperitoneal infection in the submucosal tissues of the vaginal vault was positively diagnosed in 20 patients Spontaneous drainage into the vagina occurred in all of these patients and all had a febrile course until drainage occurred Two had large hematomas but no true pelvic abscess was noted or diagnosed In 5 additional patients presumptive diagnosis of extraperitoneal infection in the vaginal vault was made Drainage did not occur and the temperature elevation was slight

*Peritonitis* Generalized peritonitis occurred in 4 patients and was preceded by infection in the tissues of the vaginal vault

The patients were discharged from the hospital on the 18th, 24th, 30th, and 42nd postoperative day.

**Fistula** Two patients developed uretero-vaginal fistulas. The first occurred following a vaginal hysterectomy with anterior and posterior vaginal wall repair together with a right salpingo-oophorectomy all of which was performed without difficulty. The postoperative course was uneventful and the patient was discharged on the 9th postoperative day. On the 15th postoperative day, while at home, she noticed a sudden painless discharge of fluid from the vagina. She was readmitted and an attempt to pass a ureteral catheter into the left ureter was unsuccessful. A left ureterovaginal fistula was diagnosed and a left ureterovesical transplant was performed on the 21st postoperative day. The transplant was not successful and 1 month later the left kidney was removed. The patient's recovery was uneventful and at present she is well with no apparent after-effects. The other patient developed a fistula following a vaginal hysterectomy with anterior vaginal wall repair. During the vaginal hysterectomy there was considerable difficulty in obtaining hemostasis in the right broad ligament, the patient went into shock necessitating rapid completion of the surgical procedure. On the 4th postoperative day, she developed acute pain in the right kidney region. An attempt to pass a ureteral catheter into the right ureter was unsuccessful. A diagnosis of obstruction in the right ureter was made due probably, to ligation of the ureter during the surgical procedure. On the 10th postoperative day, a large amount of foul fluid discharged from the vagina. She was discharged on the 21st postoperative day with a right ureterovaginal fistula to be repaired at a later time. Two months later she was readmitted with a right unilateral pyelitis. Following treatment of this a right nephrectomy was performed. The postoperative course was uneventful and the patient is well at the present time.

**Follow-up survey** Preoperative urinary symptoms were present in 338 patients. In 286 of them anterior vaginal wall repair was performed. Ninety seven per cent (277) of

the 286 patients were followed postoperatively, most of them for a period of 3 years or longer.

**Recurrence of relaxation of vaginal wall** Four patients developed recurrent cystocele, rectocele. One patient developed a recurrent enterocele that required repair. One patient had a complete prolapse of the vaginal vault with symptoms. She was followed for 16 months, refused treatment and did not return for further management.

**Recurrence of urinary symptoms** Stress incontinence was present in 163 patients preoperatively. This symptom was relieved in 156 patients following surgery. Five (3.1 per cent) continued to have incontinence after operative attempt at correction of the lesion. In 2 additional patients stress incontinence had been present since childhood and continued after the operation. Nocturia was present preoperatively in 175 and frequency was present in 186. Four (2 per cent) continued to have nocturia after surgery, and 1 (1.6 per cent) continued to have frequency after surgery.

**Mortality** There was 1 death in the series. This represents an uncorrected mortality rate of 0.18 per cent. The patient, a 65 year old primipara, who was 11 years postmenopausal was hospitalized because of complete uterine prolapse. The operation performed was vaginal hysterectomy with anterior and posterior vaginal wall repair. On the 4th postoperative day, the patient developed intermittent pain in the epigastrium associated with nausea and vomiting. The pulse rate varied between 120 and 140. The temperature remained between 100 and 101 degrees Fahrenheit. On the 7th postoperative day the abdomen became distended, bowel sounds were absent and a generalized jaundice developed. The usual supportive measures were instituted which included Wangensteen suction, continuous oxygen and cardiac stimulation. The liver and the heart were enlarged and an auricular fibrillation developed. The patient's condition became worse and she expired suddenly on the 9th postoperative day. The diagnosis was cardiac failure and jaundice of undetermined origin. Autopsy permission was denied.

## DISCUSSION

Vaginal removal of the uterus with repair of relaxations of the vaginal walls carries with it as low a mortality rate as any of the major surgical procedures in gynecology. In our series of 570 vaginal hysterectomies, the uncorrected mortality rate was 0.18 per cent. Other clinics report similar low mortality figures. In the 2,798 vaginal hysterectomies performed by the staff of the Presbyterian Hospital of Chicago, the mortality rate was 0.21 per cent. Danforth (2) had 1 death in 600 vaginal hysterectomies or 0.16 per cent. A mortality rate of 0.66 per cent occurred in the 305 cases reported by Tyrone and Weed. In a series of 6,800 vaginal hysterectomies in the various clinics, there were 18 deaths. This represents a mortality rate of 0.26 per cent and is an enviable record for any major surgical procedure. The average mortality rate reported in more than 40,000 abdominal hysterectomies over a similar period of time and by comparable operators was 2.4 per cent. It is obvious to us that the two approaches cannot be compared accurately. We realize that many abdominal hysterectomies are of a much more difficult nature and that they could not be performed vaginally. However, when feasible, removal of the uterus through the vagina is much safer than removal through the abdomen because of the lower mortality rate.

Less often encountered causes of death are those resulting from medical complications that were present before the surgical procedure.

The death in our series was of a medical nature, precipitated by the surgical procedure, and it would no doubt have occurred whichever approach had been used. At the time of operation there was no evident medical contraindication to the surgery. The postoperative course was clearly a complication on a medical basis. We do not believe an error in judgment was involved in permitting this patient to be operated upon.

A morbidity study is not a part of this report. Gynecologic morbidity based on temperature records in accordance with obstetrical standards is not significant, is not adequate, and in no way reflects the true

postoperative condition of the patient. This has been brought out in an earlier report by Jones and Doyle as it applies to abdominal hysterectomy. For this reason specific temperature reactions were not studied. Clinical evaluation of the individual patient's general condition is more pertinent in determining her postoperative status than is the presence of an elevated temperature. Temperatures to 101 degrees Fahrenheit or less during the first 3 to 4 postoperative days are quite common and are rarely indicative of a surgical complication. The temperature usually returns to normal by the 5th day.

Patients upon whom vaginal hysterectomies have been performed experience much less postoperative discomfort than do the abdominal cases. The majority of them are comfortable and require very little sedation after the first 36 hours. They have no tender abdominal incision and therefore there is no need for the abdomen to be splinted by the patient in her movements. There is much less trauma in vaginal surgery and there is no need to pack the intestines up under the diaphragm with resulting gas pains from such manipulation. A lighter plane of anesthesia is possible because of this and because relaxation of the tissues is not as necessary in vaginal surgery.

The average hospital stay in this group was 14 days. In the last year of this report it was 12.5 days. Many are able to go home in 8 days and some of them do so.

The most common complication encountered in this series was urinary tract infection. This represents 52 per cent of all complications, and it occurred in 8 per cent of all patients who had vaginal hysterectomy. Infection of the urinary bladder occurred in 41 of 49 patients who had anterior vaginal wall repair. They required repeated catheterizations and therefore were more likely to develop urinary tract infection. The group of patients that developed infection voided just as promptly as those that did not develop infection. However, they required catheterization for a much longer period of time.

Some patients, before operation, have a chronic low grade cystitis from residual urine

that accompanies a cystourethrocele. Others develop infection from repeated catheterization postoperatively. Overdistention of the bladder postoperatively may be a factor in the development of infection. Trauma to the urinary bladder that accompanies the surgical repair of a cystourethrocele may predispose to infection in the bladder. Extraperitoneal infection in the vaginal vault is frequently associated with cystitis. Vesical or ureteral fistulas are always followed by urinary tract infection. Urinary tract infection prolonged the hospital stay 2 days. Three patients had pyelitis develop 1 month after discharge from the hospital and they were readmitted for treatment. All of these patients responded to therapy and did not have disabilities at a later time.

The possibility of cutting or ligating a ureter exists by either route and may not necessarily be restricted to difficult cases. In the instance where it occurred during a difficult case, the thought that injury to the ureter might result was uppermost in the surgeon's mind during the operation. In the other it occurred during an easily accomplished vaginal hysterectomy. The possibility of ureteral injury is greater in those cases with intraligamentous fibromyomas, inflammatory masses and endometriosis. This danger also exists in complete uterine prolapse because the dissection must be extended farther out into the supporting ligaments in order adequately to perform the necessary repair of the hernia, in this way the ureter may be cut or ligated.

The incidence of fatal pulmonary embolism is less following vaginal hysterectomy than it is after abdominal hysterectomy. Erskine and Shures report that in 21,066 gynecologic procedures at Chelsea over a period of 13 years, the incidence of fatal embolism was 1 in 526 abdominal operations or 0.19 per cent. There were 13,061 vaginal procedures with an incidence of 1 fatal pulmonary embolism in 1,088 vaginal operations or 0.092 per cent. In a group of vaginal hysterectomies at various clinics in the United States, there were 3 cases of fatal pulmonary embolism in 7,000 operations. This is 1 in 2,330 or an incidence of 0.042 per cent.

The occurrence of thrombophlebitis is more frequent following abdominal hysterectomy particularly when a patient has a history of previous thrombophlebitis, pulmonary embolism, or both. Such patients are operated upon vaginally with much more safety.

Severe shock resulting from difficult surgical procedures and excessive blood loss may occur no matter which approach is employed. The degree of shock may be minimized by anticipating its onset. The specific causes for excessive blood loss are varied. During the vaginal removal of a uterus the ligatures may occasionally slip and it may be difficult to religate the tissues, similarly the tissues may slip out of the clamp before the ligature is placed. To reduce the occurrence of these mishaps large pedicles are left on cutting the clamped tissues. Adequate hemostasis is the best safeguard against late postoperative hemorrhage.

Operative failures occurred in 10 (1.8 per cent) of the 570 vaginal hysterectomies. In 6 patients there was recurrence of lesions or relaxations as mentioned. In 8 patients there was a continuation of certain preoperative symptoms for which the patient was, in part, operated upon. It is difficult to account for the recurrences of the lesions. In some it is due to poorly developed tissues utilized for the repair. It is possible that failure to do a sufficiently extensive dissection of the enterocele might account for a recurrence of this lesion. The persistence, for 1 or 2 months postoperatively, of stress incontinence, nocturia, or frequency is not unusual. These symptoms subside where correction is obtained. Stress incontinence persisted in 5 patients for more than 3 months after surgery. In 2 patients, not counted with the above 5, stress incontinence persisted but it had been present since childhood and was not due to any lesion that could be corrected surgically. However, cystourethrocele repair was done (in conjunction with vaginal hysterectomy) in the hope that the incontinence might be alleviated, but this did not result. The 5 patients represent a 3 per cent recurrence of stress incontinence.

We have excellent results with vaginal hysterectomy and repair in the treatment of

complete and partial uterine prolapse We feel that the main supporting structures, the uterosacral, the cardinal, and the pubocervical ligaments are more adequately utilized in the repair with the uterus removed In most instances a prolapsed uterus occurs in women who have either had their desired number of children or who are beyond the childbearing age, and the removal of the uterus need not be questioned on this basis Furthermore, vaginal delivery of an infant in a patient who has had a previous vaginal wall repair carries with it the likelihood of the repair breaking down This possibility of pregnancy exists even in those patients nearing the end of their reproductive period This is obviated with removal of the uterus at the time of the repair

All gynecologists are familiar with the poor results frequently obtained in the medical treatment of "functional uterine bleeding" When medical treatment has been unsuccessful and surgery is necessary, hysterectomy is ideally performed by the vaginal route

Endometriosis in its milder forms such as the subperitoneal type that does not result in adhesions may be treated by vaginal hysterectomy However, the other forms of endometriosis that produce adhesions involving the bowel and adnexa are best handled via the abdominal approach

Fibromyomas often can be removed through the vagina Those of larger size are adequately managed by morcellation, thus we have done with tumors as large as a 4 month pregnant uterus The size of the tumor is not as important as is the associated fixation and position of the tumor or its integral parts Subvesical or broad ligament tumors are best removed abdominally

When surgery is necessary in patients with systemic medical disabilities, vaginal hysterectomy where feasible, is the safer procedure This is particularly true in pulmonary conditions such as tuberculosis or bronchiectasis The patients require less total anesthesia since a lighter plane of anesthesia is permissible, and postoperative excursion of the diaphragm (and lungs) is not as limited as it is in abdominal procedures The blood pressure, blood volume, and cardiac function

are not altered as much in the vaginal approach and therefore cardiac patients (organic heart disease, arteriosclerosis, hypertension) tolerate vaginal surgery with a greater margin of safety For this reason the aged patient is more safely operated upon by the vaginal route

Previous abdominal surgery is seldom a contraindication to vaginal hysterectomy Appendectomies that are uncomplicated rarely interfere with vaginal surgery However, complications such as ruptured appendices with peritonitis may cause adhesions that are very apt to increase the difficulty of vaginal hysterectomy Previous gynecologic surgery is not often a contraindication to vaginal surgery It is seldom that adnexal surgery makes a subsequent vaginal hysterectomy difficult and in none in this report was it a factor Previous cesarean sections or plastic procedures on the anterior or posterior vaginal wall may produce fibrous scar tissue and it may be tedious work to find the correct plane of cleavage between the bladder and the uterus It was in 2 such patients who had had previous cesarean sections that the urinary bladder was opened Previous suspension operations on the uterus may result in fixation of the fundus of the uterus or the upper portion of the broad ligaments However, the uterus can usually be brought into view with tension on the cervix and the hysterectomy completed Those cases with marked fixation are best done abdominally Previous transposition operations (Watkins) almost as a rule result in difficult and tedious surgery This is not necessarily a contraindication as it would be difficult surgery if operated upon abdominally In none of the cases in this report was it necessary to open the abdomen because of adhesions or fixation from previous surgery

We feel that vaginal hysterectomy is superior to the Manchester operation in those cases that require repair of the vaginal walls with or without descensus The Manchester operation is reserved for a select small group of patients who are postmenopausal and have cystourethrocele, normal well supported uterus with long cervixes, and who are not good surgical risks The operating time is shorter

(which here is important) and the results in this type of patient have been uniformly excellent

We do not recommend the Manchester operation in younger women because some of them will require subsequent hysterectomy for uterine disease and it frequently results in difficult surgery by either route

Ovarian tumors or cysts are best removed abdominally. The character of the tumor or cyst cannot be determined accurately before operation and it is most undesirable to rupture cysts during an operation with resultant spill of its contents into the peritoneal cavity. If an ovarian tumor or cyst is encountered during a vaginal hysterectomy, unless of small size, the hysterectomy is completed vaginally, and the abdomen is then opened to remove the cyst. There was one instance of this in our report when a serous cyst was encountered and it was removed through the abdomen after the vaginal hysterectomy had been completed.

Cancers of the uterus or adnexa should not be removed vaginally. A much wider and more adequate removal is accomplished abdominally, and in addition, a better evaluation of the extent of the malignant growth is possible. There are occasional exceptions to this policy. A very old patient with carcinoma of the endometrium is more apt to survive a vaginal removal of the uterus.

The clinical evaluation of the individual patient is usually sufficient to rule out the case with a probable carcinoma of the uterus, if not, curettage is an important aid. If question remains, the abdominal route is elected almost as a rule. In an attempt to become more familiar with the curetted endometrium and to avoid such mistakes, 2 members of the staff have routinely curetted all their patients subjected to vaginal hysterectomy since January 1, 1947. A tentative diagnosis is made at the time of the curettement.

During the 8 year period covered in this report, 27.5 per cent of the hysterectomies were performed through the vagina. During 1946, 48.2 per cent were done in this manner. This increase in the number of vaginal hysterectomies is largely due to increasing ex-

perience and this has broadened our indications for vaginal removal of the uterus.

From all of this we have established the following indications and contraindications for use in our private and ward practice, and for teaching purposes.

#### INDICATIONS

- 1 Lower mortality rate for vaginal hysterectomy and repair than for any other major gynecologic operation
- 2 Lower incidence of postoperative complications
- 3 Associated medical problems more safely managed when vaginal surgery is performed
- 4 Better results achieved in repair of lacerations of the childbirth canal
- 5 Removal of uterine fibromyomas as large as a 4 month pregnant uterus may be accomplished
- 6 "Functional uterine bleeding" not responsive to medical treatment ideally treated by vaginal hysterectomy

#### CONTRAINDICATIONS

- 1 Cancer of the uterus, tubes, and ovaries
- 2 Ovarian tumors, cysts, or both, unless of small size
- 3 Endometriosis unless of minimal involvement
- 4 Fibromyomas that produce fixation by their position
- 5 Residues of pelvic inflammatory disease

#### SUMMARY

- 1 An analysis of 570 vaginal hysterectomies is reported
- 2 A mortality rate of 0.18 per cent occurred
- 3 A morbidity study is not a part of this report, more significantly, complications following vaginal hysterectomy are shown and the causes for such if determined
- 4 One-half of the complications encountered were urinary tract infections and of minor nature
- 5 The more serious postoperative complications, in degree of frequency were extraperitoneal infection in the tissues of the vaginal vault, 25, postoperative hemorrhage,

9, moderately severe shock, 4, generalized peritonitis, 4, ureterovaginal fistulas, 2

6 Better results are achieved in the treatment of relaxations of the vaginal walls and uterine descensus

7 Previous gynecologic surgery is not often a contraindication to vaginal hysterectomy

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# EXPERIMENTAL THORACIC DUCT FISTULA

## Observations on the Technique, the Absorption of Fat and Fluid from the Intestine, and Protein Depletion

WILLIAM W L GLENN, M D, New Haven, Connecticut, SAMUEL L CRESSON, M D, FRANCIS X BAUER, M D, FRANZ GOLDSTEIN, OLIVE HOFFMAN, Ph D, M D, and JOHN E HEALEY, Jr, M D, Philadelphia, Pennsylvania

THE purpose of this paper is to describe a technique whereby a thoracic duct fistula, which will drain freely for a number of days, may be established in the dog. In addition, an attempt was made to determine how completely the lymph, drained by the thoracic duct, was excluded from the blood following the production of such a fistula. Observations were made on the absorption of fat and fluid from the intestine, and changes in the concentration of protein in lymph and serum were recorded.

### THE PROBLEM

Lymph fistulas in man, following neoplastic invasion and traumatic or operative injury to the thoracic duct and larger lymph channels, are not uncommon (5, 8, 11, 15, 17, 23, 25, 26). The loss of lymph rich in protein and fat in these patients may reach enormous proportions and, if uncorrected, may have disastrous consequences. The fact that lymph fistulas develop and persist in man is in striking contrast to the difficulty encountered in the deliberate attempt to create such fistulas in animals. Until recently, efforts to produce in dogs thoracic duct fistulas, which will drain freely for more than a few hours, have been unsuccessful.

The principal difficulty encountered has been the clotting of lymph in the thoracic duct cannula. In survival experiments, the usefulness of anticoagulants is limited. Heparin applied locally in the cannula is efficient in experiments of short duration but is not practical over long periods. The prolongation of the blood coagulation is difficult to control when either heparin or dicoumarin is administered

systematically to the dog. Using dicoumarin we were unable to maintain a prothrombin level in the blood sufficiently low to prevent coagulation of the lymph in a glass cannula without endangering the life of the animal. Doses of dicoumarin of 2 milligrams per kilogram body weight daily for 3 to 6 days resulted frequently in fatal hemorrhages from the gastrointestinal tract.

A second and more successful approach to the problem of preventing coagulation of the lymph is the use of thoracic duct cannulas in which coagulation is delayed.

Zimmermann and Meyers in 1945 called attention to the delayed clotting of blood in contact with the plastic polyethylene. They demonstrated that fine tubing of this material could be used to replace the conventional intravenous needle in cases in which prolonged intravenous therapy was given.

Cain and his co-workers (6) were the first to report successful thoracic duct fistulas in dogs of 4 to 8 days' duration. These authors used small tubing of polyvinyl chloride inserted into the lower thoracic duct through a transpleural approach. In approximately one-third of their experiments they reported successful cannulations suitable for study.

In our work cannulas made from polyethylene tubing have been employed for direct cannulation of the thoracic duct in the neck. These cannulas can be made easily in a few moments over a small flame (Fig 1).

### TECHNIQUE

The technique consists of the following steps:

First, under nembutal anesthesia the right lymphatic duct and the right cervical duct are ligated and divided, as are also the

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visible lymphatic connections between the right and left sides, and to the great veins in the mediastinum down to the pericardium. This procedure can usually be carried out without entering the pleura through a 2 inch transverse incision just above the medial portion of the right first rib. Freeman has clearly demonstrated in the dog that intestinal lymph may empty into the blood through channels other than the thoracic duct-venous junction in the neck. He found accessory connections between the thoracic duct and the right duct and between the thoracic duct and the azygos vein in the thorax. He states that such accessory connections are the rule rather than the exception. Other accessory connections are probably present in the abdomen (2). Ligation of the right duct and clearing of the superior vena cava down to the pericardium and the upper part of the azygos vein are important steps in eliminating a major group of these recognized accessory connections.

Second, 1 or 2 weeks later, after the animal has fully recovered from the first operation, the thoracic duct is cannulated under 1 per cent procaine infiltration anesthesia. The cannulation of the thoracic duct in the neck under local anesthesia, not a new (19) nor a difficult procedure, is preferable for several reasons. The general bodily changes incident to a more formidable procedure or to a general anesthesia are not encountered. Also, studies upon the ambulatory dogs can be started at once, an important consideration in an animal which is losing large amounts of fluid, fat, protein, and electrolytes through a thoracic duct fistula.

In the dog, the thoracic duct or frequently the largest branch, if there are several, empties into a lymphatic ampulla which also receives the termination of the left subclavian duct and the left cervical duct. The ampulla lies just behind the lower end of the jugular vein and empties into the blood stream by way of two ducts, one passing on either side of the jugular vein. The one passing laterally enters the blood stream at the junction of the jugular vein with the subclavian vein, the other passing medially enters the blood stream at the junction of the jugular vein with the innominate vein. The ampulla can usually be easily

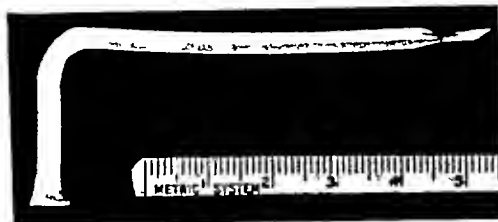


Fig 1

identified after the jugular vein is retracted laterally. The cervical duct, the left subclavian duct, and the two terminal branches of the ampulla are identified and tied off. The ampulla, with its exits to the blood thus closed, becomes distended with thoracic duct lymph. Careful dissection will reveal a distended thoracic duct coming up from below and behind the ampulla. With care being taken not to injure the duct or the immediate perilymphatic tissue, a ligature is placed, but not tied, around the thoracic duct just below the ampulla. The ampulla is then incised and the thoracic duct opening into the ampulla can be clearly seen as the lymph pours forth. A polyethylene cannula of suitable size is slipped into the opening and secured with the previously placed ligature. In this way, little damage is done to the thoracic duct distal to the cannula. Also the ampulla, fixed as it is to the surrounding tissues, makes twisting or linking of the thoracic duct unlikely. Minor variations in the anatomical arrangement of the lymphatic terminal on the left side are common, and branches of the thoracic duct emptying either separately into the ampulla or directly into the veins should be searched for and tied. Several attempts were made to thread a polyethylene tube of small diameter distally into the thoracic duct. This was prevented after a short distance by the presence of valves which could be easily demonstrated after the duct was removed.

Third, the animal is placed on its feet and a plaster cast is applied from the midthorax to the angle of the jaw. A window is left for the projection of the cannula and ample openings are provided for both forelegs to allow free locomotion. The cast is an essential part of this technique. The animal can walk, sit, or lie in comfort but is prevented from moving

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The technique consists of the following steps:

First, under nembutal anesthesia, the right lymphatic duct and the right cervical duct are ligated and divided, as are also all

visible lymphatic connections between the right and left sides, and to the great veins in the mediastinum down to the pericardium. This procedure can usually be carried out without entering the pleura through a 2 inch transverse incision just above the medial portion of the right first rib. Freeman has clearly demonstrated in the dog that intestinal lymph may empty into the blood through channels other than the thoracic duct-venous junction in the neck. He found accessory connections between the thoracic duct and the right duct and between the thoracic duct and the azygos vein in the thorax. He states that such accessory connections are the rule rather than the exception. Other accessory connections are probably present in the abdomen (2). Ligation of the right duct and clearing of the superior vena cava down to the pericardium and the upper part of the azygos vein are important steps in eliminating a major group of these recognized accessory connections.

Second, 1 or 2 weeks later, after the animal has fully recovered from the first operation, the thoracic duct is cannulated under 1 per cent procaine infiltration anesthesia. The cannulation of the thoracic duct in the neck under local anesthesia, not a new (19) nor a difficult procedure, is preferable for several reasons. The general bodily changes incident to a more formidable procedure or to a general anesthesia are not encountered. Also, studies upon the ambulatory dogs can be started at once, an important consideration in an animal which is losing large amounts of fluid, fat, protein, and electrolytes through a thoracic duct fistula.

In the dog, the thoracic duct or frequently the largest branch, if there are several, empties into a lymphatic ampulla which also receives the termination of the left subclavian duct and the left cervical duct. The ampulla lies just behind the lower end of the jugular vein and empties into the blood stream by way of two ducts, one passing on either side of the jugular vein. The one passing laterally enters the blood stream at the junction of the jugular vein with the subclavian vein, the other passing medially enters the blood stream at the junction of the jugular vein with the innominate vein. The ampulla can usually be easily

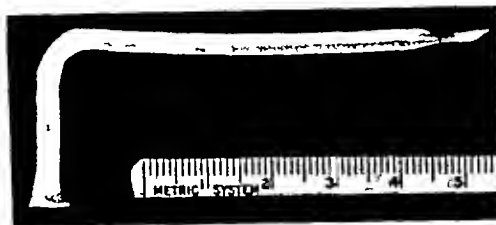


Fig 1

identified after the jugular vein is retracted laterally. The cervical duct, the left subclavian duct, and the two terminal branches of the ampulla are identified and tied off. The ampulla, with its exits to the blood thus closed, becomes distended with thoracic duct lymph. Careful dissection will reveal a distended thoracic duct coming up from below and behind the ampulla. With care being taken not to injure the duct or the immediate perilymphatic tissue, a ligature is placed, but not tied, around the thoracic duct just below the ampulla. The ampulla is then incised and the thoracic duct opening into the ampulla can be clearly seen as the lymph pours forth. A polyethylene cannula of suitable size is slipped into the opening and secured with the previously placed ligature. In this way, little damage is done to the thoracic duct distal to the cannula. Also the ampulla, fixed as it is to the surrounding tissues, makes twisting or kinking of the thoracic duct unlikely. Minor variations in the anatomical arrangement of the lymphatic terminal on the left side are common, and branches of the thoracic duct emptying either separately into the ampulla or directly into the veins should be searched for and tied. Several attempts were made to thread a polyethylene tube of small diameter distally into the thoracic duct. This was prevented after a short distance by the presence of valves which could be easily demonstrated after the duct was removed.

Third, the animal is placed on its feet and a plaster cast is applied from the midthorax to the angle of the jaw. A window is left for the projection of the cannula and ample openings are provided for both forelegs to allow free locomotion. The cast is an essential part of this technique. The animal can walk, sit, or lie in comfort but is prevented from moving

his neck and thus interfering with the position of the cannula. The cast should not be applied with the animal under general anesthesia, as a proper fitting for the plaster under these conditions is almost impossible.

If it is desired, 4 to 6 inches of a 12 to 18 inch segment of small polyethylene tubing can be inserted through a large needle into the right jugular vein (21) prior to the application of the plaster. The rest of the tubing is then brought out through the plaster. Into the open end of the polyethylene tube can be inserted a small needle tied onto the end of a segment of latex tubing distended with 300 to 500 cubic centimeters of fluid which is allowed to run in slowly, as suggested by Zinsser and Parkins. The distended latex tubing can be carried on a cannister strapped to the plaster on the animal's back.

Thirteen experiments using this technique have been carried out. Five were unsuccessful. The most frequent cause of failure was multiple branching of the thoracic duct at the point of termination in the neck. This cause of failure should become less, however, as experience with the technique is gained. Whereas there were 3 failures in the first 7 experiments due to this, there was only 1 failure in the last 6 from this cause or any other. The 1 other failure, also in the first 7 experiments, was due to the dog's becoming so restless that it was necessary to abandon the procedure under local anesthesia.

Six of the 8 successful cannulations drained freely from 4 to 8 days. Of the other 2, one cannula was pulled out deliberately on the third day of drainage as the contemplated studies had been completed, in the other, the cannula was accidentally removed while being cleaned on the third day of drainage. Occasionally, small clots form in the cannulas. These can be extracted usually by means of a twisting motion with a small wire in the lumen of the cannula. During the period of fistula drainage the animals were usually docile and co-operative. In 1 experiment however sedative doses of pentothal sodium were required.

#### ACCESSORY LYMPHATICOVENOUS CONNECTIONS

To evaluate studies on an animal with a freely draining thoracic duct fistula, it is im-

portant to determine whether collateral lymphaticovenous connections are functioning.

*Method* Within 1 hour of the creation of a freely draining thoracic duct fistula in 7 dogs, 2 cubic centimeters of a 1 per cent solution of the colloidal dye T-1824 were injected cephalad into a cannulated lymphatic on the dorsum of one hind foot. A second injection into the lymphatic on the dorsum of the opposite hind foot, was carried out after the fistula had closed some time later. In all but 1, the solute for the T-1824 was the dog's own serum. In 5 experiments, the 2 injections were performed under local anesthesia. In the other 2 experiments, nembutal anesthesia was used. The appearance time of the dye was noted in the lymph flowing from the thoracic duct cannula following the first injection. Following both injections, samples of venous blood were obtained at intervals of 3 minutes to 30 minutes after the dye was injected into the lymphatic. The presence of dye in the serum was determined by either the Beckman spectrophotometer or by the Evelyn photoelectric colorimeter.

*Results* The appearance time of the T-1824 in the lymph, flowing from the thoracic duct cannula after injection of the dye into a hind foot lymphatic, varied between 30 seconds and 5 minutes and 50 seconds with an average for the 7 experiments of 2 minutes and 39 seconds.

With a freely draining thoracic duct fistula a small amount of dye was detected in the serum within 15 minutes after the dye was injected into the peripheral lymphatic in all but 1 of these control experiments. It may be of significance that in the 1 experiment in which no dye appeared in the blood, the animal was under a general anesthetic.

A lymphatic on the dorsum of the opposite hind foot was injected in an exactly similar manner after the thoracic duct fistula closed. In every case the amount of dye found in the blood serum following the closure of the thoracic duct fistula was greater than that found when the lymph was flowing unimpeded through the fistula.

It is evident that even with a freely draining thoracic duct fistula in the dog, a colloidal dye of large molecular size passes from the lymphatic to blood stream somewhere between

the hind foot and the neck in the majority of animals. The amount of dye that reaches the blood in a freely draining fistula is extremely small but the blood concentration increases almost immediately if the thoracic duct is obstructed in the neck.

There is some question as to where the colloidal dye T-1824 passes from lymphatic to blood vessel. It is possible that some of the dye diffused through the blood capillary wall directly. The most likely site for this to occur would appear to be the lymph nodes. Although the colloidal dye T-1824 passes slowly from the blood stream into the tissues (13), it has not been demonstrated that this substance or the albumen to which it becomes attached passes through the capillary wall in the opposite direction. In view of the demonstration by several investigators (2, 16) of accessory lymphaticovenous connections in the dog, it seems unnecessary to postulate the diffusion of the dye through the capillary wall. The injection of a dye into a peripheral lymphatic gives no information as to possible connections between the mesenteric lymphatics and the mesenteric veins.

#### FAT ABSORPTION STUDY

Thoracic duct fistulas of short duration have been utilized for many years in the study of the absorption of fat from the intestine. There remains some doubt as to whether fat is absorbed solely by way of the lymphatics or whether some of it may pass directly into the portal blood. Until recently (7), general anesthesia has been employed in these studies. Also, precautions have not been taken to block the entrance of thoracic duct lymph into the blood through the right duct. The possibility that these factors may be of importance has, however, been recognized for some time (10).

**Method** Fat was determined as total lipid fatty acids in the lymph and serum, according to the method of Bloor (4). Partitioning of the fatty acids was not done. In several of the earlier experiments, specimens of blood were taken for analysis from 1 to 12 hours after the administration of fat. It was found that maximum lipemia occurred usually about the fifth hour following the administration by

TABLE I — FAT ABSORPTION STUDY  
TOTAL LIPID FATTY ACIDS

Experiment No	Time hours	Prefistula serum mgm /c.c.	During fistula		Postfistula serum mgm /c c
			Serum mgm /c c	Lymph mgm /c c	
1	Control	4.52	3.19	2.35	
	5	5.99	3.30	72.29	
2	Control	4.28	6.42	4.03	
	5	7.35	6.24	65.30	
4	Control	3.99	4.17	5.83	4.61
	5	5.07	4.12	73.28	5.65
5	Control	4.59	3.82	2.57	5.63
	5	10.12	3.58	68.81	7.77
9	Control	3.93	4.64	3.51	4.12
	3	6.06	4.14	64.50	6.02

stomach tube of 4 cubic centimeters of olive oil per kilogram of body weight. Total lipid fatty acids were determined simultaneously on the serum and lymph following the creation of the thoracic duct fistulas. The determinations were made before the administration of olive oil and on specimens taken 3 and 5 hours, and occasionally at 2 and 7 hours, after the administration of oil. In 5 healthy dogs, prefistula fat absorption studies were made approximately 1 week before the fistulas were established. Similar studies were carried out immediately following the cannulation of the thoracic duct under local anesthesia. In 3 experiments, a fat absorption study was also made on the eighth, eighteenth, and thirty-second day respectively, after the thoracic duct fistulas had closed. The animals were starved for at least 24 hours prior to each fat absorption study.

**Results** The results of this study in 5 animals are recorded in Table I. With a freely draining thoracic duct fistula, no appreciable increase in the serum lipids is evident at the time of maximum fat absorption, as judged by the level of the total lipid fatty acids in the lymph. It is possible that small amounts of absorbed fat may have reached the blood stream, either through the portal blood or through accessory lymphaticovenous connections. Small increments in the total lipid fatty acids cannot be determined reliably by chemical methods (3). The presence of functioning

TABLE II — EXPERIMENT 7, FAT ABSORPTION STUDY, THORACIC DUCT LYMPH

Time	Volume c c /min	Total lipid fatty acids mgm /c.c
Before fluid by stomach tube Control	0.47	2.60
After 450 c.c. 5% Dextrose in 0.85% Saline by stomach tube 38 min	0.60	8.21
56 min	1.64	6.65

lymphaticovenous connections, other than the thoracic duct or the right duct, is evident from the fat absorption studies carried out after the thoracic duct fistulas had closed.

With sucrose or glucose as the only source of food, a definite increase in the opalescence of the thoracic duct lymph was noted following the administration of fluid by mouth up to 7 days after any fat was given by mouth. This was coincident with an increase in lymph flow. These changes were observed to occur within 10 to 30 minutes after fluid was given and continued for 2 to 3 hours. If more fluid was given after 2 to 3 hours, or after several days, this phenomenon was repeated. The increase in the opalescence was most marked in the first 30 to 60 minutes after fluid administration and became progressively less as the lymph flow continued to increase. The initial increase in the opalescence was less evident as the administration of large amounts of fluid was repeated frequently. Determination of the total lipid fatty acids in the lymph, soon after the opalescence appeared to increase grossly, revealed an increase in the fat content. The results of such a study are recorded in Table II. This dog had received no food for 72 hours prior to the creation of the thoracic duct fistula. The study was made 22 hours after the fistula was established during which time the dog received by vein about 1600 cubic centimeters of 5 per cent dextrose in water and 1600 cubic centimeters of 5 per cent dextrose in 0.85 per cent saline. No olive oil had been given. The increase in the fat content of the lymph in this dog was somewhat more marked than usual. However, no fluid had been taken by mouth for 24 hours prior to this study. The type of fluid given, whether it was water with or without glucose

or saline, did not appear to make any difference in the degree of opalescence. However, as almost all of the animals were given a large amount of glucose, from which fat may have been formed (1), during the course of fistula drainage, it was not determined whether absolute starvation would elicit a greater or smaller increase in the opalescence of the lymph following fluid by mouth.

The rapid increase in the fat content of the lymph following the administration of fluid by mouth suggests that the fat lay within the lumen of the lacteals and that it was washed up by the absorption of some of the ingested fluid. It gives no clue, however, as to how the fat came to be in the intestinal lacteals or the mechanism involved in the replacement by more fat between periods of fluid administration. The experiments of Roney, Mortimer, and Ivy are interesting in this regard. They found high lipid levels in the thoracic duct lymph in dogs starved for 2 to 14 days, following enterectomy, however, no such increases were observed. They concluded that fat mobilized during starvation was transported to the intestinal mucosa where it was secreted into the intestine, the major portion being reabsorbed and passed into the lacteals.

#### PROTEIN STUDY

The protein concentration of the thoracic duct lymph in the dog averages 3 to 4 grams per cent (9). This is considerably higher than the concentration of protein in peripheral lymph. The difference is due to the large contribution of protein made by liver lymph (14). It is of interest to know whether there is a parallel fall of the serum protein concentration and the thoracic duct lymph protein concentration following the loss of large amounts of protein through a thoracic duct fistula.

*Method.* In 6 healthy dogs, protein determinations were made daily on the serum and lymph during the period of fistula drainage. A few of the early determinations were done by the copper sulfate method of Phillips and co-workers. This method was found unsatisfactory for some specimens of the thoracic duct lymph, apparently because of a lowering of the specific gravity of the lymph incident to the high fat content. The micro-Kjeldahl

method was used in all subsequent determinations. In 2 of the experiments, 4 and 8, the last protein determinations were made on the day prior to closure of the fistulas. An attempt was made to obtain specimens of blood and lymph at the same time each day, usually in the early morning before fluid administration was begun. Variations in the lymph flow between the daily samples could not be avoided. Except in experiment 2 (Fig. 3), in which a deliberate attempt was made to obtain a maximum flow of lymph, these variations were usually not great, but may have accounted for some of the irregularities in the lymph protein concentration.

**Results.** A progressive fall in both the serum protein concentration and the lymph protein concentration was found. The control determinations and the last determinations made while the fistulas were still draining are recorded in Table III. The loss of protein was greater than is evident from these findings, however, as in every case some degree of hemoconcentration developed. It is apparent that the loss of protein through a thoracic duct fistula in the presence of a protein free diet, in the course of a few days will markedly reduce the serum protein concentration. Clinically, Crandall, Barker and Graham have found the loss of protein in the lymph draining from a thoracic duct fistula to be a major therapeutic consideration.

#### FLUID ABSORPTION STUDY

A distinct difference in the thoracic duct lymph flow was observed in some of the earlier experiments following the prolonged administration by mouth of 5 per cent glucose in 0.6 or 0.85 per cent saline solution and 5 per cent glucose in distilled water. The ingestion of smaller amounts of these solutions did not however reveal appreciable differences in the volume of thoracic duct lymph flow. With a thoracic duct fistula of several days duration, an opportunity is afforded to make observations on the variation in lymph flow following the prolonged administration of either or both of these fluids.

**Method.** Four experiments were performed. These were divided into two groups with 2 experiments in each group. The first group

TABLE III.—PROTEIN STUDY

Experiment No.	Duration of fistula days	Serum gm./100 c.c.	Lymph gm./100 c.c.
1	Control	6.16	3.1
	4	4.18	1.8
2	Change	-2.29	-1.5
	Control	5.43	3.91
	5	3.80	0.91
	Change	-1.57	-2.0
4	Control	6.08	3.35
	5	4.22	1.9
	Change	-2.86	-2.3
	Control	*5.81	*4.10
5	8	2.1	0.31
	Change	-3.10	-3.76
	Control	6.05	3.91
	3	3.71	1.06
8	Change	-2.3	-2.86
	Control	5.03	2.30
	3	2.1	1.09
	Change	-1.69	-1.21

\*Copper sulfate method. See text.

received fluids by mouth and the second group received fluids by vein. In each experiment there were 2 periods of fluid administration. Five per cent glucose in distilled water was given in one period, and 5 per cent glucose in 0.85 per cent saline solution was given in the other. In 1 of the oral experiments 5 per cent sucrose in 0.6 per cent saline solution was given instead. One hundred to 150 cubic centimeters of fluid per kilogram body weight were administered over a 9 to 15 hour period. The amount of fluid given, however, and the time required for administration were approximately the same for the two fluid periods in each of the experiments. When fluids were given by mouth, there was an interval of at least 2 hours between the administration of additional amounts of the same type of fluid and 8 to 10 hours between the two fluid periods. Fluids by vein were administered continuously and there was no interval between the two fluid periods.

**Results.** In all of the experiments saline solution produced a sustained and continued increase in lymph flow with a low urinary output. The prolonged administration of



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or saline, did not appear to make any difference in the degree of opalescence. However, as almost all of the animals were given a large amount of glucose, from which fat may have been formed (1), during the course of fistula drainage, it was not determined whether absolute starvation would elicit a greater or smaller increase in the opalescence of the lymph following fluid by mouth.

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**Method** Four experiments were performed. These were divided into two groups, with 2 experiments in each group. The first group

TABLE III —PROTEIN STUDY

Experiment No	Duration of fistula days	Serum gm /100 c.c.	Lymph gm /100 c.c.
1	Control	6.46	3.41
	4	4.18	1.87
2	Change	-2.28	-1.54
	Control	5.43	3.91
	5	3.86	0.94
4	Change	-1.57	-2.07
	Control	7.08	4.35
	5	4.22	1.92
5	Change	-2.86	-2.43
	Control	*5.81	*4.10
	8	2.71	0.34
7	Change	-3.10	-3.76
	Control	6.05	3.94
	3	3.71	1.06
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**Results** In all of the experiments, saline solution produced a sustained and continued increase in lymph flow with a low urinary output. The prolonged administration of

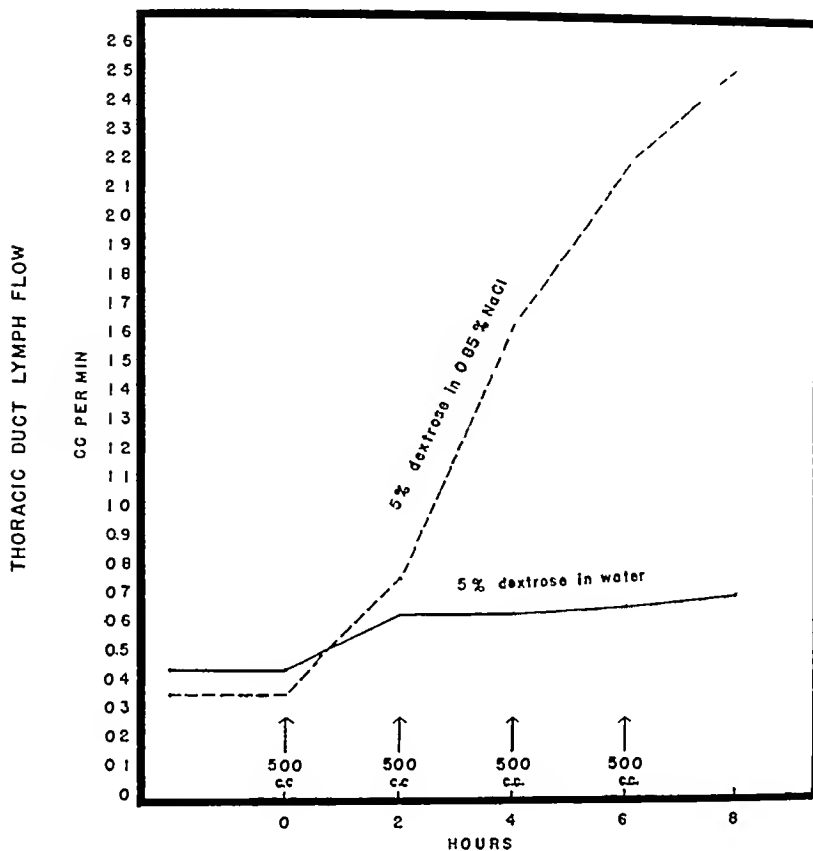


Fig 2

water was accompanied by a moderate initial increase in lymph flow, and a relative diuresis. In Figure 2, the thoracic duct lymph flow is recorded graphically in one of the experiments in which fluids were given by mouth. The animal was initially hypoproteinemic (not included in the normal series, Table III). Two thousand cubic centimeters of 5 per cent dextrose in water was given on the second day of fistula drainage and a like amount of 5 per cent dextrose in 0.85 per cent saline solution was given on the third day of fistula drainage. The serum protein concentration at the start of the dextrose in water was 3.15 grams per cent and on the following day at the start of dextrose in saline was 3.87 grams per cent. The values recorded are the average amounts of lymph drained per minute over successive 2 hour periods. The increase in lymph flow when saline solution was administered by mouth was much greater than when saline

solution was administered by vein. In the 2 animals receiving saline solution by vein, gross peripheral edema became evident. However, edema was moderate or absent in the animals receiving saline solution by mouth. In 1 earlier experiment (Fig 4) not included in this series, approximately 15 liters of 0.6 per cent saline, most of it with 10 per cent sucrose, was given by mouth to a 21 kilogram dog over a period of 4 days. The estimated lymph flow, based on interval collections made over a 16 to 18 hour period daily, almost equalled the fluid intake. The lymph flow stopped on the fifth day of drainage when the cannula fell out. Persistent edema in this animal was evident only at the site of the operative wounds. The estimated total amount of lymph drained, and the duration of saline administration was greater in this dog than in any other. This experiment is cited principally to show the maximum lymph flow ob-

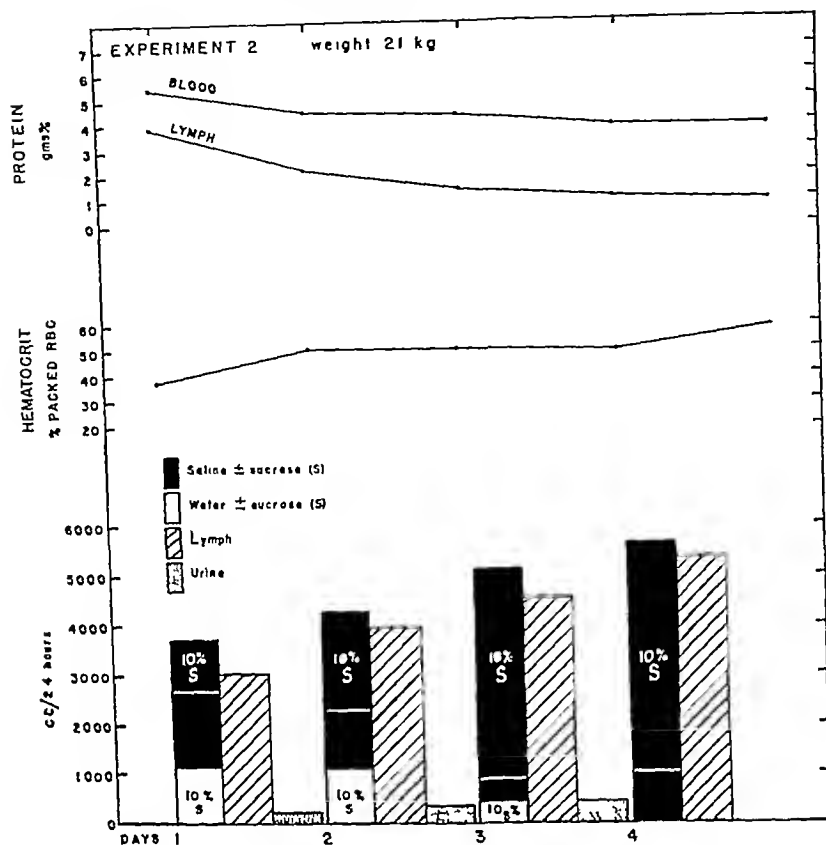


Fig 3

tained. It is not intended to imply that all or even a major portion of the saline solution given by mouth was absorbed into the intestinal lacteals. Other factors, such as the fact that this animal was unusually active (28), undoubtedly contributed to the maximal flow of lymph.

The difference in the thoracic duct lymph flow accompanying the administration of saline solution by mouth and water by mouth may be explained in the following manner. The moderate lymph flow that accompanied the prolonged administration of water would indicate that water was, for the most part, absorbed directly into the blood. On the other hand, relatively more of the saline solution administered in the same manner appeared to pass into the tissue spaces of the intestinal wall where it was forced into and along the adjacent lacteals by the continuous propulsive force of intestinal peristalsis. Saline so-

lution administered intravenously accumulated in the loose subcutaneous tissue where no such involuntary propulsive muscular activity exists. One must consider the fact that during the periods of fluid administration the transudation of saline into the interstitial spaces was enhanced by the invariable fall in serum protein concentration observed in these animals (12, 24, 27).

#### SUMMARY

1 Thoracic duct fistulas which drained freely for a number of days have been established in 8 dogs. The thoracic duct was cannulated in the neck under local anesthesia with a cannula made from polyethylene tubing.

2 From the studies carried out with the dye T-1824, it seems probable that an abundance of accessory lymphaticovenous connections exist and that they are, as Freeman says, the rule rather than the exception. It is im-

portant, therefore, that in the interpretation of experimental data with a thoracic duct fistula, one considers the possible functional significance of these accessory connections

3 In the presence of a thoracic duct fistula, the administration of olive oil by stomach tube did not cause an appreciable rise in the total lipid fatty acids in the serum at the time of maximum fat absorption as judged by the lipid content of the thoracic duct lymph. This does not mean, however, that fat may not have reached the blood through direct portal vein absorption or through accessory lymphaticovenous connections. It only indicates that in the presence of an unobstructed thoracic duct, the absorption of fats by any other route must be small.

There was an increase in the lipid content of thoracic duct lymph following the administration of fluids by mouth to dogs whose only source of food was glucose or sucrose. The experiments suggested that fat was being continuously replaced in the intestinal lacteals. The mechanism of this replacement was not determined.

4 There was a progressive loss of protein through the thoracic duct fistula. This resulted in a rapid fall in the protein concentration of both lymph and blood. In general, the fall in serum protein concentration paralleled the fall in lymph protein concentration.

5 Glucose in saline solution by mouth resulted in a greater increase in thoracic duct lymph flow than did glucose in water by mouth, or glucose in saline solution or water by vein. Some of the factors of importance in the interpretation of these observations are the propulsive force of intestinal peristalsis, depletion of serum proteins, different rates of excretion of these fluids by the kidneys.

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# EWING'S TUMOR

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THE purpose of this article is primarily to report the apparent cures of 3 patients with Ewing's tumor of bone (in one of whom there was disappearance, without direct treatment, of an apparent pulmonary metastasis), and secondarily to summarize the features of all cases of Ewing's tumor which have been seen at the Vanderbilt University Hospital since 1925

## INCIDENCE

*General* Since 1925 there have been 192 specimens of bone tumors, exclusive of metastases, submitted to the Surgical Pathology Laboratory, of which 71 were malignant. The 20 Ewing's tumors found in this series thus represent an incidence of 10 per cent of all bone tumors and 28 per cent of malignant bone tumors

*Race* Geschickter and Copeland (35) noted the occurrence of Ewing's tumor in only 1 negro in a total of 122 patients with such tumors, whereas 2 of our 20 patients were negroes

*Sex* Like other observers (35), we found that Ewing's tumors are more frequent in males, there having been 13 males and 7 females

*Age* The youngest patient was 3 and the eldest 43 years of age. There were 5 patients in the first decade, 9 in the second, 3 in the third, 1 in the fourth, and 2 in the fifth. The occurrence of Ewing's tumors in patients over 40 years of age is unusual, but Geschickter and Copeland (35) reported 2 such cases in patients 44 years of age, and Stout (87) stated that "the age variation extends from 4 to 79 years." Eighty per cent of our patients were less than 25 years of age

*Site* (Table I) In contradistinction to the findings of Ewing (32) and Geschickter and Copeland (35), but like Stout (87) and Lich-

tenstein and Jaffe (61) we found the tumors more frequently in flat bones (14 cases) than in long bones (6 cases). Five of the tumors of the long bones originated in the diaphysis, only 1 of these 5 having arisen in the region of the metaphysis. In the sixth patient the roentgenogram of the femur showed involvement of both the metaphysis and the epiphysis so that it was impossible to state the exact site of origin of the tumor

## SUBJECTIVE MANIFESTATIONS

*Duration of symptoms* The periods which had elapsed from the onset of symptoms until the application to this clinic for treatment ranged from 5 weeks to 12 months, the average time having been 5 months for all patients and slightly less than 5 months for the individuals who died. The patients still alive had had symptoms for 4, 4, and 10 months, respectively

*Injury* The question as to whether injury may be a factor in causing a bone tumor or whether it simply calls attention to an area in which the lesion is already present has never been settled. However, in instances in which a tumor occurs at a site which, a few weeks before, was subjected to a severe blow one hesitates to deny the possibility of such trauma as an etiologic agent. In 10 patients there was no injury, while in each of the other 10 there was a definite history of a severe injury, however in 1 patient injury occurred 25 years before admission. In 1 instance, the interval between injury and swelling was not recorded and in another it was stated to have been "several weeks." In 2 individuals pain occurred at the time of the injury and did not subside, the swelling having been noted 3 days later in 1 patient (Case 2) and 2 months later in the other. In the 5 remaining patients the injury preceded the occurrence of pain or swelling by intervals of 1 week, 1 month, 2 months, 10 months, and 10 months



Fig 1 The roentgenogram of the scapula shows new bone formation in the so-called "sunray" fashion which is often considered highly suggestive of osteogenic sarcoma. Microscopic section of the tissue removed at exploration showed Ewing's tumor.

**Pain** The occurrence of pain was recorded in all instances except that of a child with a tumor of the scapula, who was brought to the hospital because his parents noted the presence of a mass.

**Swelling** Swelling was noted by the patient or his family in all instances except 1 in which the tumor was in the twelfth rib. In 10 patients there had been a slow increase in size, in 4 the increase had been rapid, in 1 patient there had been no change since the mass was first noticed (9 weeks before admission to the hospital), and in 1 patient the presence or absence of this symptom was not recorded. There was a definite history of fluctuation in the size of the tumor in each of 3 individuals. One patient developed a swelling which subsided completely and then recurred and persisted until time of admission to this clinic. In 2 patients the swelling occurred, subsided completely, recurred and subsided, and again recurred and subsided before the third recurrence which failed to regress before treatment.

TABLE I —SITE OF EWING'S TUMOR

Author	Flat bones	Long bones
Ewing	4	6
Geschickter and Copeland	48	78
Lichtenstein and Jaffe	12	3
Stout	24	18
Present series	14	6
	Rib 4 Ilium 2 Ischium Sacrum 2 Scapula Mandible 1 Clavicle 1 14	Femur 3 Fibula 2 Tibia 1 0

**Fracture** A spontaneous fracture occurred in only 1 instance, the patient having fractured the shaft of the femur 15 months after injury and 5 months after the appearance of the tumor.

#### PHYSICAL AND LABORATORY FINDINGS

**Evidence of inflammatory disease** There was some evidence of inflammatory disease in all patients. Every individual had an elevation of temperature before operation to 99 degrees F or more. In each of 14 patients there was a rise in temperature before operation to 100 degrees or more, the maximum temperature in any patient having been 103 degrees. In 15 patients there was tenderness over the involved area. In 9 instances it was noted that the skin over the tumor was warmer than it was elsewhere, in 1 instance there was a statement that the skin was not warmer, and in 10 patients the presence or absence of this sign was not recorded. The minimum leukocyte count was 5,200 and the maximum was 18,000. In 10 patients the white blood cell count was 10,000 or more. The evidence of inflammatory disease was so striking that, before admission, aspiration had been done in 1 instance and incision and drainage in another and in the clinic incision and drainage were done in 1 patient.

**Characteristics of the tumor** In most instances the tumors were visible and in 21 patients they were palpable. Most of the tumors were smooth and all of them were firm or hard, and immovable. Although none was fixed to the skin, one (a tumor of the mu-

TABLE II — PREOPERATIVE DIAGNOSIS

Flat bones		
	Clinical	Roentgenologic
Ewing's tumor	4	5
Tumor	7	3
Tumor or inflammation	0	2
Inflammation	2	1
Cyst	1	1
Long bones		
Ewing's tumor	2	0
Sarcoma	3	4
Osteomyelitis	1	2
Total	20	18 <sup>1</sup>

<sup>1</sup>One patient with a tumor of the scapula did not have a preoperative roentgenogram because the diagnosis was thought to be acute osteomyelitis. Another patient with a tumor of the twelfth rib had a preoperative roentgenogram elsewhere before admission to the Vanderbilt University Hospital. Therefore there is a discrepancy in the totals.

ble) was ulcerated, having been incised before admission.

**Erythrocyte count** In 4 patients the erythrocyte count was below 4 million and in 7 it was below 4.5 million. The range in the other individuals was from 4.5 to 5.5 million. The minimum count was 2.7 million, the maximum 5.5 million.

#### ROENTGENOLOGIC FINDINGS

The roentgenologic findings (Table II) in our patients were so variable that the diagnosis of Ewing's tumor was made by the roentgenologist in only 5 of the cases which occurred in the flat bones and in none of those which occurred in the long bones. In the patients with tumors of the flat bones the changes were thought to be due to tumor or inflammation in 2 instances and to inflammation in 1 instance. The changes in 2 of the tumors of long bones were thought to be due to osteomyelitis. In 1 instance the so called "sunray" picture (Fig. 1) was seen and in another patient the characteristic roentgenologic findings of a bone cyst (Figs. 2 and 3) in the twelfth rib were observed. In 1 instance in this clinic the fairly characteristic "onion-peel" appearance has been seen in a bone lesion which on microscopic examination proved to be an osteogenic sarcoma. However, since the occurrence of this onion-peel formation is quite unusual in any bone disease other than

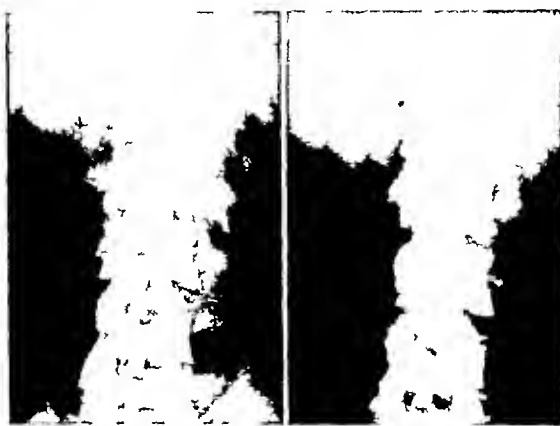


Fig. 2, left. This roentgenogram, a plain film of the abdomen of a patient thought to have acute appendicitis, shows a lesion of the twelfth rib which the roentgenologist believed to be a bone cyst.

Fig. 3. The roentgenogram of the same patient whose film is shown in Figure 2. Even after a period of 11 months the roentgenologic findings resemble bone cyst more than Ewing's tumor. The rib was excised and microscopic sections showed Ewing's tumor.

Ewing's tumor, we believe that such a finding is highly suggestive but not pathognomonic of Ewing's tumor.

#### OPERATIVE FINDINGS AND GROSS PATHOLOGICAL CHANGES

Exploration in some instances revealed a false capsule which was probably periosteum, but in most of the patients there was invasion of the muscle by tumor. Some of the tumors were not very vascular but a few showed extreme vascularity, one of them necessitating the insertion of a gauze pack to control the bleeding which followed excision of tissue for microscopic examination. The color of the neoplastic tissue was gray in the majority of the patients, but in some it was red or purple, because of hemorrhage. Some of the tumors were firm and others were soft and friable.

#### MICROSCOPIC FINDINGS

There was no stroma between the individual cells, but in most instances there were coarse strands of connective tissue which divided the cells into groups (Figs. 5, 9, 15, and 21). Erythrocytes were present in most of the sections. Striated muscle had been invaded by tumor in several instances. Perivascular or perithelial arrangement of cells was noted in the sec-





Fig. 1 The roentgenogram of the scapula shows new bone formation in the so-called "sunray" fashion which is often considered highly suggestive of osteogenic sarcoma. Microscopic section of the tissue removed at exploration showed Ewing's tumor.

**Pain** The occurrence of pain was recorded in all instances except that of a child with a tumor of the scapula, who was brought to the hospital because his parents noted the presence of a mass.

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**Fracture** A spontaneous fracture occurred in only 1 instance, the patient having fractured the shaft of the femur 15 months after injury and 5 months after the appearance of the tumor.

#### PHYSICAL AND LABORATORY FINDINGS

**Evidence of inflammatory disease** There was some evidence of inflammatory disease in all patients. Every individual had an elevation of temperature before operation to 100 degrees F or more. In each of 14 patients there was a rise in temperature before operation to 100 degrees or more, the maximum temperature in any patient having been 103 degrees. In 15 patients there was tenderness over the involved area. In 9 instances it was noted that the skin over the tumor was warmer than elsewhere, in 1 instance there was a statement that the skin was not warmer, and in 1 patient the presence or absence of this sign was not recorded. The minimum leucocyte count was 5,200 and the maximum was 18,000. In 10 patients the white blood cell count was 10,000 or more. The evidence of inflammatory disease was so striking that, before admission, aspiration had been done in 1 instance and incision and drainage in another and, in this clinic, incision and drainage were done in 1 patient.

**Characteristics of the tumor** In most instances, the tumors were visible and in all patients they were palpable. Most of the tumors were smooth and all of them were firm or hard, and immovable. Although none was fixed to the skin, one (a tumor of the mandible)

Fourteen patients were subjected only to biopsy and irradiation. One tumor was in the tibia and the patient should have been subjected to amputation. It was shown by Lichtenstein and Jaffe (61) that inspection of the gross specimen of a long bone may reveal that the tumor has spread farther than one is led to believe by the roentgenogram. This observation justifies the statement that amputation should be done not through the involved bone but through the bone proximal to it. Thus amputation should be done through the femur for Ewing's tumor of the tibia. In instances of Ewing's tumor of the femur we believe that hip-joint disarticulation should be done, but of our 3 patients with Ewing's tumors in the femora, 2 were subjected only to biopsy and irradiation and the third to high thigh amputation. In cases of Ewing's tumor of the shoulder and pelvic girdle the question of whether to advise radical surgery or irradiation is not definitely settled. Such operative procedures as shoulder girdle amputation and hemipelvectomy are extremely mutilating and are especially undesirable in the young patients affected by this disease. The other two factors which make this subject a controversial one are that cures even by such radical procedures are extremely rare, and that a few patients are cured by roentgen ray therapy alone. We believe that amputation through the humerus or femur and not simple excision of the involved bone should be done for Ewing's tumor of the radius or fibula because of the fact that the greater possibility of cure by amputation outweighs the advantage of the better functional result by simple excision.

Table III shows the sites of involvement, the treatment, and the duration of life after the diagnosis had been made. Of the 14 patients subjected only to biopsy and irradiation, there is only 1 who is still living. Both patients on whom excision of the ribs was done and followed by irradiation are dead. One patient subjected to biopsy, irradiation, and amputation is alive. One of the 2 patients subjected to amputation alone is alive. One patient in whom no treatment was given is dead. Table IV shows the duration of life, after the establishment of the diagnosis, of our 17 patients who died. Five patients sur-

vived less than 6 months and 10 patients survived less than 12 months.

Meyerding (69) from the Mayo Clinic reported that of 114 patients, in 100 of whom the diagnosis had been confirmed by microscopic examination, 21 lived 5 or more years (18.4 per cent). Geschickter and Copeland (35) reported 5 year cures in 6 of 99 patients (6 per cent) who were followed. Coley (13) stated that 3 of 70 patients (4.3 per cent) followed were alive and well 5 or more years after the diagnosis had been established. None of Lichtenstein and Jaffe's (61) 17 patients lived 5 years. Including the 20 patients herein discussed, 3 of whom survived 5 or more years (15 per cent), the total number is 320, with 5 year survivals in 33, or approximately 10 per cent. In a review of the literature on Ewing's tumor it was found impossible to determine accurately the total number of such cases reported and the total number of 5 year cures because some workers reported 5 year survivals without mentioning the total number of tumors they had seen, others reported cases without mentioning 5 year survivals, and still others reported cases which had been reported previously. However, it is thought worth while to report our observations from the literature. The reports were divided into 3 groups: (1) those in which the author gave the total number of cases and the number of 5 year survivals (Table V), (2) those in which 5 year survivals were reported without mention of the total number of cases seen (Table VI), and (3) cases reported without mention of 5 year survivals (Table VII). In group 1 were 386 patients with 48 five year survivals, in group 2 were 3 patients with 3 five year survivals, and in group 3, 176 patients, survivals not mentioned. A summary of the findings in these tables shows that of a total of 565 cases of Ewing's tumor reported in the literature, 51 patients, or 9 per cent, survived 5 years. Nowhere in the literature was a report found in which it was stated that the metastasis from a Ewing's tumor disappeared, without treatment of the metastasis.

#### CAUSE OF DEATH

Although none of the patients died in the hospital, the reports from the families, family

TABLE III — TREATMENT AND RESULTS

Treatment	Bones involved		Total No of patients	Average sur- vival time of patients who died (mos)	No of patients living and well
	Bone	No of bones			
Irradiation only	Pelvis	6	14	12.5	1
	Rib	2			
	Scapula	2			
	Femur	2			
	Clavicle	1			
	Tibia	1			
Excision and irradiation	Rib	2	2	43	0
Biopsy irradiation and amputation	Fibula	1	1		1
Amputation	Femur	1	2	9	1
	Fibula	1			
No treatment	Mandible	1	1	1	0

tions from only 4 patients. Although all of the sections of all of the patients were repeatedly studied only one formation in one section was seen which resembled the rosette seen in neuroblastoma. The nuclei of the cells were round or oval. The chromatin in most cases was finely divided but in a few it was fairly coarse. In 5 instances a single central nucleolus was seen in a type of cell in which the chromatin was fairly coarse. In the majority of sections the cells showed practically no cytoplasm, and in the cells in which cytoplasm was visible it was small in amount and slightly acidophilic in staining reaction. The cell border was indistinct except in one section. There was usually very little variation in the size of the cells. Mitotic figures were few in all except 2 instances, in which they were fairly frequent, being as many as 4 per high power field in one and 3 per high power field in the other. The microscopic patholog-

TABLE IV — DURATION OF LIFE IN FATAL CASES

Patients	Months
5	0 to 6
5	7 to 12
4	13 to 24
1	27
1	54
1	59
Minimum	1
Maximum	59
Average	15

ic changes were fairly constant and were considered to be typical in 12 of the tumors. In the 8 other tumors, the microscopic findings, although not perfectly typical, were characteristic enough to make the diagnosis of Ewing's tumor incontrovertible.<sup>1</sup>

#### DIAGNOSIS, TREATMENT, AND RESULTS

We believe that it is impossible to make an unequivocal diagnosis of Ewing's tumor by means of the roentgenogram alone and that all such lesions should be subjected to exploration and removal of tissue for microscopic examination. Furthermore, it seems unwise to administer roentgen ray therapy as preoperative therapy or a so called therapeutic test without microscopic confirmation of the diagnosis. Tissue examined after roentgen ray therapy sometimes does not show pathologic changes definite enough to justify the diagnosis of Ewing's tumor and thus the true nature of the disease must always remain open to question. In one case in point (Case 2) the fibula was explored and tissue was removed which showed Ewing's tumor (Fig 9). Inasmuch as the parents of the patient would not permit her to be subjected to an amputation, roentgen ray therapy was given. Later, consent having been obtained, amputation was done, and, although sections were cut from 5 different sites, a definite diagnosis of Ewing's tumor could not be made (Fig 11). In instances of probable Ewing's tumor in a bone such as the ilium, which cannot be removed without extreme mutilation of the patient, tissue for microscopic examination should be removed before roentgen ray treatment is started. In short, the diagnosis of Ewing's tumor should be made by microscopic examination before amputation is done or roentgen ray therapy is administered. In a case of probable Ewing's tumor in a rib, excision of the rib may be done without previous biopsy.

<sup>1</sup>Microscopic sections of the tumors herein reported in detail (Cases 1 to 4) were reviewed by E. W. Goodpasture, professor of pathology at Vanderbilt University Medical School and V. C. Foot, professor of surgical pathology at Cornell University Medical College. Dr. Goodpasture agreed with our diagnosis in all instances. Dr. Foot thought that the diagnoses in Cases 1 and 4 were Ewing's tumor. In regard to Case 3, Dr. Foot stated that it could be Ewing's tumor. The invaded muscle looks like it but the bone marrow has the appearance of harboring a growth that is more like angiosarcoma with perithelial proliferation. That type of tumor is one of Ewing's endotheliomas of bone.

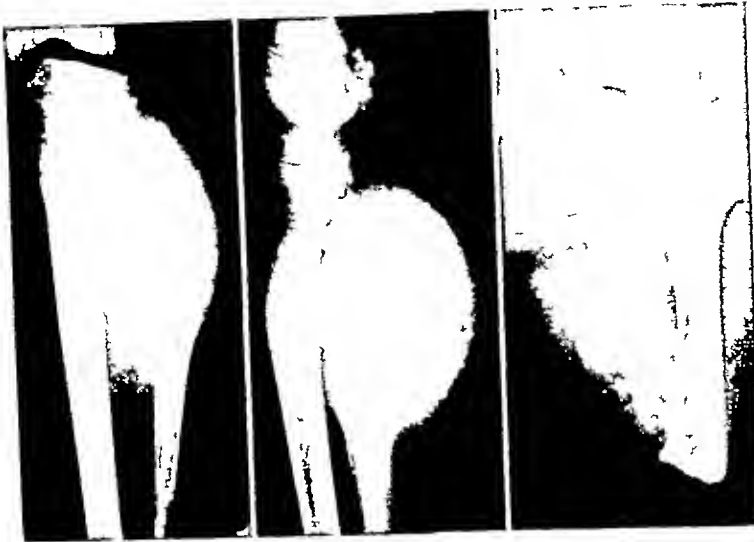


Fig 4a

Fig 4b

Fig 6

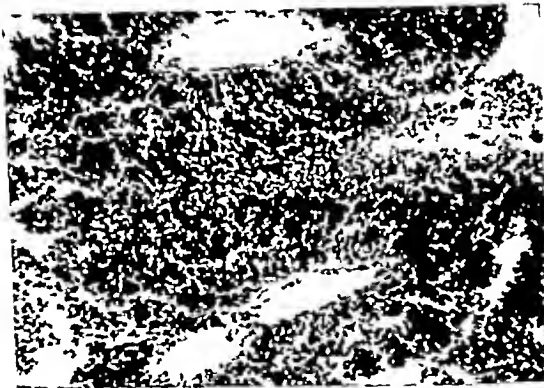


Fig 5

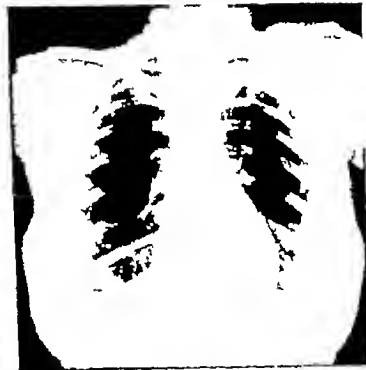


Fig 7

Fig 4 Case 1 The roentgenogram shows, in the fibula, both "onionpeel" and "sunray" formations, that is, there is new bone formation both parallel and perpendicular to the shaft of the fibula

Fig 5 Case 1 The photomicrograph shows Ewing's tumor cells in the penitential or perivascular formation

Fig 6 Case 1 The roentgenogram of the stump of the femur made more than 17 years after amputation shows no evidence of neoplastic disease

Fig 7 Case 1 No evidence of metastasis is present in the roentgenogram made more than 17 years after the establishment of diagnosis of Ewing's tumor of fibula

the leg. Aspiration by her family physician obtained blood

At the time of admission to the hospital, the patient's temperature was 99 degrees F and it rose to 100 degrees F the next day. On the lateral and posterior aspects of the leg there was a firm slightly tender, poorly circumscribed mass. Over the tumor the veins were prominent and the skin was warmer than elsewhere. The leucocyte count was 9600.

The roentgenogram (Fig 4) showed a soft tissue tumor of the upper portion of the leg, destruction of the upper end of the shaft of the fibula, and new bone formation both parallel and perpendicular to

the shaft of the bone. The film of the chest showed nothing abnormal.

The clinical and preoperative roentgenologic diagnosis was osteogenic sarcoma.

A tourniquet was placed 1 inch above the femoral condyles and an incision was made over the tumor. After the thinned cortex had been opened, soft tumor tissue was seen, frozen section of which showed malignant tumor. A second tourniquet was placed high on the thigh and a mid thigh amputation was done between the tourniquets.

On microscopic examination (Fig 5) the cells were found to be quite uniform with a very small amount





Fig 8a Fig 8b Fig 10a Fig 10b



Fig 12



Fig 13



Fig 9



Fig 11

Fig 8 Case 2 The roentgenogram shows a small area of bone destruction at a point just distal to the middle of the shaft of the fibula

Fig 9 Case 2 The photomicrograph shows Ewing's tumor

Fig 10 Case 2 The roentgenogram made 40 days after exploration of the fibula and 5 days after the completion of administration of roentgen ray therapy

Fig 11 Case 2 Following administration of 1,000

roentgens through each of two portals to the fibula, amputation was done This photomicrograph of a section of tissue removed from the diseased area shows no cells which can be identified as those of Ewing's tumor

Fig 12 Case 2 The roentgenogram of the stump of the femur made more than 9 years after amputation shows no disease

Fig 13 Case 2 The roentgenogram of the chest, made more than 9 years after amputation, shows no metastases

On microscopic examination the cells were found to be fairly uniform with very little cytoplasm and no distinct cell border (Fig 15) The nuclei were round or oval and basophilic The chromatin was fairly finely divided The tumor had extended into the striated muscle The packing was removed 6 days after operation and roentgen ray therapy was started the next day Over a period of 27 days, 3,200 roentgens were given through each of 3 portals

On February 3, 1941, a roentgenogram of the chest (Fig 16) showed a nodule in the left lung at the level of the second intercostal space and one in the right lung at the level of the third rib These nodules were thought to be metastatic tumor No roentgen ray therapy was administered to the chest Amenorrhea had been present from February, 1941, until August, 1942 A roentgenogram of the chest (Fig 17) made on October 30, 1941, showed that the

of cytoplasm and indistinct cell borders. The nuclei were round or oval and basophilic, and contained chromatin which was fairly finely divided. The perivascular or perithelial formation was quite marked. Although there was very little stroma, a few septa of connective tissue could be seen. The tumor cells had extended into the striated muscle.

Roentgen ray therapy was not given. On April 16, 1948, more than 17 years after operation, her general condition was found to be excellent. The patient was able to walk very well with the help of the artificial extremity. The stump was normal. There were no palpable masses in the stump, inguinal region, or abdomen. Roentgenograms of the stump (Fig. 6) and chest (Fig. 7) showed no evidence of recurrence or metastasis.

The biopsy was done distal to a tourniquet proximal to which amputation was done. Such a procedure, when possible, seems advisable, to prevent dissemination of the tumor during exploration. However, Case 2 reveals the fact that this procedure is not always necessary to effect a cure.

CASE 2 Surg Path No 10153, Registry of Bone Sarcoma No 2297

The patient was a white girl 16 years of age who was admitted to the Vanderbilt University Hospital on July 1, 1938, complaining of a swelling of the left leg. Four months before admission to the hospital she fell from a truck and injured the lateral part of the left leg. Three days later, swelling, bluish discoloration, and pain occurred. After a few days these signs subsided to some extent, but they again began to increase 2 months later.

On the day of admission to the hospital, her temperature was 99 degrees F. At the junction of the middle and lower thirds of the left leg, there was an annular, firm, slightly tender swelling. The skin over the tumor showed redness and increased warmth. The leucocyte count was 12,000.

Just distal to the middle of the shaft of the left fibula, there was an irregular area of destruction (Fig. 8). The roentgenogram of the chest showed nothing abnormal.

Although the roentgenologic diagnosis was osteomyelitis, the clinical diagnosis was malignant tumor, probably Ewing's tumor.

A posterolateral incision was made over the site of maximum swelling. The fibula was rough and surrounded by gray, soft, friable tissue which had extended into the muscle. Several pieces of fibula and tumor were removed and the wound was closed with silk.

On microscopic examination the cells were found to be fairly uniform with very little cytoplasm (Fig. 9). The nuclei were round or oval and basophilic. In the majority of the nuclei the chromatin was finely divided but, rarely, a central nucleolus was present. There were a few areas of necrosis. Tumor cells were seen in bone and in striated muscle.

The parents of the child were told that amputation should be done but they refused to give their consent. Seven days after the biopsy the wound disrupted. Twenty-three days after the biopsy roentgen ray therapy was begun and over a period of 14 days a total of 1,000 roentgens was administered to each of 2 portals over the leg (Fig. 10) and 1,200 roentgens to the left inguinal region. At this time the parents gave permission for an amputation. Forty-three days after biopsy a supracondylar femoral amputation was done.

On microscopic examination, although sections were made from 5 sites, a definite diagnosis of tumor could not be made (Fig. 11). There were a few areas in which cells with round nuclei and little cytoplasm could be seen, but these cells resembled lymphocytes more than cells of Ewing's tumor. There had been considerable replacement of striated muscle by connective tissue.

This patient was delivered of a normal infant July 8, 1947. On February 21, 1948, more than 9 years after amputation, she was in excellent health. She was able to walk very well, using the artificial limb. Examination revealed a well healed incision with a smooth bone end and no inguinal or abdominal masses. A roentgenogram of the stump (Fig. 12) showed no recurrence and a roentgenogram of the chest (Fig. 13) showed no metastases.

Inasmuch as 43 days elapsed between the biopsy and amputation, what would appear to be adequate opportunity for dissemination of the tumor was present. The roentgen ray therapy was administered because permission for amputation could not be obtained. We see no reason for irradiation preceding amputation.

CASE 3 Surg Path No 13468 Not registered with the Registry of Bone Sarcoma

The patient was a white girl 17 years of age who was admitted to the Vanderbilt University Hospital on December 26, 1940, complaining of pain in the right hip. There had been no injury. Four months before admission to the hospital she began to have pain in the hip and 2 months later she noticed that the right hip was larger than the left one.

The temperature was 99.2 degrees F. In the medial portion of the ilium there was a firm, non-tender, poorly circumscribed mass over which the skin was warmer than elsewhere. The leucocyte count was 7,200.

A roentgenogram showed an area of destruction in the medial portion of the right ilium (Fig. 14).

The roentgenologic and clinical diagnosis was Ewing's tumor.

An incision was made over the wing of the ilium and through the muscle. The false capsule of the tumor was incised and there was encountered tumor tissue which was pinkish white, friable, and so irregular that, after several small pieces were removed, packing was required to control the bleeding.

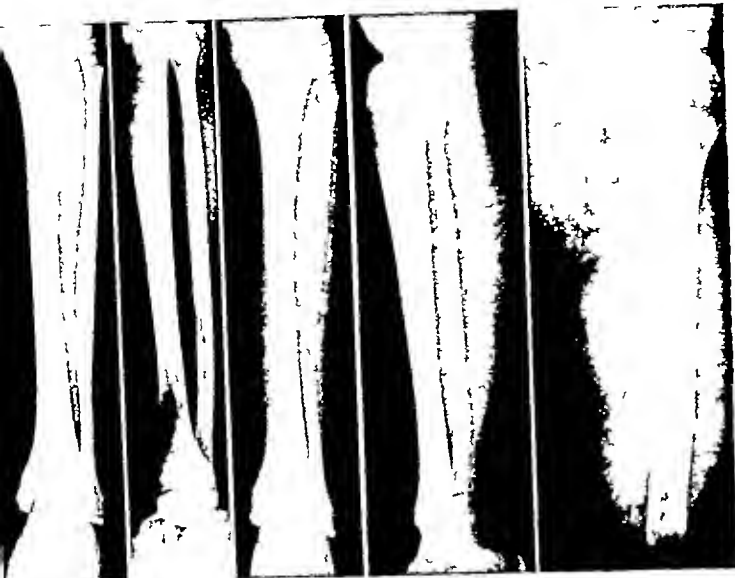


Fig 8a Fig 8b Fig 10a Fig 10b

Fig 12



Fig 13



Fig 9



Fig 11

Fig 8 Case 2 The roentgenogram shows a small area of bone destruction at a point just distal to the middle of the shaft of the fibula

Fig 9 Case 2 The photomicrograph shows Ewing's tumor

Fig 10 Case 2 The roentgenogram made 40 days after exploration of the fibula and 5 days after the completion of administration of roentgen ray therapy

Fig 11 Case 2 Following administration of 1,000

On microscopic examination the cells were found to be fairly uniform with very little cytoplasm and no distinct cell border (Fig 15). The nuclei were round or oval and basophilic. The chromatin was fairly finely divided. The tumor had extended into the striated muscle. The packing was removed 6 days after operation and roentgen ray therapy was started the next day. Over a period of 27 days, 3,200 roentgens were given through each of 3 portals

roentgens through each of two portals to the fibula, amputation was done. This photomicrograph of a section of tissue removed from the diseased area shows no cells which can be identified as those of Ewing's tumor

Fig 12 Case 2 The roentgenogram of the stump of the femur made more than 9 years after amputation shows no disease

Fig 13 Case 2 The roentgenogram of the chest, made more than 9 years after amputation, shows no metastases

On February 3, 1941, a roentgenogram of the chest (Fig 16) showed a nodule in the left lung at the level of the second intercostal space and one in the right lung at the level of the third rib. These nodules were thought to be metastatic tumor. No roentgen ray therapy was administered to the chest. Amenorrhea had been present from February, 1941, until August, 1942. A roentgenogram of the chest (Fig 17) made on October 30, 1941, showed that the





Fig 14



Fig 15



Fig 16

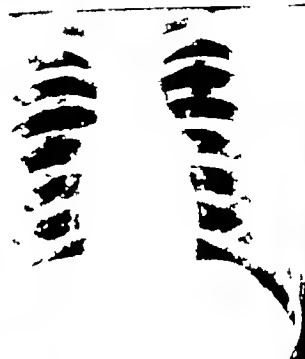


Fig 17



Fig 19



Fig 18

Fig 14 Case 3 The roentgenogram of the pelvis shows an area of bone destruction in the medial portion of the right ilium

Fig 15 Case 3 The photomicrograph shows Ewing's tumor

Fig 16 Case 3 This roentgenogram was made 5 weeks after the ilium had been explored There is a nodule in the left lung at the level of the second intercostal space and one in the right lung at the level of the third rib These nodules were thought to be metastases from the Ewing's tumor of the ilium

Fig 17 Case 3 This roentgenogram was made 8 months after the one shown in Figure 16 The nodules are not visible although this patient received no roentgen ray therapy to the chest

Fig 18 Case 3 The roentgenogram of the pelvis made 7 years after exploration of the ilium shows no evidence of recurrence

Fig 19 Case 3 The roentgenogram of the chest made 7 years after the establishment of the diagnosis of Ewing's tumor shows no recurrence of metastatic nodules

nodules in the lung had completely disappeared There was a considerable amount of calcification in the ilium on this date On September 21, 1944, roentgenograms showed normal lung fields and evidence of bone regeneration in the ilium In April, 1945, the patient was delivered of a 7 months' in-

fant who lived 6 months In October, 1947, she was delivered of a 6 5 months' infant who lived only 2 hours A roentgenogram of the pelvis made on December 4, 1947 (Fig 18), 7 years after operation, showed that there had been no change in the appearance of the ilium since the film was made in



Fig 20



Fig 21

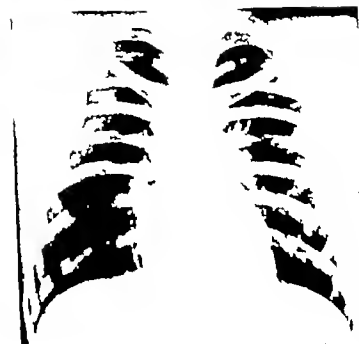


Fig 22



Fig 23



Fig 24

Fig 20 Case 4 The roentgenogram shows areas of decreased and of increased density in the inferior portion of the body of the right ilium and the superior portion of the superior ramus of the pubis

Fig 21 Case 4 The photomicrograph of a section of the tissue removed at exploration of the ilium shows Ewing's tumor

Fig 22 Case 4 The roentgenogram of the chest shows a nodule near the periphery of the upper lobe of the right lung which was thought to be metastatic from the Ewing's

tumor of the ilium and pubis

Fig 23 Case 4 This roentgenogram made 9 months after the one shown in Figure 22 shows that the nodule has disappeared This patient received no roentgen ray therapy to the chest between June 18, 1937 (Fig 22) and March 29, 1938 (Fig 23)

Fig 24 Case 4 The roentgenogram made 3 years after the one shown in Figure 22 shows large masses of metastatic tumor on the right but none at the site of the first apparently metastatic nodule

1944 There was no evidence of metastatic lesions in the chest (Fig 19) On March 3, 1948, she was in excellent health Physical examination showed no evidence of recurrence

The amazing feature in this patient was the disappearance of lesions which roentgenographically appeared to be metastatic nodules Except for the diagnostic chest film, the nodules themselves were not irradiated, although the ilium and, evidently incidentally, the ovaries were irradiated Eight months after their appearance on the film, the nodules disappeared and had not recurred 6 years

later Furthermore, this patient went through 2 pregnancies without reactivation of the disease

CASE 4 Surg Path No 8785 Not registered with Registry of Bone Sarcoma

This patient was a white man, 27 years of age, who was admitted to the Vanderbilt University Hospital on March 30, 1937, complaining of swelling of the bladder One year previously he injured his back and right hip in an automobile accident The pain in these regions subsided after a few days Three months before admission to the hospital he began having pain in the right hip and 1 month later he noticed a tender mass in the right lumbar region

which disappeared after a week. Three weeks before admission a mass appeared in the suprapubic region. This mass steadily increased in size.

The temperature was 98 degrees F and rose subsequently to 100.4 degrees F. In the lower abdomen, extending upward from the pubis, there was a smooth, firm, slightly tender, immovable mass. Rectal examination revealed a mass with similar characteristics. The white blood cell count was 12,400.

A roentgenogram showed that a destructive lesion which involved the medial aspects of the inferior portion of the body of the ilium and the superior portion of the superior ramus of the pubis (Fig. 20).

The clinical diagnosis was tumor of the pelvic bones. The roentgenologist thought that the correct diagnosis was tumor, but stated that the possibility of osteomyelitis could not be ruled out by the roentgenogram alone.

An incision was made near the lateral border of the right rectus muscle and the tumor was exposed retroperitoneally. The tumor tissue was gray, friable, and very vascular. Two pieces of tissue were removed.

On microscopic examination the cells were found to be fairly uniform (Fig. 21). There was a very small amount of faintly eosinophilic cytoplasm, but the cell borders were not distinct. The nuclei were round, basophilic, and contained finely divided chromatin. Small blood vessels were quite numerous.

Six days after operation, roentgen ray therapy was started. Over a period of 17 days a total of 3,200 roentgens was administered through each of 2 portals over the diseased portions of the ilium and pubis.

The abdominal mass decreased in size but did not disappear. On May 20, 1937, a roentgenogram of the chest revealed a large nodule near the periphery of the upper lobe of the right lung. On June 18, 1937, a chest film (Fig. 22) showed that the nodule had increased in size. Although no irradiation was given to the chest except that administered during the 2 diagnostic chest films, the roentgenogram on March 29, 1938, 9 months later (Fig. 23), showed that the nodule had disappeared. On February 4, 1939, no lung metastases were seen on the chest film. On November 1, 1939, a metastatic nodule appeared near the right cardiohepatic angle and on May 29, 1940, several nodules were seen in the right lung, but none in the region where the first metastasis had been seen. Irradiation was administered with some decrease in size of the lesions, but on May 22, 1941, large solid tumor masses were seen (Fig. 24) and roentgen ray therapy was started again. The patient died on October 16, 1941. There never was a recurrence of the nodule that had disappeared without having been directly treated.

The following hypotheses have been considered to explain the disappearances of the pulmonary nodules in Cases 3 and 4.

1 They were not metastatic neoplasms.

2 They were so radiosensitive that the tiny amount of irradiation from the diagnostic chest roentgenography caused them to disappear.

3 Irradiation of the site of the primary tumor activated the cells in the circulation which rendered secondary irradiation to the lungs.

4 Irradiation of the gonads changed the hormonal balance in such a way as to establish conditions which were incompatible with life of the tumor cells.

5 So called Ewing's tumor is not a neoplastic but an inflammatory disease.

#### SUMMARY

1 The clinical, roentgenologic, operative, and microscopic findings, the treatment, and the results in 20 cases of Ewing's tumor of bone have been described.

2 Three instances of apparent cure of Ewing's tumors have been reported.

3 Two instances have been recorded in which, without direct treatment, apparent pulmonary metastases from Ewing's tumor disappeared.

#### CONCLUSIONS

1 The bone changes produced by Ewing's tumor of bone and revealed by roentgenography are so variable that a definite diagnosis by that method alone can be made only in the minority of instances.

2 No suspected case of Ewing's tumor should be subjected to irradiation or amputation until microscopic examination of excised tissue has confirmed the diagnosis.

3 It has been possible apparently to cure this disease in 1 instance by amputation, in another by irradiation, and in a third instance by irradiation and amputation.

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# THE POSTERIOR SUBSPHINCTERIC SPACE

## Its Relation to Posterior Horseshoe Fistula

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**E**VEN a cursory review of the literature reveals that the superficial variety of anorectal infections has been covered adequately from every standpoint except the anatomic by many well known authorities. Nearly every writer asserts that an intimate knowledge of the anatomy of these related regions is essential, yet few describe these relationships in detail.

For decades it has been recognized clinically that (1) infection of one ischioanal fossa is often followed by infection of the other, (2) this is especially true in neglected cases, (3) as the infection spreads from one ischioanal fossa to the other, it establishes a "posterior horseshoe fistula" in almost every instance. Yet neither the mechanism of spread nor the reason for its location posterior to the anus has been clear. In view of these facts, I shall explain the anatomic relationship of the anorectum as related to posterior horseshoe fistula. The anatomic relationships revealed by my research are in disagreement with the statements made by many previous investigators.

Some have contended that the so-called "anococcygeal raphe" underlying the anococcygeal skin sulcus, forms a definite barrier to the contiguous spread of infection from one ischioanal fossa to the other. This group is inclined to believe that the infection is transmitted by the lymphatics. Nesselrod has confirmed the belief that the lymphatics of this area are intracutaneous and that they are not deep enough to form the basis of a fistulous tract.

Many proctologists have demonstrated clinically the existence of a communicating tract between the two fossae.

From the Anatomical Laboratories of the Graduate School of Medicine of the University of Pennsylvania under the direction of Oscar V. Batson, M.D., Professor of Anatomy, and the proctologic services at Syron's General Hospital and Olmsted County Tuberculosis Sanatorium.

Others have considered the possibility that this tract was represented in normal anatomy by a surgical space. Hibschan was a proponent of this idea and was responsible for its vogue in Philadelphia.

Several terms, such as the posterior triangular space, the postanal space, and the posterior communicating space, have been used by clinicians to designate collections of areolar tissue in this area. Gorsch and Levy have referred particularly to the posterior triangular and communicating spaces and have delimited their limits. Their descriptions and schematic figures appear to be based upon clinical deductions rather than upon detailed dissections.

During the study of the muscles and fascia of the pelvis, several undescribed details bearing on this problem came to light. These are the basis of this report.

### RESEARCH MATERIAL

Pelves of 8 human cadavers of the negro and white races, male and female, were dissected in detail. Pelves of 40 cadavers of the negro and white races, male and female, were surveyed in the laboratory while dissected by others. This description is based upon a dissection made from both the perineal and pelvic approach and a comparison of the dissection with sagittal, parasagittal, and coronal sections.

### TERMINOLOGY

For clarification I shall define and limit the following anatomic terms as used in this paper. *Coccygeal muscular raphe*. This is a proposed new term to indicate more accurately the musculo-fibro-tendinous insertions of all three divisions of the inferior layer of the levator (puborectalis, pubococcygeus, and the coccygeus) into the tip and sides of the coccyx, formerly spoken of as the anococcygeal raphe. The term anococcygeal raphe is a misnomer.

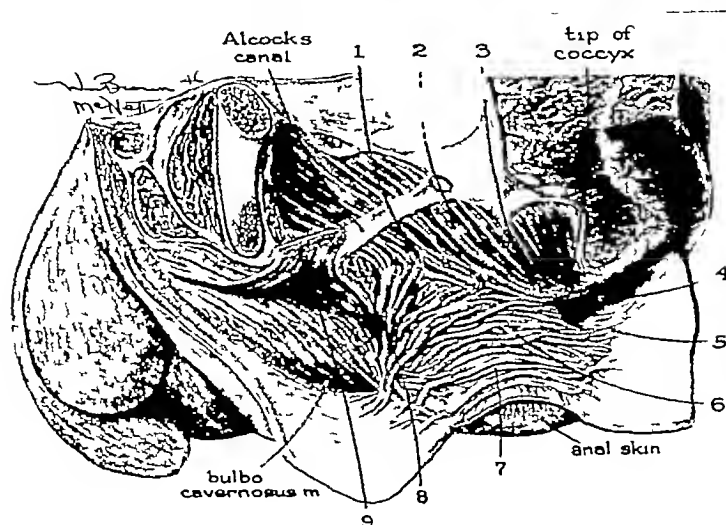


Fig 1 Lateral view of dissected male pelvis, showing the distribution of the fibers of the levator and external anal sphincter muscles (Dissection by author) 1, Pubococcygeus, 2, iliococcygeus, 3, coccygeal muscular raphe, attaching to tip and sides of coccyx, 4, posterior subspincteric space, lying between the coccygeal muscular raphe and the coccyx, above, and the posterior insertions of the deep anal sphincter into the skin, along the anococcygeal skin sulcus, below, 5, posterior insertions of the deep anal sphincter into the skin along the anococcygeal skin sulcus, 6, deep external anal sphincter muscle, formed from fibers of the puborectalis, as it winds itself around the bowel

because in no place does this web of muscle fibers attach to, or come in contact with, the anus

*Anococcygeal skin sulcus* This term indicates the groove, crease, or furrow of the skin normally present in the posterior midline of the body, separating the buttocks. It extends from the anus to a variable point over the posterior surface of the sacrum

*Ischioanal fossa* This term, used as a synonym for the ischioanal fossa, denotes the boundary more accurately for in no place is this space in relation to the rectum

#### ANATOMY

The sphincter muscles and the levator muscle fibers were dissected into their components. By doing this, it was shown that a portion of the fibers of the puborectalis (Fig 3, 12), reinforced by fibers of the pubococcygeus (Fig 1, 1) and the iliococcygeus (Fig 1, 2), forms a flat fibromuscular expanse which inserts into the tip and sides of the coccyx. These combined fibers form the coccygeal muscular raphe of our definition (Figs 1, 3, 3, 10, and 4, 11)

Just posterior to the anorectum the remaining portion of the puborectalis winds and en-

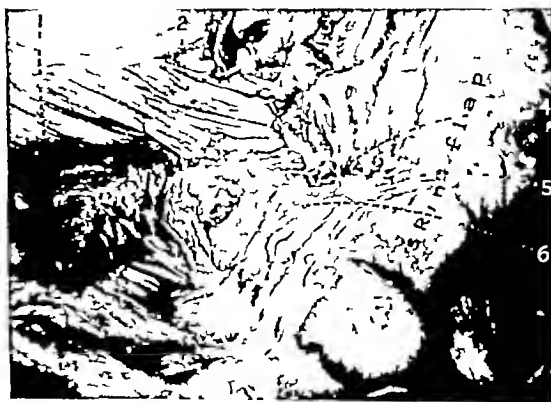


Fig 2 Actual close up photograph of the dissection, as shown in Figure 1 (Dissection by author) 1, Pubococcygeus, 2, iliococcygeus, 3, coccygeal muscular raphe, attaching to tip and sides of coccyx 4, posterior subspincteric space, lying between the coccygeal muscular raphe and the coccyx, above, and the posterior insertions of the deep anal sphincter into the skin along the anococcygeal skin sulcus, below 5, posterior insertions of the deep anal sphincter into the skin along the anococcygeal skin sulcus, 6, deep external anal sphincter muscle, formed from fibers of the puborectalis as it winds itself around the bowel

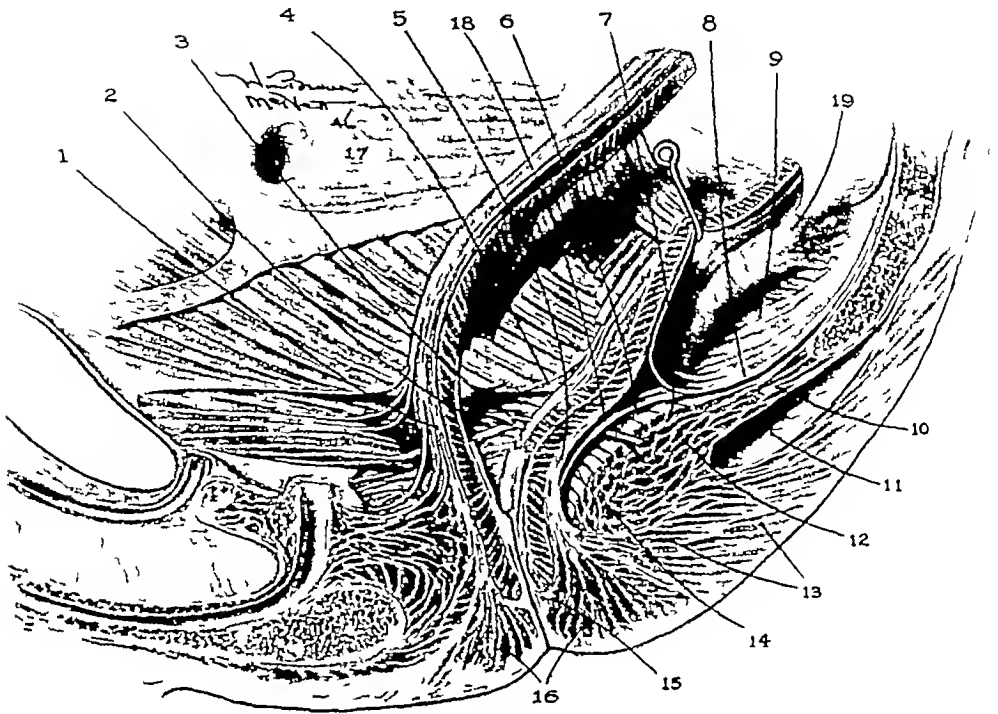


Fig 3 Drawing showing midsagittal section somewhat schematically, illustrating the relationships of the anorectum to the pelvic diaphragm and the anorectal musculature. A window has been cut through the lateral wall of the rectum, layer by layer, to show the relationships lateral to the rectum. (Dissection by author) 1, Combined longitudinal muscle layer (anterior to the rectum). This layer is composed of the longitudinal muscle layer of the rectum, fibers from the levator fascia and fibers from both the superior and inferior layers of the levator. 2, Inferior layer of the puborectalis muscle. 3, Arrow lying in the posterior levator space. This space surrounds the rectum like a horseshoe, with the open end of the horseshoe toward the pubis. 4, Superior layer of the levator muscle. 5, Combined longitudinal muscle layer of the rectum (posterior to the rectum). 6, Fiber from the superior layer of the levator, to the combined longitudinal muscle layer of the rectum. 7, Inferior boundary of the posterior levator space formed behind the rectum by the superior surface of the coccygeal muscular raphe. 8, Iliorectococcygeus muscle formed by fibers from the iliococcygeus (striped), fibers from the longitudinal muscle layer of the rectum (smooth), and a few fibers from the levator fascia. This muscle forms the superior boundary of the posterior levator space behind the rectum. 9, Retrorectal space. 10, coccygeal muscular raphe, attaching to the tip and sides of the coccyx. 11, Posterior subsphincteric space (connecting the two ischioanal fossae) bounded anteriorly, by the posterior surface of the deep external anal sphincter, superiorly, by the inferior surface of the coccygeal muscular raphe, and inferiorly, by the decussating fibers of the deep portion of the external anal sphincter as they insert into the skin. 12, Puborectalis muscle (the sling of the puborectalis behind the rectum). 13, Fibers of the deep external anal sphincter muscle inserting into the skin along the anococcygeal skin sulcus. 14, Deep external anal sphincter muscle (posterior to the rectum). 15, Anal intermuscular septum.

twines itself around the bowel to form the deep external sphincter muscle (Figs 1, 6, 3, 14, and 4, 9). Some of these puborectalis fibers split off and form a flat web which lies inferior to the coccygeal muscular raphe. The fibers of this web, which are the posterior insertions of the deep external sphincter, lie just beneath the skin of the anococcygeal skin sulcus and terminate by inserting into this skin (Figs 1, 5 and 3, 13). Between these super-

ficial and deep muscle extensions, there is a thin mass of fat and loose connective tissue which extends to either side and is there continuous with the fat and areolar tissue of the ischioanal fossae.

This potential fat filled space, for which I propose the descriptive, anatomic name "the posterior subsphincteric space" (Figs 1, 4 and 3, 11) is situated between the muscular wall of the anal canal in front and the coccygeal

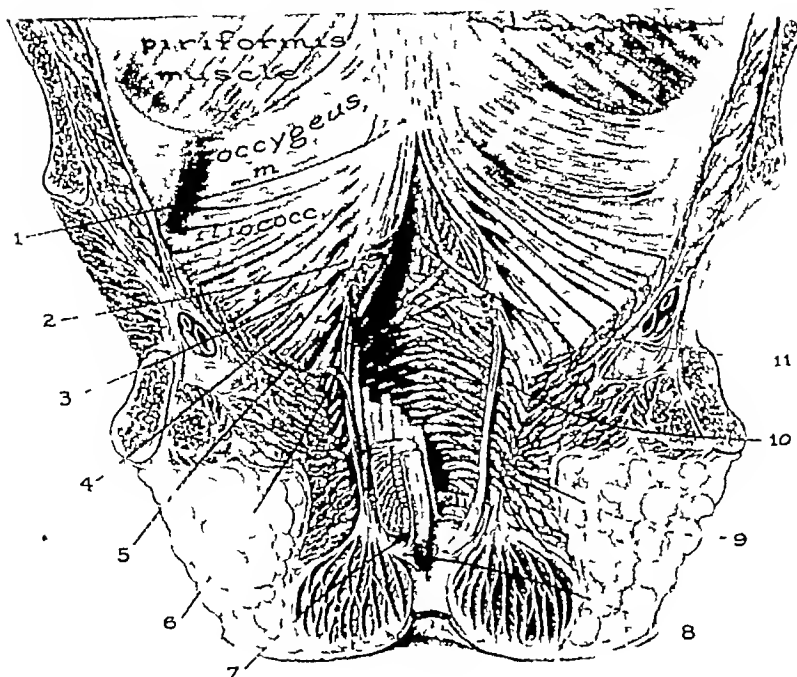


Fig 4 Drawing showing the coronal section of a dissected male pelvis somewhat schematically, illustrating the extent of the posterior levator space posterior to the rectum, and the manner in which the inferior layer of the levator winds itself around the rectum to form the deep external sphincter muscle of the anus. The iliorectococcygeus muscle has been split in the posterior midline and the flaps turned upward. The wall of the posterior half of the rectum has been removed, with the exception of a few muscle bundles of the combined longitudinal muscle layer on each side and a block of the lower end of the internal sphincter muscle on the right. The skin of the anal canal has been removed (Dissection by author). 1, iliorectococcygeus muscle, 2, superior layer of the levator, 3, inferior layer of the levator, 4, levator muscle (lateral to the point of division into a superior and an inferior layer), 5, muscle bundle from the superior layer of the levator to the combined longitudinal muscle layer of the rectum, 6, muscle bundle from the inferior layer of the levator to the combined longitudinal muscle layer of the rectum, 7, circumanal space, 8, anal intermuscular septum, 9, deep external anal sphincter muscle, 10, puborectalis muscle showing the inferior layer as it winds and entwines itself around the bowel to form the deep external anal sphincter muscle, 11, coccygeal muscular raphe (inferior boundary of the posterior levator space behind the rectum)

hind. On sagittal section the shape of this space varies somewhat, depending upon whether the section is made through the anococcygeal skin sulcus or at points lateral to it. The narrowest part of the space is found by section through the midline of the body (through the anococcygeal skin sulcus) in which plane the space is irregularly elliptical in shape. The actual photographs and drawings give a better idea of the space than the description. In anatomic terms, however, the space may be said to be bounded anteriorly, by the posterior surface of the deep external

anal sphincter (Figs 1, 6 and 3, 14), superiorly, by the inferior surface of the coccygeal muscular raphe (Figs 1, 3 and 3, 10), and, inferiorly, by the decussating fibers of the deep portion of the external anal sphincter as they insert into the skin (Figs 1, 5 and 3, 13). Actually, these several muscle components are derivatives or extensions of the puborectalis muscle.

This posterior subsphincteric space (1, 2, 3, 4) lies in the exact location of posterior horseshoe fistula. It appears then, that this fistula represents the extension of an infection by contiguity



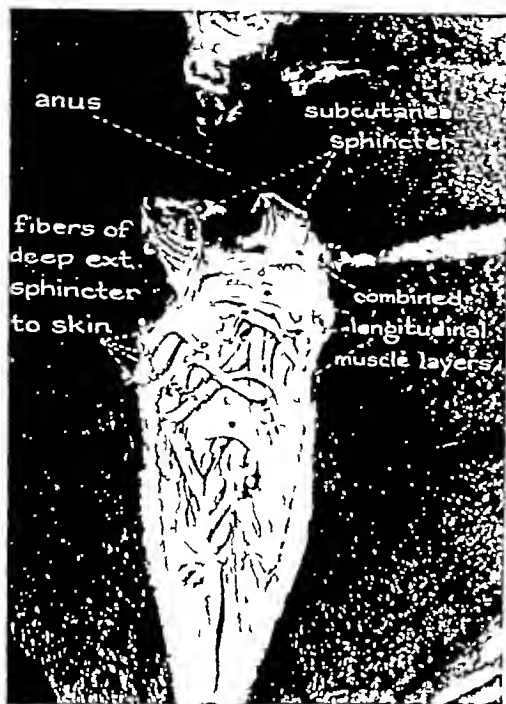


Fig 5 Photograph showing the insertions of the subcutaneous sphincter, the deep sphincter, and fibers from the combined longitudinal muscle layer of the rectum into the skin along the posterior midline. An incision has been made through the skin in the midline (anococcygeal skin sulcus) and extended into the anal canal. The skin edges have been pulled apart and held in place by pins (Dissection by author)

### SURGERY

Muscles, including their origins and insertions, must be preserved whenever possible if one is to secure the best functional result. In the majority of cases it is unnecessary to make the usual horseshoe-shaped incision, passing around the anus posteriorly, to cure this type of fistula. Curvilinear incisions are made lateral to the external sphincter muscle over the most prominent part of the ischioanal abscess on either side. These incisions are carried anteriorly to the full extent of the abscess cavity and are terminated posteriorly at the lateral margins of the insertion of the anal sphincter into the skin. If a Penrose drain is passed from one incision to the other, through the posterior subsphincteric space, adequate drainage will be secured. The preservation of

the posterior insertion of the anal sphincter into the skin prevents unnecessary loss of sphincter control and the horrible deformity often seen following the use of the horseshoe incision. The lateral incisions must be extensive and the wounds saucerized. However, when the deep spaces are involved (the posterior levator, the retrorectal, and the lateral pelvic spaces), it sometimes becomes necessary to make the horseshoe incision in order to follow the deep portion of the fistula tract and to secure proper exposure and drainage of these deeper spaces. In these cases, it is far better to sacrifice the insertion of the anal sphincter into the skin than the insertion of the levator into the tip and sides of the coccyx. Whenever this is necessary, the incision posterior to the anus should be made well up over the coccyx and a flap of skin, including the insertion of the sphincter muscle into it, should be reflected forward until the posterior subsphincteric space is reached.

### SUMMARY

Dissection of a series of cadavers has shown a definite, fatty, areolar tract joining the two ischioanal fossae. This tract lies posterior to the anus and between two prolongations of the puborectalis muscle. The location of this space coincides with the location of posterior horseshoe fistula.

### CONCLUSION

Since a knowledge of the presence, location, and limitations of every potential space is essential to fistula surgery, and since there has been much confusion as to the exact pathway of posterior horseshoe fistula in the past, it is hoped that this paper will be of some value in clarifying this situation in the future.

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# THE CRITERIA, CLASSIFICATION, AND TECHNIQUE OF ILIOPECTINEAL (COOPER'S) LIGAMENT HERNIOPLASTY

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THE acquisition of knowledge of the surgical treatment of hernia entails, among other things, an acceptable yet practicable classification of hernial operations. In a previous publication mention has been made of three major classifications of hernial operations, namely, herniotomy, herniorrhaphy, and hernioplasty. It is not proposed to discuss further herniotomy or herniorrhaphy but we would like to clarify the current conception of hernioplasty. With the universal acceptance of iliopectineal (Cooper's) ligament repairs, hernioplasty has become more inclusive. Currently it connotes a greater scope of plastic variants than it did a decade or so ago when repairs were confined almost exclusively to the use of the inguinal ligament as anchorage for the separated fascial boundary. The recognition of two types of hernioplasty, inguinal ligament hernioplasty, and iliopectineal (Cooper's) ligament hernioplasty, has been helpful and an advance-step in lessening misunderstanding when referring to these plastic reparative procedures. The technical development of the former, with the use successively of fascial sutures, of free or pedicled fascial grafts, of pedicled muscle grafts, and recently of cutis grafts, constitutes one of the most interesting chapters in the progress of hernial surgery. Furthermore, it seems likely that the cumulative story of the progressive evolution of various maneuvers employed in iliopectineal ligament repairs will ultimately be equally as fascinating.

The purpose of this paper is (1) to focus attention on some of the factors which have played a role in retarding the development of the various maneuvers in Cooper's ligament repairs, (2) to present a practical classification and the criteria for each variant, and (3) to describe and illustrate the technique of the combined operation.

In recent years there has been a rising interest in and a general acceptance of iliopectineal ligament hernioplasty, which has been reflected in an increasing number of articles appearing in the literature on this technical aspect of hernia repair. As a result of this transition in technique, the successive variants employed for implementing the coexisting anatomical weaknesses have become standardized and correlated so that the composite operation is rapidly approaching the position of challenging the choice of the inguinal ligament in the repair of certain types of inguinal hernias. In retrospect, it is difficult to understand why anyone familiar with the anatomic relationships in the inguino-femoral region and the dynamics of the progression of the hernia, could overlook for long the inherent advantages of a deeper parietal anchorage and a mechanically better shunting angle to intra-abdominal force which obtain in iliopectineal ligament repairs.

The chief factors which may be considered as playing a contributing role in the reluctance of surgeons to take advantage of this valuable and, for the most part, easily accessible ligament are

1. *The failure of technical progress to keep pace with anatomic knowledge.* Progress in surgery is not wholly dependent on anatomic knowledge, but, sharing importantly in its progress is the ability to recognize discernible technical pitfalls and on the increasingly efficient application of ways of correcting congenital or acquired deficiencies. The latter prerequisite imposes the necessity of constant acquisition of new information. Moreover, we should realize that during the evolution of the modern concept of hernia repair, which had its inception only a half-century ago, the opportunities for surgical training in herniology were far less than in the present day of industrialization in which operative repair of hernia is universally accepted as the treatment of

choice In the former era of surgery, hernias were not operated on unless they became strangulated or reached a size incompatible with gaining a livelihood, while in the present era many hernias are repaired that were previously unrecognized by the individual and were only discovered during a pre-employment examination or on induction into military service Consequently, the opportunity for surgical experience in the treatment of hernia in its incipency, as contrasted with the prevalent scrotal hernia of a half-century ago, has increased manifoldly Moreover, during this interim there has been a decided trend toward internal or deeper repair by the correction of the saccular weakness intraperitoneally and the use of Cooper's ligament as anchorage for the wall, in contrast to the former practice of extraperitoneal removal of the sac, reinforcement of the anterior layers of the wall and the employment of the inguinal ligament as the sheet anchor

2 *The erroneous but prevailing concept of the origin and eradication of the femoral variant of the sac* Because of earlier reports of the low incidence of recurrence of femoral hernias repaired by the inferior or femoral approach, a technique which precludes total removal of the sac, surgeons generally gained the erroneous idea of the efficacy of this technique It did not occur to them to challenge the technique on anatomical grounds or to analyze and re-evaluate the source of the statistical data which were obtained from small series of patients operated upon and from what is currently recognized as incomplete follow-up records It is therefore not surprising that there has been professional resistance to any suggestions for alteration of the conventional technique of saccular ligation from below, usually implemented by the suturing of the inferior margin of the inguinal ligament to the pectineal fascia or occasionally to Cooper's ligament, a technique which had been in effect for a quarter of a century Statistical surveys of the last decade have shown that the inguinal approach is favored over the femoral and coincidentally with decreasing incidence of inguinal and femoral recurrences McClure and Gallis (1939) in their series of 90 femoral hernias found that 22.3 per cent had been op-

erated on previously for inguinal hernia on the same side These findings suggest that the patients were subjected to two operations because of a diagnostic error or that more than casual relationship exists between femoral and inguinal hernias

The superiority of the inguinal route lies in providing (1) greater accessibility to the sac and its variants, (2) better definitive exposure of the wall adjacent and remote to the defects in the floor of the canal as well as those occurring in the interligamentous space, (3) more accurate evaluation of the composite weaknesses and of the neighboring structural integrity, and (4) complete visualization of the iliopectineal ligament and triangular space Consequently, the superior approach has increased the anatomical frontiers of the congenital and distortion weaknesses of the inguina and coincidentally has extended the surgical horizon of hernia repair This composite concept of inguinofemoral herniation provides the resourceful surgeon with a wider range of ingenious maneuvers for augmenting the combined inguinopectineal or three dimensional repair Simultaneously with the almost universal acceptance of the principle of retrogressive mobilization and conversion of the various locules into the parent sac before total exsection, there has come a revival of the concept of triangulation of the inguina which was originally proposed by Hesselbach in 1806 Ferguson, and Andrews and Bissell recognized the importance of the smaller internal inguinal triangle in the development of incipient direct hernia, and emphasized the necessity for reinforcing the wall overlying the internal fossa in the prevention of recurrences of this type of hernia

Ordinarily we are prone to think only of the urogenital and vascular orifices in or adjacent to the floor of the canal as sources of the hernia, overlooking the other rare but equally important congenitally susceptible mural or ligamentous weaknesses Yet, in Cooper's book published in 1804, there is a plate depicting 6 such orifices Anatomically and surgically there is currently recognized 12 or more actual or potential areas of weakness through which herniations have occurred It would therefore seem logical for the purpose of exactness of

their location to describe them in relation to the triangles of the inguina. Burton and Dugdale have revived and extended this idea by considering the entire hernia-bearing region as a composite unit or the inguina. Each inguen is triangularized by dividing it into (1) a major superior triangle, which lies anteromedial to the inguinal ligament and comprises Hesselbach's and a medial triangle, and (2) a major inferior triangle which is inferomedial to the inguinal ligament or trihedral space. It consists of the lesser vascular and the muscular triangles, respectively. Therefore, by correlating the saccular and triangular relationship one can better understand the validity of the retrogressive removal of the saccular variants and better define adjacent structural elements preparatory to the creation of barriers to prevent recurrence of the herniation.

Unfortunately, in descriptions of inguinal and femoral hernias, so complete has been the regional bias that each area has usually been discussed with little regard to the anatomical relationships or the continuities of the fascial layers therein.

3. *Failure explicitly to set forth criteria for iliopectineal (Cooper's) ligament hernioplasty.* Experience gained from contact with the resident staff has revealed that they seldom have any preconceived idea as to what structural deficiencies or parietal distortions warrant the use of the iliopectineal ligament in hernia repair. There is a common tendency, which is a valid one, to employ it in all refractory hernias, included in this category are most preternaturally large recurrent hernias. They are confounded as to what saccular variants or precise structural deprivations constitute the indications for a Cooper's ligament repair. This lack of complete understanding of the relationship of the various anatomical weaknesses is due in part to the paucity of the literature on this etiologic aspect of hernia but is many times traceable to the delinquency of the senior surgeons who have inadvertently failed to point out the reasons for the application of this progressive step of employing the iliopectineal ligament in the radical treatment of hernia.

The criteria for the employment of Cooper's ligament may be classified as absolute and

equivocal. The absolute are (a) all femoral loculations of the sac and (b) inadequacy of the inguinal ligament. The equivocal indications are (a) multiple coexisting saccular locules, (b) generalized parietal laxity of the inguina, (c) fascial incompetency, which not infrequently is associated with aponeurotic or interfascicular defects, (d) refractory hernias or the presence of any marked distortional anatomical pattern as obtains in plural recurrences, (e) certain extrinsic factors such as the constitutional habitus and particularly those individuals suffering from asthmatic bronchitis or chronic recurring coughing paroxysms. It is realized that some of the correlative indications enumerated in the equivocal group fall within that controversial frontier which is only measurable by surgical experience.

#### CLASSIFICATION OF ILIOPECTINEAL LIGAMENT HERNIOPLASTY

The hernia-bearing region of either lower abdominal quadrant is commonly referred to as the inguinal region and less frequently as the groin. This large triangular area is bounded by the inguinal ligament, the rectus sheath, and the ilioumbilical line with the pubic spine as its apex. (3) Such an anatomicosurgical concept envisages herniations through the floor and cranial portion of the canal as well as spontaneous hernias in the semilunar and semicircular lines (spigelian). The other triangular component which is more deeply placed lies inferior and medial to the inguinal ligament with Cooper's ligament as its deeper boundary and the spinoeminential line, its superior limit, is known as the inferior inguinal region, interligamentous or trihedral space. Similarly, the composite superior and inferior inguinal regions are designated the inguina. By the foregoing triangulation of the inguina there is more accurate orientation and correlation of the various saccular and structural departures.

Surgeons have long searched for a single anatomic approach through which all protean weaknesses of the inguina can be corrected. Such a route should fulfill the following prerequisites: (1) afford adequate exposure to meet any contingency that has developed in

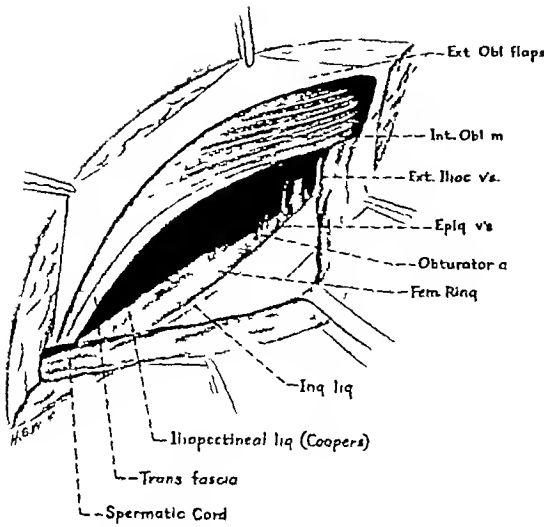


Fig 1 The anatomy of the inguen is illustrated depicting the important anatomical structures which are encountered in performing the combined inguinopectineal repair. Attention is called to the relationship of the inguinal and iliopectineal relationship of the inguinal and iliopectineal (Cooper's) ligaments. The epigastric vessels which lie in the superior triangular space are constant and are routinely ligated. The obturator vessels are frequently anomalous but their most frequent relationship is shown, which is in the inferior triangular space. They cross the superior pubic ramus just medial to the external iliac vein and when in this position are routinely ligated. The ligation of these vessels exposes the iliopectineal ligament to the level of the external iliac vein, so that wide anchorage of the parietal wall to this ligament is possible.

the progress of the hernia or which may arise during the course of the operation, (2) possess flexibility in dealing with definitive and congenitally susceptible weaknesses, (3) facilitate saccular excision inclusive of aberrant locules, and (4) permit leeway for the exercise of ingenuity of the surgeon in the creation of a deeply placed unyielding floor. It is our contention that the inguinal approach of Lotheissen meets all the requirements as outlined for the employment of the iliopectineal ligament in hernia repair. However, because of the frequency of diverse and occasional anatomic or embryonic inguinofemoral weaknesses which may coexist, this foundational approach to all inguinal triangles makes possible many intrinsic maneuvers for augmenting definitive mural, intraligamentous or interligamentous defects. These technical variants have been classified according to their evolutionary de-

velopment into (1) femoral hernioplasty, (2) pectineal hernioplasty, (3) inguinopectineal hernioplasty, and (4) combined inguinopectineal hernioplasty.

1 *Femoral hernioplasty* This technical procedure was the first evolutionary step in the departure from the conventionally used inguinal ligament. It constitutes the simplest type of Cooper's ligament repair. The technique was originally proposed by Sir Astley Cooper but it was Annandale in 1876 who made practical application of it. Rugg in 1892 advocated its employment routinely in all femoral hernias. The operation entails ligation of the femoral locule, followed by either occluding the femoral ring with a plug of redundant tissue or by its direct closure by suturing the anterior margin of the ring to Cooper's ligament. The normal relationship of the cord or parietal structures are not disturbed. Like other maneuvers there are certain limitations imposed on this procedure. The hernia must be exclusively femoral, and there must be no coexisting mural weakness. Unfortunately, these criteria seldom exist alone. The operation is the counterpart of the early inguinal herniotomy of Ferguson in which the indirect locule is ligated but the floor of the canal is not mended and the position of the cord is not altered.

It should be an unvarying rule in every hernia operation to expose the peritoneum at the internal ring first. From this pivotal point, all saccular variants are successively mobilized. The presence of a femoral loculation is an absolute indication for iliopectineal repair. It differs from the indirect locule in its location and the fact it does not arise from a vestigial remnant. Its site of exit is through the velamentous fascia in the interligamentous space and usually through an enlarged femoral ring. By tracing intraperitoneally the origin of the different variants of the sac, it has been observed that the femoral outpouching arises from the inferior convex portion of the direct component of the sac. Ordinarily with the intraperitoneal approach the femoral protrusion and its fatty envelope can be easily withdrawn through the femoral ring. If the hernia is incarcerated it may be necessary to suture the lateral margin of the lacunar ligament.

which will facilitate intrapelvic delivery of the incarcerated mass. After the femoral locule is inguinalized the direct component of the sac is freed and indirectalized. This retrogressive procedure of mobilizing the sac intraperitoneally and intrapelvically is of imminent importance but unfortunately this technique of total saccular extirpation is not universally followed.

The infraligamentous approach to a femoral hernia has many disadvantages: (1) it provides accessibility only to the femoral variant of the sac, (2) it is not possible through this route digitally to examine the sac for other communicating locules which frequently coexist, (3) there is greater likelihood of injuring incarcerated bowel or if it should be suddenly released the surgeon may not be able to ascertain its viability before it disappears into the general peritoneal cavity, (4) a total excision of the femoral locule is more difficult, (5) should a loop of incarcerated bowel become gangrenous, its resection and anastomosis of the viable ends as advocated by Dennis and Varco could not be done through the inferior exposure.

The second maneuver in femoral hernioplasty is the closure of the ring. This is done by bringing the anterior margin of the ring, which is the inferior edge of the inguinal ligament, down to the iliopectineal (Cooper's) ligament by means of either a silk or a living fascial suture. If the femoral ring is dilated and the inguinal ligament unyielding, precluding its apposition to Cooper's ligament without tension, a fascial suture is preferable. Carscadden and Payne adapted the principle of McArthur by using a strip of external aponeurosis as a suture to bridge the annular defect. A Gallic free fascia lata suture serves equally as well. Dowden contends that the walls of the femoral ring are too rigid to be amenable to sound and reliable approximation. He therefore proposed buttressing the ring by suturing the bunched-up stump of the sac, properitoneal fat or omentum, so as to overlie and occlude the entrance to the canal. The prototype of this technique was employed to occlude the internal abdominal ring by Macewen in 1886 and McLewen in 1890 but was subsequently abandoned.

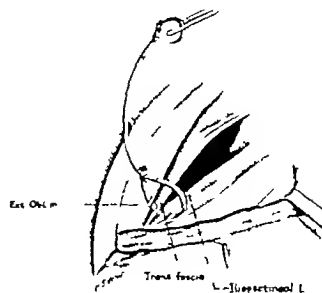


Fig. 2 The first fascia lata suture is started, showing it autotransfixed after passing through the edge of the medial aponeurotic flap and the fascia transversalis and through the iliopectineal ligament near the inguopectineal junction, posterior to the pubic spine.

Because of its limitations, femoral hernioplasty without implementing it with some other maneuver is rarely employed.

**2 Pectineal hernioplasty** This operation consists of two steps. The first entails the removal of the sac inclusive of all its locules, the second entails the exclusion of the femoral ring and the repair of the wall by suturing the fascia transversalis alone, or jointly with the other parietal strata, to the iliopectineal (Cooper's) ligament, starting deep to the pubic spine and continuing to the medial border of the external iliac vein.

In the presence of a coexisting saccular and mural hernia, additive reparative measures are called for. The sac is first disposed of in the conventional way. When the parietal insufficiency of the floor of the canal is chiefly of the atonic type, a special effort is directed toward taking up the slack by the creation of a deeply placed wall, which is also strategically more secure. By the utilization of Cooper's ligament as anchorage, the angle of diversion of the wall with the pelvis becomes more acute, thus lessening the concavity of the inguinal fossae; coincidentally there is early shunting of the intra-abdominal thrust. Figures 2 and 3 depict the attachment of the fascia transversalis and medial aponeurotic flap jointly to the iliopectineal ligament with a living fascial suture. The suture begins posterior to the pubic spine and progresses lateralward to the medial border of the femoral vein. This point is usually marked by a minute bony ridge paralleling the vessel or less

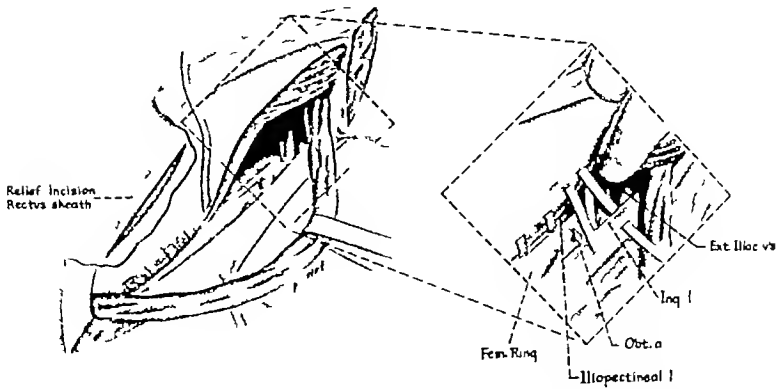


Fig 3 The first fascial suture has progressed from the caudal end of the iliopectineal ligament to the external iliac vein where it alters its direction, leaving the iliopectineal ligament and becoming more superficial. From this transitional point it passes through the parietal wall (internal and external oblique) and through the inguinal ligament successively to the newly placed external ring which now lies cephalad to the internal abdominal ring. The cord is displaced with concomitant reversal of the obliquity of its transparietal portion. A relief incision medially placed in the anterior rectus sheath is occasionally necessary to release undue tension on the fascial suture. The insert shows in greater detail the placement of the suture at the transitional space.

frequently by a small eminence on the superior pubic ramus. At this juncture, the suture changes its direction and passes from the iliopectineal ligament through the inferior margin of the inguinal ligament. It continues successively through the internal-external oblique strata and the inguinal ligament to the external ring. In this technique the external ring is reversed and occupies a position cephalad to the internal abdominal ring. The cord is transposed extra-aponeurotically. It should be noted that in the placement of this suture the wall is moved medial and deep to the femoral ring and interligamentous space.

A prerequisite to a pectineal hernioplasty is an available, competent fascial stratum. In the event the fascia transversalis becomes stretched, the medial denser portion near its conjunction with the rectus sheath may be brought down to the ligament. Should this maneuver cause undue tension of the fascia, a vertical or curved incision through the anterior rectus sheath, as suggested by Fallis and Tanner, respectively, will permit sufficient fascial separation without predisposing to any underlying weakness to relieve the abnormal tautness of the fascia transversalis. In our experience the Gallie fascial suture is

ideally suited for this step of the repair. The suture is easily obtainable, strong, somewhat elastic, nonirritating, lasts many years, produces broader contacting surfaces and its placement is accompanied by minimal trauma.

3 *Inguinopectineal hernioplasty (closure of the interligamentous space)* The interligamentous, inguinopectineal or trihedral space lies between the inguinal and iliopectineal ligaments and the anterior abdominal wall. Its superior limit is the internal ring and it extends inferiorly to the pubic spine. As a potential source of weakness this space has received only passing attention. In the conventional or classic hernia operation this vulnerable area is usually given little consideration. In modern textbooks of surgery no mention is made of the importance of reinforcing the velamentous fascia of this space or of stabilizing the inferior edge of the inguinal ligament. Statistically there are no reports incriminating this area as a possible cause of recurrent herniations other than femoral ring, yet, not infrequently one encounters a diffuse bulging through this subinguinal space. This singular lack of recognition or its proper evaluation in hernia repair is explained on the ground there is no classification for

herniation through the interligamentous space unless it is considered a variant of femoral hernia. The only exception is Wilmoth's classification of femoral hernia into prevascular, pectineal, translacunar, and multidiverticular. Too often, we are prone to think of femoral hernia as coming through only the femoral ring rather than bulging through the inguinopectineal space.

The idea of closing the interligamentous space is not new. Fabricius (19) divided the inguinal ligament to facilitate its approximation to the pubic ramus. Subsequently this principle was revived by Litsitsyn and Cheever who modified it by staggering the sectioning of the ligament. While there is concurrence in the objective to be attained by this maneuver, nevertheless the repair of such a strategically important structure as the divided inguinal ligament is an objectional feature which is almost as serious as the correction of the initial weakness. This perhaps accounts for the paucity of surgeons using this departure in technique. Moschcowitz in 1907 popularized the earlier novel idea of Ruggi of obliterating the interligamentous space by suturing the recurved portion of the intact inguinal ligament to the iliopectineal (Cooper's) ligament but omitted the previous objection of cutting the former. Since Cooper's ligament is a constant fixed structure of unvarying density, success of the Moschcowitz operation is dependent upon the pliability of the inguinal ligament, permitting it to span this vulnerable space. The pitfall of this technique is the tendency forcibly to displace a tense inguinal ligament in an endeavor to close the interligamentous space, unmindful of the fact that the maneuver is unphysiological and frequently results either in tearing the ligament or in cutting through of the silk sutures. Too often the ultimate outcome is the return of the sutured structures to their former position. To obviate this objectional feature an autogenous fascial suture may be interlaced between the ligaments, in effect to form a permanent fascial barrier (Fig 5a).

Another simple but effective method of reinforcing the interligamentous space is the reflection of the lateral aponeurotic flap medially and inferiorly. Ordinarily the flap is

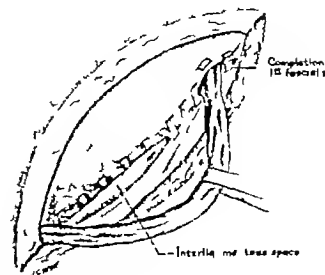


Fig 4 The first fascial suture has been laid. It may or may not encircle the cord at the external ring, depending upon its length and the preference of the surgeon. The space between the inferior edge of the inguinal ligament and Cooper's ligament (interligamentous space) has not been obliterated. By attaching the parietal wall well laterally so that it is contiguous with the external iliac vein, the femoral ring is excluded and lies superficial to the first imposed parietopectineal barrier.

of sufficient width to allow its edge to be sutured to the iliopectineal ligament without tension (Fig 5b). The converging medial and lateral aponeurotic flaps which are anchored to the iliopectineal ligament producing a narrow gutter superjacent to the ligament. By suturing the adjacent surfaces of the aponeurotic flaps, the depression will be smoothed out and the wall further strengthened. This method of obliterating the interligamentous space is technically easier, more physiological and since there is fascia-to-fascia contact it lessens the need for a living suture.

In placing the inguinopectineal hernioplasty in its proper perspective in relation to allied maneuvers, it would seem rational to use it as an adjunctive rather than a basic maneuver.

4. *Combined inguinopectineal hernioplasty (The composite operation or three dimensional repair)* The preceding variants in technique have been successful when measured in terms of comparative results and invaluable in contributing to the progressive security of the wall. But, each maneuver was designed to correct a specific anatomical deficiency and consequently they each have their limitations. It is not uncommon for the surgeon to be confronted with plural and varied weaknesses coexisting in the superior and inferior inguinal triangles, the correction of which no single technical maneuver would suffice. An analysis of the criteria for the various maneuvers has led to the conclusion of proposing a composite



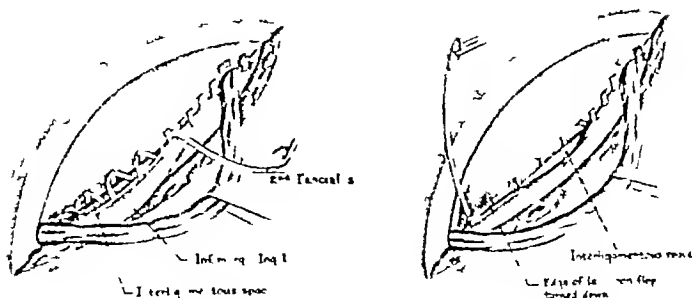


Fig 5 a, left, The second step of combined operation has for its objective the closing or reinforcement of the interligamentous space. It begins with the placement of second fascial suture which passes through the loops of the first fascial suture and through the inferior edge of the inguinal ligament running from the pubic spine laterally to the transitional angle. The suture serves as a living fascial barrier, in the event the inguinal ligament is taut and cannot be apposed to the iliopectineal ligament. b, The second fascial suture starts at the pubic spine but anterior to the first, going through the first loop of the first fascial suture and through the turned down edge of the lateral aponeurotic flap.

operation compounding the advantages of the several standardized technical variants employed in the evolution of Cooper's ligament repair.

#### TECHNIQUE OF COMBINED OPERATION

Certain cardinal principles, such as mobilization and excision of all locules of the sac and defining the anatomical structures of the floor of the canal are commonly agreed upon by all surgeons preparatory to proceeding with the repair. Therefore, these preliminary features of the operation will be omitted from the description. An inguinal approach is used. The first step of the composite operation is identical with pectineal hernioplasty. As suture material we prefer two fascia lata strips as described by Gallie and LeMesurier. Strategically, this is considered the most important maneuver of the operation for, if this defense barrier fails to hold, the subsequent adjunctive maneuvers are jeopardized. Attention is drawn to certain minor technical departures which will shorten the operating time without compromising the integrity of the wall. In our earlier experience only the fascia transversalis was apposed to the iliopectineal ligament. It was recalled that Joyce sutured the fascia transversalis and medial aponeurotic flap jointly as one stratum to the recurved portion of the inguinal ligament. He reported an enviable recurrence rate using this tech-

nique. We simply adapted the principle of Joyce but substituted the iliopectineal ligament for the inguinal ligament.

The first fascial suture passes through the fascia transversalis and medial aponeurotic flap and then through Cooper's ligament respectively (Fig 2), which is continued in the manner to the external iliac vein. The vein is displaced and protected with the finger or placement of the last suture in Cooper's ligament (Fig 3). At this point the fascial suture changes its direction, which is at the level of the iliac vein where it crosses Cooper's ligament and runs obliquely cephalad, passing through the inguinal ligament and pectineal strata to the newly created external ring. In effect, this closure reverses the obliquity of the transparietal portion of the canal. The transition from the iliopectineal ligament to the inguinal ligament is of crucial importance for it is the most frequent site of recurrence in this type of repair. It is therefore essential that great care be exercised in the placement of the transitional suture as it passes through the adjacent strategic structures, the pectineal wall, iliopectineal and inguinal ligament respectively (Fig 3). Since this is a triangular space a continuous or figure of eight suture superior to interrupted sutures. Moreover, because of easy compressibility of the external iliac vein which conceivably could occur from intra-abdominal pressure, it is

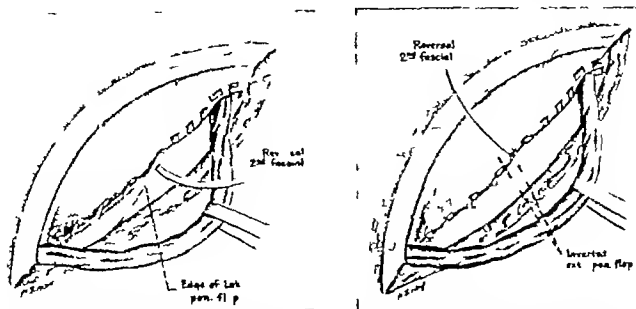


Fig 6 a, left, The second fascial suture is reversed and imbrication of the lateral aponeurotic flap begun. It passes through the edge of this flap and through the ventral surface of the medial b, The second fascial suture continues cephalad passing through the same structures, which pulls the lateral aponeurotic flap down to the iliopectineal (Cooper's) ligament. This maneuver obliterates the interligamentous space from the pubic spine to the medial border of the external iliac vein where the suture is reversed.

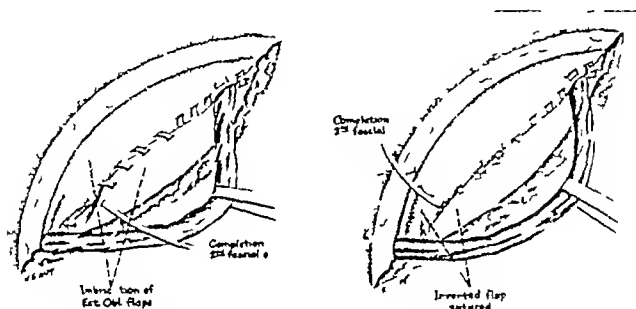


Fig 7 a, left, Completion of second fascial suture. In this three dimensional repair there is reinforcement of the floor which is more deeply placed, implemented by closure of the interligamentous space. The cord is transposed extraaponeurotically and the transpanetel portion points cephalad b, The second fascial suture has been reversed and runs caudally through the ventral surfaces of the inverted medial and lateral aponeurotic flaps, which eliminates the gutter suprajacent to the superior pubic ramus and completes the all fascial closure. The cord is placed extraaponeurotically.

ous that the potential vulnerability of this space cannot be totally eliminated.

In the placement of the first fascial suture, which is the first step of the combined operation, it is essential to have adequate exposure of Cooper's ligament. Routinely ligating the epigastric vessels and also the obturator vessels when present will be helpful. An ingenious maneuver has been described by Rees in which the direction of the femoral vein is changed from 15 degrees inward to 35 degrees outward by abduction of the hip. It would facilitate the placement of the lateralmost and deepest sutures in the iliopectineal ligament.

In those cases in which the fascia transversalis is attenuated, producing in effect a fascial

gap in the floor, there have been proposed three methods of augmenting it (1) By making a relief incision in the rectus sheath (Fig 3), the components of the aponeurotic stratum may be displaced lateralward and overlie the subfunicular area of weakness, or the fascial sheath may be reflected and sutured to Cooper's ligament. The objection to the latter is that it predisposes to herniation by the creation of a spindle-shaped gap at the lateral border of the rectus muscle. (2) Another method is by weaving a living fascial suture between the medial fascial boundary and the iliopectineal ligament. In this way a permanent fascial barrier is formed spanning the vulnerable floor. (3) Perhaps the method that

is rapidly gaining favor is a combination of the relief incision of Fallis with a fascial suture

The primary objectives of the second step of the combined operation are obliteration of the interligamentous space and the stabilization, rarely the replacement, of the inguinal ligament. For the most part, it concerns the details in the placement of the second fascial suture in the alternate maneuvers depending on whether the interligamentous space is closed by a living suture or by turning down the lateral aponeurotic flap. Figures 5a and 6a show the second fascial suture passing through the loops of the first and through the inferior edge of the inguinal ligament beginning behind the pubic spine and continuing to the external iliac veins where it is reversed and returns attaching the edge of the lateral flap to the anterior surface of the medial. Figure 5b depicts the alternative technique in which the second suture passes through the loops of the first and through the turned down edge of the lateral flap. It continues in this manner to the external iliac vein or transitional level where it is reversed (Fig 6b and 7b) passing through the adjacent anterior surfaces of the aponeurotic flaps. In both variants the cord is transposed extra-aponeurotically.

In those rare instances in which the inguinal ligament is totally absent, usually having been destroyed by trauma or infection following a previous repair, Wilmoth has constructed an inguinal ligament by raising a pedicled rectangular flap of the tensor fascia femoris muscle with its enveloping fasciae. The flap is swung into the inguen below the anterior-superior spine of the ilium. Its inferior edge is sutured to Cooper's ligament from the pubic spine to the iliofemoral vein. This unique variant of Wilmoth is worth remembering, but it has not been used in our experience.

#### CONCLUSIONS

1 Iliopectineal (Cooper's) ligament hernioplasty has been defined in the light of present progress, distinguishing it from the conventional inguinal ligament hernioplasty.

2 Factors responsible for the reluctance of surgeons to accept Cooper's ligament repairs have been discussed.

3 Absolute and equivocal criteria for the combined operation are given.

4 A classification of iliopectineal ligament hernioplasty has been presented from the point of view of evolution and correlation of the various technical maneuvers with the vulnerable area for which each variant was designed to correct.

5 A composite operation incorporating the different reparative departures of Cooper's ligament technique is submitted.

6 Often, because of one's enthusiasm there is a tendency to prejudge a technique before there is available adequate follow-up statistics. This should restrain our expectancy for any new or revived maneuver, no matter how valid it may seem at first. Fundamental principles, anatomical and surgical, still hold. The correlation of the weakness present with the knowledge of the available means for its repair remains paramount in the treatment of hernia.

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# SUPERFICIAL LOBECTOMY AND TOTAL PAROTIDECTOMY WITH PRESERVATION OF THE FACIAL NERVE IN THE TREATMENT OF PAROTID TUMORS

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**A**LTHOUGH mixed tumors of the parotid gland are relatively infrequent (comprising about 4 per cent of all tumors of the oral cavity and adjacent region) (12) still the high incidence of recurrence following excision gives them added importance. The recurrence rates of between 20 to 40 per cent (5), are due mainly to inadequate excision of the neoplasm. The very fact that the tumor is usually poorly encapsulated and contains myxomatous tissue, is probably directly responsible for its incomplete removal when the surgeon attempts to enucleate the tumor from the surrounding parotid tissue. Inadequate excision is also encouraged by the fear of injury to the facial nerve. By the usual surgical approach, the facial nerve is not visualized and consequently its position in relation to the tumor is unknown. The results of injury to the seventh cranial nerve are so blatantly evident that one can readily appreciate the tendency for the surgeon to be most conservative in an effort to avoid this disaster.

Recurrences following surgery are of importance because they tend to grow rapidly and disseminate far into normal tissue. Further, about 25 per cent of mixed tumors (14) tend to become malignant following the appearance of recurrent growths.

## ANATOMICAL CONSIDERATIONS

Anatomy textbooks (10) usually describe the seventh cranial nerve as running through the parotid gland. The careful dissections of McWhorter, however, showed that the facial nerve does not run through the parotid gland but rather it courses between the superficial and deep parts of this salivary gland. Our dissections on the cadaver substantiate McWhorter's findings.

The nerve has the same relationship to the two parts of parotid gland as a bookmarker has

to two pages of a book that it separates. After emerging from the stylomastoid foramen the nerve passes anteriorly and laterally to the mastoid process and then comes to be deep to the superficial portion of the gland. The nerve is then split into two main divisions, the temporofacial and cervicofacial nerves by the isthmus connecting the deep and superficial portions of the parotid. These divisions in turn, divide and emerge at the anterior border of the parotid as five terminal branches (Fig 1) the temporal, zygomatic, buccal, mandibular and cervical nerves.

McCormack, Cauldwell, and Anson have described in detail the variations of the terminal divisions of the seventh cranial nerve and the anastomosis connecting the cervicofacial and temporofacial divisions. Furthermore, they have confirmed the findings of McWhorter concerning the relationship of the facial nerve to the superficial and deep part of the gland.

The parotid has no true capsule. It is covered laterally by the parotidomasseteric fascia which is tough and dense posteriorly but becomes thin and fades at the anterior border of the gland. The gland lobules are held together by thin areolar tissue and this same type of connective tissue separates the medial surface of the superficial part of the gland from the facial nerve. The isthmus forming the superficial and deep portion of the parotid varies considerably in thickness, in fact, it may be entirely absent. The deep portion of the gland is wrapped about the external carotid artery and its two terminal branches, the internal maxillary and superficial temporal arteries. The posterior facial vein which is formed by the union of the superficial temporal and middle temporal veins passes down in the substance of the deep lobe of the parotid with the external carotid artery.

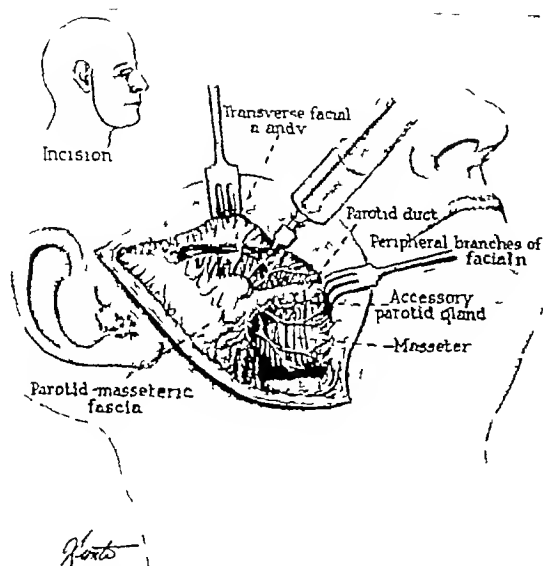


Fig 1 Skin flap dissected to expose entire superficial lobe of parotid. Dissection in the plane between the facial nerve and gland is begun anteriorly. The injection of a few cubic centimeters of saline in the loose areolar tissue between the parotid and the nerve aids the dissection. Insert shows skin incision.

#### OPERATIVE TECHNIQUE

The anesthesia used is Baird's solution (pentothal-curare solution) with oxygen administered through the intratracheal tube (4). The incision (Fig 1) extends vertically from the zygomatic process to a finger-breadth below the angle of the mandible and then forward to the posterior border of the submandibular gland. The vertical component of the incision passes through the natural longitudinal skin creases immediately in front of the external ear and hence is barely visible after it has healed. The horizontal component is similarly well hidden under the ramus of the mandible. The skin flap is then raised and dissected anteriorly until the anterior border of the parotid and the parotid duct are visible beneath the thin, fading parotidomasseteric fascia. This initial dissection of the skin flap must be done with meticulous hemostasis for the planes of dissection which must be obtained can readily be missed in a field which is being covered with blood from multiple small oozing points.

Beyond the medial (deep) to the exposed superficial portion of the parotid the terminal

branches of the facial nerve are readily seen (Fig 1). The parotid duct is next identified and transected. The distal end is tied with a No. 0000 suture and the proximal end is similarly treated, with forceps left attached so that gentle traction may be placed upon it. With any of the readily visible anterior terminal branches of the facial nerve as a landmark, blunt dissection is carried out gently and carefully by spreading with small curved mosquito forceps. The plane that must be entered is that between the medial (deep) surface of the superficial part of the parotid and the branches of the facial nerve. This plane is composed of loose areolar tissue and to facilitate its recognition gentle traction outward is put on the transected proximal end of the parotid duct. A few cubic centimeters of saline solution containing 6 drops of adrenalin to the ounce are also injected into this plane, so that an artificial separation is produced between the gland and nerve. The adrenalin causes local vasoconstriction and aids in effecting hemostasis. The dissection proceeds from the anterior border of the gland posteriorly until the level of the isthmus is reached (Fig 2). Greatest difficulty is experienced in starting the dissection anteriorly and particularly about the parotid duct where almost invariably several small communicating nerve fibers are closely adherent to the lateral aspect of Stenson's duct. The fact that this dissection must be done carefully, gently, and without haste cannot be too strongly emphasized. When the isthmus is reached the site of bifurcation of the main trunk of the facial nerve can be readily visualized and thus avoided in the remainder of the dissection. The posterior border of the superficial portion of the parotid is next dissected from the external auditory canal and adjacent sternomastoid muscle. This portion of the dissection is vascular and must be carried out slowly and carefully. By carrying this dissection anteriorly the isthmus and the seventh cranial nerve is again reached. By transecting the isthmus the superficial portion of the gland is removed. The deep portion is removed (Fig 3) by transecting the external carotid artery and posterior facial vein at the inferior border of the deep lobe, the superficial temporal artery and vein at the superior border and the inter

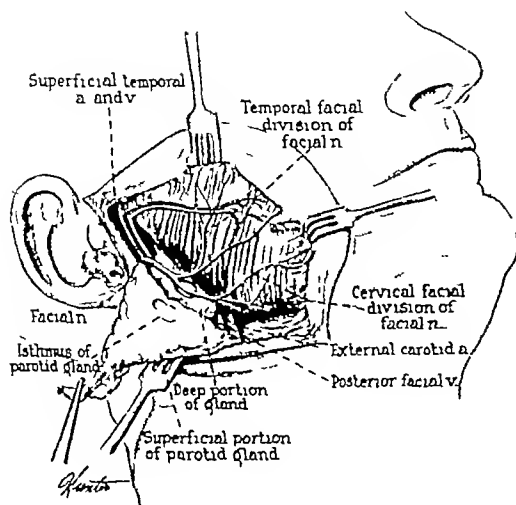


Fig 2 Superficial lobe of parotid dissected back to isthmus already transected. Note relationship between facial nerve and superficial and deep portions of parotid.

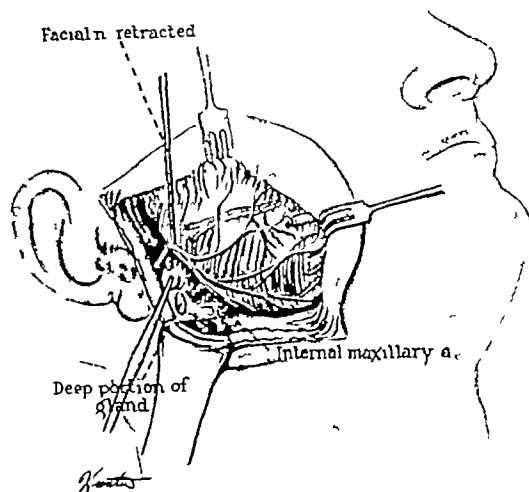


Fig 3 Superficial portion of gland has been resected. The facial nerve is retracted and the deep portion of the parotid is removed.

nal maxillary artery at the mid-portion of the anterior border of the deep lobe. By elevating the facial nerve with a nerve hook the deep part may be dissected away from the main stem of the nerve and lifted out as a separate unit.

The operative site is checked carefully for bleeding points and after thorough irrigation with saline solution, the subcutaneous tissues of the incision are approximated with No. 000 plain catgut and the skin is closed with interrupted No. 0000 silk. A small Penrose drain is brought out through a small stab wound posterior to the incision in a dependent portion beneath the angle of the mandible. This is left for 48 hours only.

#### INDICATIONS FOR SUBTOTAL AND PARTIAL PAROTIDECTOMY

Because mixed tumors of the parotid are usually so poorly delineated from the surrounding gland tissues and because they may be multicentric in origin (1, 15) we believe that attempts at enucleation of the tumor will result in continued high recurrence rates. For these reasons we have decided to treat some of the patients with tumors of the superficial lobe

of the parotid with superficial lobectomy, and in the remainder a total parotidectomy will be done. It is hoped by observing the recurrence rate in both groups that an answer will be available as to the best method of treating the superficial tumors.

Patients with tumors of the isthmus and deep portion of the gland should have total parotidectomies, similarly, if there is any suspicion as to the presence of malignant degeneration of the tumor, a total parotidectomy should be done.

#### CASE REPORTS

**CASE 1** A K, No 736705, a white female, 56 years of age, was first seen in the outpatient tumor clinic at the University Hospital on October 28, 1946, complaining of two masses just behind the angle of the mandible on the left side, of 3 months' duration. These masses had grown steadily but slowly until they collected to form one and had caused patient intermittent moderately severe pain, particularly on opening and closing of the jaws. Examination revealed a mass about 2 by 3 centimeters just behind the angle of the left mandible, with an irregular firm surface and well defined nodular border. The tumor was moderately tender. There were no enlargements of the left cervical nodes and the chest plate was negative for metastases. The clinical impression was mixed tumor of the left parotid. On December 30,



Fig 4, left A. K., 3 months after left total parotidectomy.  
Fig 5 Same patient. Note intact junction of facial nerve.

1946, a left total parotidectomy was done. The exposed tumor was ill-defined and appeared to be multinodular. It would have been very difficult to enucleate the tumor because of its apparent multinodular character. The pathological examination revealed the superficial portion of the parotid to be almost completely replaced by multinodular tumor with the largest nodules measuring up to 1.5 centimeters. Microscopic sections revealed the tumor to be composed chiefly of epithelial cells arranged in cords separated by hyaline connective tissue. In one or two areas were gland-like structures containing a mucous material in the center. The pathological diagnosis was cylindromatous type of mixed tumor. Following operation there was a temporary paresis of the muscles about the mouth which lasted for about 2 weeks. This patient was last seen on February 26, 1948. Examination revealed no evidence of recurrence and complete return of the facial nerve function (Figs 4, 5).

CASE 2. R. W., No. 776033, a white male, 35 years of age, was first seen at the University Hospitals, on February 26, 1947, complaining of a small mass beneath the right ear which had been present for about 25 years. During the 6 months prior to his hospital visit the tumor had increased in size, slowly but definitely, and in addition he noted pain down the right side of the neck. He also stated that he had noticed slight numbness of the right side of the face and slight asymmetry of the right corner of the mouth. Biopsy of the lesion by his doctor about 3 weeks prior to his admission to the University Hospitals resulted in a pathological report of mixed tumor of the parotid. Examination revealed a single mass, 3 by 4.5 centimeters, submandibular sub-auricular space with a recent biopsy scar over the prominence of the tumor. The facial nerve was intact and the remainder of the physical examination was essentially negative. On February 27, 1947, a right total parotidectomy was done. The skin overlying the mass was also removed. The pathological report revealed a single circumscribed mass 2 by 5



Fig 6, left R. W., 17 months following right total parotidectomy.

Fig 7 Same patient. Note intact junction of facial nerve.

centimeters in diameter in the superficial portion of the gland. Microscopically the tumor was of a mixed type composed chiefly of myxomatous tissue divided into coarse rounded lobules by slender strands of connective tissue. Throughout there were scattered epithelial cords. After operation the patient had slight paresis of the orbicular oculi muscle which lasted about 4 months. He was last seen on June 13, 1948, at which time there were no evidences of recurrence of the tumor, and the facial nerve function had returned completely (Fig 6, 7).

In addition to these 2 cases,<sup>1</sup> 4 patients had superficial lobectomies and 5 have had total parotidectomies, and in all individuals except one, the seventh cranial nerve has been spared. In one case with recurrent tumors the cervical branch of the facial nerve was inadvertently transected. These cases have been done too recently to warrant any comments concerning recurrences.

#### DISCUSSION

Our own anatomical dissections of the parotid gland confirmed the observations of McWhorter and led to the adoption of the surgical technique described. McCormack, Cauldwell and Anson also suggested from their dissections that parotidectomy could be done by starting at the anterior aspect of the gland. Sistrunk in 1921 and Adson and Ott in 1924 suggested the identification of the intramandibular branch of the facial nerve as the starting

<sup>1</sup>Since this paper was submitted for publication 11 additional patients have had superficial lobectomies and 9 have had parotidectomies.

point for removal of the parotid gland without injury to the facial nerve. Like H. Bailey (2) we have found it has been difficult to identify this branch readily in all patients.

Hamilton Bailey (2, 3) has also been a strong advocate of adequate exposure of the parotid gland before an attempt to remove the tumor is undertaken. He begins his dissection of the superficial lobe of the parotid at the lower anterior border of the gland. The main trunk of the facial nerve is identified posteriorly with the digastric muscle as a guide. Janes advocates identification of the stem of the facial nerve soon after it leaves the stylomastoid foramen. However, the depth of the stylomastoid foramen makes this approach to the facial nerve more difficult than the one described in this paper, where identification of the nerve fibers is made where they are superficial.

Parotidectomy performed by the technique described above is admirably suited for dealing with mixed tumors of the parotid. There is no question of trying to determine the extent of the tumor, of violating the pseudocapsule, and of injury to the facial nerve. Further, if there are multiple small tumors, as was present in one of the cases reported, or if there is a possibility of multiple foci of origin of mixed tumor as suggested by Ewing, total parotidectomy should result in a marked decrease in recurrent growths following surgery. The validity of this contention can be established only with the passage of time, for as McFarland pointed out, the average interval before recurrence after surgery was approximately 7 years, although a goodly number of recurrences appeared within a year of surgery.

By defining the anterior border of the gland, then dissecting posteriorly between it and the facial nerve the only part of the gland substance that is entered is the thin isthmus. This technique is used to facilitate the dissection. However, if the tumor occupies the isthmus, the transection of this part of the parotid is avoided and the whole gland is removed intact. This technique results in more handling and trauma to the facial nerve with a consequent longer period before recovery of its functions occurs.

Radical excision of the superficial portion of a parotid or a total parotidectomy should be

considered for all solid tumors of the gland, for these neoplasms should be assumed to be malignant until proved otherwise. On reviewing pathological sections of 210 parotid tumors at the Mayo Clinic, Quattlebaum and co-workers found 21 instances in which a previous diagnosis of a typical mixed tumor was reversed to adenocarcinoma of the cylindroma.

#### SUMMARY

1 The high recurrence rate following excision of parotid tumors is due primarily to inadequate excision of the tumor.

2 The lack of a true capsule and the myxomatous type of tissue of the tumor makes it difficult to determine the true extent of the neoplasm.

3 Fear of injury to the facial nerve also makes for inadequate conservative excision of parotid tumors.

4 The possibility that parotid tumors may be multiple or arise from multiple foci in different portions of the gland is also suggested as a possible cause of the high recurrence rate.

5 Radical excision of solid parotid tumors is also recommended because they may be malignant.

6 A surgical technique of superficial lobectomy of the parotid and total parotidectomy without injury to the seventh nerve is described.

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AUGUST, 1949

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### THE TREATMENT OF CARCINOMA OF THE VULVA

CARCINOMA of the vulva is not a clinical entity. At some unknown time long ago the custom was established of including under this term carcinoma of the glans clitoris, of Bartholin's gland, some other glandular tumors and, occasionally, melanosarcoma of the vulva, along with the more common epithelioma of the labia, adjacent perineum, and vestibule. These represent such a variety of lesions from almost all points of view that there would seem to be no justification for grouping them together. There are, however, two reasons for continuing the tradition. Therapy has been similar throughout the group though yielding different degrees of effectiveness. The common epithelioma makes up an overwhelmingly large proportion of the total tumors so that inclusion of the special tumors has not seriously interfered with the expression of results. They may then be considered as a group in the present discussion of treatment.

Carcinoma of the vulva has been a relatively rare disease. But since it is characteristically a disease of advanced age, an increasing number may be expected as the age of the population increases. In general, use is not being made of knowledge and experience, the application of which has been demonstrated to improve very significantly the end results. For these reasons, it would seem wise to try to reach an understanding as to the problems, the attack, and the rewards in this condition. The object of this discussion is to demonstrate the applicability, effectiveness and safety of single stage radical vulvectomy under local anesthesia and to urge the acceptance of it as the standard method of treatment.

An astonishing variety of combinations of treatment forms has been applied to vulva carcinoma. At the University of Minnesota from 1928 through 1938, there were approximately half as many such combinations used as there were patients treated. This yielded a five year cure rate of 15 per cent. No single stage radical vulvectomy was done during this time but all manner of combinations of simple vulvectomy, gland resection, x-ray, surface and interstitial radium were used. Such excessive individualization of therapy can mean only that none of it was satisfactory, and the result produced would seem to confirm this. Anyone who has studied such clinical material will have little difficulty in arriving at the conclusion that simple vulvectomy is not an effective method of treatment. Irradiation is not even useful as a palliative procedure. Adequate depth doses cannot be obtained without destroying the skin of this sensitive area. And the tumor is radioresistant. While no standard arrangement of the two stage combina-

tion of vulvectomy and bilateral gland resection was applied in this material, the combination as it was carried out was not sufficiently effective to recommend it

One gets the impression that three attitudes have brought about the decision to undertake minor forms of treatment. Many of the patients are old and there is a very natural fear of the surgical risk involved. The poor results of minor therapy in these have been observed and the conclusion drawn that the disease is relatively incurable. And finally, too much importance has been ascribed to the problem of obtaining primary healing of the wound in the more extensive dissection of the single stage procedure.

On the other hand, the single stage radical removal of the vulva together with the inguinal and femoral glands in one intact piece has many attractions. It satisfies the generally applicable basic principles of surgical attack on malignant disease. Dissection is carried out in healthy tissue without cutting into the tumor or its lymph drainage area. This latter is removed intact to a point beyond which extension of the surgery will add more to the mortality of the procedure than it will to the cure rate. Bilateral gland removal is always done since it has proved impossible to determine accurately by clinical examination the presence or absence of gland metastasis, and since contralateral metastasis is frequent. The poor results shown to follow lesser procedures recommend the radical approach.

And now let us see what can be done with this radical approach. If it is to be useful, it must have a wide applicability, be reasonably free of serious after effects, produce a real increase in the cure rate and have a reasonably small primary procedural mortality. Ten years ago the department of obstetrics and gynecology at the University of Minnesota Medical School set out to study these prob-

lems. Only single stage radical vulvectomy under local procaine and adrenalin anesthesia was used in treatment. Except for minor variations in technique, this has not been changed during the period of study. The results have been reported in detail elsewhere. Every patient was included, whether she had been previously treated or not. Many had practically hopeless recurrences when first seen. A number had been refused treatment as hopeless by competent gynecologists. Some of the five year cures were derived from this latter group.

In more than 90 per cent of the patients, single stage radical vulvectomy was carried out. Four were not so treated because of extensive metastases above the inguinal and femoral gland groups. One refused treatment and one had no demonstrable tumor on biopsy or on examination of the simple vulvectomy specimen by two departments. It was found later as a microscopic tumor when the specimen was being completely cut for other purposes. No patient was excluded from surgery because of the local extent of the tumor or because of other physical abnormality. The applicability of the procedure is then practically complete where any reasonable hope of recovery exists. One is satisfied that the largest single factor in this degree of applicability lies in the use of local anesthesia.

No serious after effects have been seen. Occasionally edema of one or both legs may be present, particularly in obese women, for some time after operation. This has never been more than a nuisance. The local scar has not produced trouble.

More than 50 per cent of these patients were alive and free of tumor after five years. In view of the fact that a large proportion of these patients had advanced or recurrent tumor and many were very elderly, this cure rate would lead to the conclusion that carcinoma of the vulva ranks among the best of the

human cancers in its response to adequate therapy. Indeed, given a patient with a reasonable life expectancy and a reasonably early tumor which has not been tampered with, radical vulvectomy offers an excellent probability of permanent cure.

What operative mortality price was paid for this? Six per cent of the patients operated upon died before discharge from the hospital. None of these died in immediate association with the surgical event. One very old lady simply faded away some weeks after surgery and even autopsy failed to show a definite cause. One, who had a complete heart block before operation eventually died of this. One with a known preoperative pyelonephritis underwent a flare-up of this and died as a result. Two deaths were caused by pulmonary emboli. This does not seem to be too great a price to pay for the results achieved.<sup>1</sup>

It would seem fair to conclude that single stage radical vulvectomy under local anesthesia routinely applied as early as possible but irrespective of the earliness or lateness of the local tumor and almost irrespective of the age or general physical status of the patient, offers the opportunity of reasonably safely increasing by three to five fold the salvage rate of lesser procedures sometimes used in the treatment of carcinoma of the vulva.

JOHN L. MCKELVEY

## STREPTOMYCIN IN SKELETAL TUBERCULOSIS

AS clinical data accumulate, it is evident that streptomycin and its derivatives are really effective weapons for use in the treatment of tuberculosis of the bones and their allied structures. Tuberculosis, a slow unrelenting process, must be observed

for prolonged periods in order to determine its progression or arrest. This is especially true of tuberculosis in and about bones; therefore, these observations are being made with caution on tuberculosis of bones and joints.

It has been pointed out many times that when a therapeutic agent is carried to its desired destination by the blood stream, it does its best work if this region is flushed with blood. To date the best results from use of streptomycin in the treatment of tuberculosis of bones and allied structures have been in early tuberculosis of the soft tissues and synovia before bony involvement or soft tissue fibrosis has developed. At this time, frequently, the diagnosis is in doubt, but it should be proved by biopsy, culture, and animal inoculation. In several proved cases of synovial tuberculosis, a second biopsy after a course of streptomycin therapy has been negative for tuberculosis. The clinical results have been just as dramatic and what appears to be a cure has been effected. Fulminating open lesions of the extremities have been seen to return to a nearly normal status after a course of treatment with streptomycin. In the past many tuberculous sinuses and bursae were excised and cured without streptomycin, but with streptomycin as an adjunct complete and thorough excision of these lesions now can be done with greater assurance of healing.

Tuberculous lesions of the shafts of long bones are sufficiently rare, so that, as far as I know, no experience has been gained in their treatment with streptomycin.

The treatment of tuberculosis of joints presents two distinct problems. In a weight bearing joint where the demand is for a nearly normal structure which can maintain its function without mechanical flaws, the problem is more difficult than in a nonweight bearing joint where the demand on the joint is not so exacting. In the weight-bearing joints it

<sup>1</sup>For further details reference is made to the *American Journal of Obstetrics and Gynecology*, 1947, 54, 676 and to the multiple reports of Taussig.

especially is important, then, to make an early diagnosis and institute treatment while the infection is still limited to the synovia and cartilaginous margins of the joint. When the diagnosis is made thus early, these joints have been and can be salvaged and their function retained. There are decided opinions as to whether joints of this sort should be immobilized during treatment. Traditionally, rest is indicated for the cure of tuberculosis. Practically more hyperemia and active dispersal of the streptomycin throughout the joint and its adjacent structures may occur when active motion without weight bearing is allowed. In cases which I have observed personally, the joint has been less stiff after treatment is stopped if it is allowed to be mobile during treatment. Obviously, streptomycin can be considered only an adjunct to surgical treatment when the articular surfaces are sufficiently destroyed so that even if the tuberculosis were arrested, traumatic arthritis would be present. It seems to me, however, that a preoperative course of treatment with streptomycin has allowed excision and arthrodesis in cases of fulminating tuberculosis of the joints in which the chances of success without it were slight. In the past amputation would have been necessary in many of these cases. Treatment with streptomycin also seems to have lessened the danger of disseminated tuberculosis and persistent draining sinuses and mixed infections do not appear to be as common before operation as formerly.

In lesions of the nonweight-bearing joints, it does not appear that arthrodesis will need to be recommended as frequently as it was when streptomycin was not available. This statement is made with some reservations because, in cases of extensive fibrotic and sclerotic tuberculosis about these joints a period of arrest followed by reactivation in a year or two has been noted. This reactivation may

or may not be controlled by a second course of streptomycin. The danger of appearance of strains of tubercle bacilli resistant to streptomycin has to be considered in these cases. Experience is not great enough, as yet, for anyone to know whether streptomycin should be considered an adjunct to surgery or as a complete therapeutic agent for tuberculosis of these joints. It is possible that, at present, with the more conservative attitude, we are missing the golden opportunity to succeed with arthrodesis. We will have to await the lesson of experience.

Solutions of streptomycin have been injected into the joints but the drug appears to be somewhat irritating. Clinical experience has shown, however, that effective concentrations can be obtained within the joint by intramuscular injection.

Tuberculosis of the spinal column presents a somewhat more difficult problem of analysis. Even when roentgenograms are good, critical evaluation of destruction and repair can vary within broad bounds. Conclusions on results must be slowly formed because of the nature of the disease and the nature of bone repair itself. Thus far, preliminary surveys are mildly favorable. If the disease is fairly advanced and was discovered late, too startling a result cannot be expected. The disease is serious enough so that all modes of treatment, including streptomycin, are being used. Rest and spinal fusion in the past effected cures so that everyone concerned must be cautious about giving too much credit to streptomycin. I believe, however, that it facilitates the process of healing.

The exact place of streptomycin in the treatment of tuberculosis of bones and allied structures is not known as yet. At the end of the next decade of study its place should be evaluated better than at present.

WILLIAM H. BICKEL

# THE SURGEON'S LIBRARY

## REVIEWS OF NEW BOOKS

THE fourth book in the series *British Surgical Practice*<sup>1</sup> begins with the subject of "Facial Palsy" and ends with "Hiccup."

The editors have adhered closely to their original promise to select authorities in each field and to permit each author to develop his topic without interference. Subjects are listed in alphabetic order entirely, so there is no central theme for any one volume. Concise review of the entire volume is therefore impossible, but certain features are outstanding and deserve comment.

Many of the topics in the present volume might be considered decidedly nonsurgical in scope, for example, filariasis, frostbite, gonorrhea, gout, and herpes zoster, and the casual observer might feel that for the sake of brevity many of these could be omitted. However, the set of volumes includes at least brief references to many situations which will confront the doctor, especially one who is in a remote community. The delightful style apparent in the first 3 volumes is still a feature and makes pleasant reading.

The discussion of facial palsy emphasizes injuries to nerves likely to occur in performing radical mastoidectomy. The illustrations are excellent, the outline method of presentation is convenient, and the general discussion is adequate. The enthusiasm of the author of this section for various procedures leads the reader to feel that operations, such as nerve crossing and anastomosis, are attended by far happier results than certain American authorities have achieved.

The chapter on maxillofacial injury is clear and concise. Most of the present knowledge on this subject is included, although the references are a bit brief. It is interesting to note that in the discussion of treatment of fracture of the jaw space is devoted to the use of multiple pins for external fixation. It seems somewhat surprising that there is so little mention of war injuries. Complications and post-operative care could well have received more detailed discussion.

A fascinating chapter on fascial grafts by no less an authority than Professor Gallie presents the background for use of fascia as a living or nonliving suture, and there are excellent illustrations of the proper application of the suture. The convenience of the Masson stripper is emphasized. The reviewer

realizes that the use of fascial grafts may become a lost art if the young surgeon of today does not master the technique required for successful use of this valuable aid because so many foreign substances, such as wire, screen, and mesh gauze, are now being used to supplant fascial grafts. Professor Gallie's chapter is most timely in that regard.

The miscellaneous chapters on fields of greater or lesser surgical interest will probably be of use to a limited group of surgeons. A long and complete outline on surgery of the foot is outstanding, and the diagrams and illustrations are very practical, they will probably be used widely as an authoritative reference for the busy practitioner. Other chapters deal with orthopedic problems including those of the upper extremity, clavicle, femur and some of the smaller bones. It is noteworthy that considerable space is devoted to the use of appliances and splints, and relatively little comment is directed toward open operation with internal fixation which is used extensively in many centers today.

One of the most valuable chapters is the one dealing with the gall bladder and bile passages. A convenient outline presents briefly the historical background where indicated and, at the same time, brings the reader up to date on many of the newer concepts. The portion dealing with acute cholecystitis is in complete accord with leading surgical thought in America. Warnings are sounded at the proper places and pitfalls and safeguards are stressed properly. Each feature is catalogued in alphabetic sequence and, although brevity is the keynote of the chapter, completeness is one of its strong points. The American surgeon will note with interest the discussion on acquired stricture of the common bile duct. Recently, American specialists in internal medicine have tended to point to Great Britain because it seemed that tragedy of this type was almost unheard of there. However, British surgeons apparently still do encounter an occasional case and have just as much difficulty with this problem as American surgeons have. It is noteworthy that the author predicted a brilliant future for those patients who had undergone reconstruction of the common bile duct over vitallium tubes. It may not be common knowledge but the fact remains that the use of vitallium tubes has been met with almost universal failure because they become plugged. Little is included concerning the Whipple operation and its modifications. The assumption is that a subsequent volume will contain more discussion of malignant lesions in the biliary system.

<sup>1</sup>BRITISH SURGICAL PRACTICE. Under the general editorship of Sir Ernest Rock, Carling FRCS FRCP, and J. Patterson Ross MS FRCS Vol. 4. London: Butterworth & Co Ltd. St. Louis: The C. V. Mosby Co. 1943.

The chapter on gas gangrene follows a logical sequence, namely, a comparison of the experiences in World War I with those in World War II. It is of interest that the author felt that penicillin might change the entire picture of this dread complication. The consensus now is that penicillin has been of little or no value in the treatment of patients who have gas gangrene, at least this proved to be true in the series of cases observed in the American army in the Pacific area.

One reads with mixed opinions the chapter on gland puncture and aspiration biopsy. This seems to be a controversial topic throughout the civilized world today. Although most of the points that the author makes are undoubtedly true and the illustrations he presents are excellent, many American authorities hold this technique in a questionable light. They feel that for biopsy removal of actual tissue with the scalpel is a thorough and less dangerous method. Many surgeons in America endeavor to supply the pathologist with an adequate amount of tissue for a final opinion and feel that this method is more satisfactory than obtaining the specimen for biopsy with the needle. In the United States there has been an evolution from obtaining a specimen of the liver for biopsy by needle. Two years ago the great enthusiasm for this method led to the inevitable situation hemorrhage was encountered which required laparotomy for control. In scattered reports it has now been learned that in a few cases this type of biopsy has resulted in death of the patient.

Some miscellaneous topics are of considerable interest if only because of the knowledge that the data are available for ready reference in this volume. The chapters concerning gunshot wounds are rather too brief, inasmuch as the average reader of these volumes will undoubtedly be in a position to require considerable information on the proper management in this type of case. Strangely enough, more space is devoted to reconstructive surgery than to acute injuries. The same criticism might apply to this volume which was offered in previous volumes, namely, that patients requiring reconstructive surgery might profit greatly if they were referred to special centers where proper definitive treatment could be carried out.

The detailed discussion of hernias is indeed timely, as the tremendous advances in surgery might lead the young surgeon to overlook this type of lesion. Thorough understanding of the primary situation should reduce the necessity for much experience with recurrent hernias. This part of this volume is one of the most valuable of all.

The volume ends with a short chapter on hiccup. Evidently this is as much of a problem in the British Isles as it is in the United States and the variety of methods used in attempts to overcome this distressing condition is testimony to the obvious fact that there is no reliable method. Brief comment is made about interruption of the phrenic nerve with the conclusion that "this can rarely be justified."

E S JUDD, JR

THE fourth edition of the *Manual of Urology*<sup>1</sup> by Ralph M. LeComte is a valuable contribution to the field of urologic literature.

The author has tried to write for the student beginning the study of urology. This aim has been achieved, and the simplicity of the text is one of its most outstanding features. It should be in the hands of every senior medical student.

That portion of the text dealing with infections of the urinary tract is as up to date as it can possibly be. The material on chemotherapeutic agents and antibiotics is authoritative and is clearly written.

It is of interest to notice how the author handles such controversial material as nephropotosis and ureteral stricture. His words are certainly conservative.

He believes that all diagnostic procedures and all other therapeutic procedures should be carried out carefully before considering nephropexy. Likewise, he feels that, while a ureteral stricture certainly may occur, its frequency is not as great as formerly believed, and the symptoms it causes are not as legion as previously considered.

One of the best sections in the book is that concerning the treatment of benign prostatic enlargement. The author considers all sides of this problem and then gives his own opinion. He favors open operation except in cases of small enlargement and cases of fibrosis of the vesical neck. In these cases, he believes that transurethral resection definitely is indicated.

The chapter on impotence and sterility in the male should be read by all practicing urologists and should benefit the general practitioner as well.

THOMAS L. POOL

IN the volume *Principi di chirurgia del cervello e del midollo spinale*<sup>2</sup> (Principles of Surgery of the Brain and Spinal Cord), Africo Serra deals mostly with the surgical technique devised by Cushing, de Martel, Fedor Krause, Olivecrona, Elsberg, Frazier and their predecessors. Few of the recent advances are described or even mentioned in this book. The most important chapters deal with the subtemporal and suboccipital decompressions, the puncture of the corpus callosum for decompressive purposes, the frontal, frontoparietal and parieto-occipital craniotomies for the removal of tumors or the cure of Jacksonian epilepsy, the different types of craniotomies of the posterior fossa, the temporal craniotomy for the relief of trigeminal neuralgia and the laminectomies. In 2 long, and perhaps the most interesting chapters, the author discusses the postoperative courses of the various types of brain tumors and their complications. He pays a great deal of attention to the influence of cerebral edema. The action of disturbances of the mesencephalic medullary centers on the centers of respiration, blood circulation, and

<sup>1</sup>MANUAL OF UROLOGY. By R. M. LeComte, M.D. F.A.C.S. 4th ed. Baltimore: The Williams & Wilkins Co., 1948.

<sup>2</sup>PRINCIPI DI CHIRURGIA DEL CERVELLO E DEL MIDOLLO SPINALE. By Africo Serra. Bologna: Licio Cappelli, 1948.

heart is illustrated by interesting case reports and is discussed from anatomical points of view.

Shorter chapters deal with interventions on the lateral and the third ventricles, however, the widely used Torkildsen procedure is completely ignored. The treatment of spastic torticollis is the one devised by Dandy and Olivecrona. The surgery of intracranial aneurysms is only briefly mentioned and the author states that he had only one such case. He also fails to mention the treatment of brain abscess, intracranial and intracerebral hematoma, hydrocephalus, platybasia, etc. He does not discuss any diagnostic studies, or the management of cranio-cerebral injuries.

The great value of the book lies mostly in the beautiful illustrations and especially the excellent colored drawings of operative fields and anatomical dissections made by the author himself. It also contains a large number of operative photographs showing the major steps in the various types of craniotomies. This 569 page book contains 401 text illustrations and 52 plates.

GEORGE PERRET

**THE** author of *Bronchogenic Carcinoma and Adenoma*<sup>1</sup>, B. M. Fried, has drawn on the extensive experience of the Division of Chest Diseases of the Montefiore Hospital in New York and on the surgical literature in preparing this monograph.

**BRONCHIOGENIC CARCINOMA AND ADENOMA WITH A CHAPTER ON MEDIASTINAL TUMORS** By B. M. Fried, M.D. Baltimore: The Williams & Wilkins Co. 1948.

The chapters on the medical aspects of carcinoma of the bronchus are adequate and are profusely illustrated with pictures of gross specimens, photomicrographs, and reproductions of roentgenograms of the chest. In contrast, the treatment of the condition is covered inadequately, only 3 pages being devoted to the discussion of the surgical treatment. The same criticism might be applied to the chapter on adenoma of the bronchus, the treatment of which is discussed briefly in one-half page.

The questions of alveolar cell carcinoma and adenomatosis of the lungs are discussed together in a special supplement although there is no evidence that there is any relation between them. The author takes the dogmatic stand that alveolar cell carcinoma does not occur, attributing the condition to canalicular metastases from an invisible or overlooked carcinoma of the bronchus.

There is a lengthy discussion of the coincidental occurrence of carcinoma of the bronchus and pulmonary tuberculosis in the same patient. Another chapter is devoted to hypertrophic pulmonary osteoarthropathy which the author suggests is due to a "disturbance in the function of the organs of internal secretion." There is a final chapter on mediastinal tumors but this is incomplete and is of questionable value in this book.

Although the book is a worthwhile addition to the literature on carcinoma of the bronchus it does not satisfy the need for a complete review of our present knowledge about the condition. DAVIN C. WALKER

## BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

**TEXTBOOK OF HISTOLOGY** By Jose F. Nonidez, D.Sc., and William F. Windle, Ph.D., Sc.D. 1st ed. New York: Toronto and London: McGraw Hill Book Co., Inc., 1949.

**ARTHRITIS AND ALLIED CONDITIONS** By the late Bernard I. Comroe, M.D. Edited by Joseph L. Hollander, M.D., and collaborators. 4th rev. ed. Philadelphia: Lea & Febiger, 1949.

**PSYCHOSOMATIC MEDICINE, THE CLINICAL APPLICATION OF PSYCHOPATHOLOGY TO GENERAL MEDICAL PROBLEMS** By Edward Weiss, M.D., and O. Spurgeon English, M.D. 2d ed. Philadelphia: W. B. Saunders Co., 1949.

**ARMY FOOT SURVEY, AN INVESTIGATION OF FOOT AFFECTIONS IN CANADIAN SOLDIERS** By Colonel R. I. Harris, M.C., R.C.A.M.C. and Major J. Beath, R.C.A.M.C. Vol. 1. Main Report. Ottawa: National Research Council of Canada, 1947.

**THE PRENATAL INFANT, MEDICAL AND NURSING CARE** By Julius H. Hess, M.D. and Evelyn C. Iundeen, R.N. 2d ed. Philadelphia: London and Montreal: J. B. Lippincott Co., 1949.

**MEDICINE OF THE YEAH** By Hugh J. Morgan, M.D. and Frank Whitacre, M.D. Henry G. Poncher, M.D. and

Warren H. Cole, M.D. Under the editorial direction of John B. Youmans, M.D. Philadelphia, London and Montreal: J. B. Lippincott Co., 1949.

**DIE INDIVIDUELLE REAKTIONSWEGE BEI CHIRURGISCHEN INFektionsPROZessen** By Dr. Gerd Hegemann. Leipzig, Göttingen, and Heidelberg: Springer Verlag, 1949.

**ANNALS OF ROENTGENOLOGY, A SERIES OF MONOGRAPHIC ATLASSES** Vol. 17—ROENTGEN DIAGNOSIS OF THE FRIGIDITIES AND SPINE. 2d ed. rev. ed. By Albert B. Ferguson, M.D. New York: Paul B. Hoeber Inc., 1949.

**DEMONSTRATIONS OF PHYSICAL SIGNS IN CLINICAL MEDICINE** By Hamilton Bailey, F.R.C.S. (Hon.), F.R.C.S. (Ed.), F.R.C.S. (F.R.S.), 11th ed. Baltimore: The Williams & Wilkins Co., 1949.

**REGIONAL ILIITIS** By Burrill B. Crohn, M.D. New York: Grune & Stratton, 1949.

**EXPERIMENTAL SURGERY, INCLUDING SURGICAL PHYSIOLOGY** By J. Markowitz, M.B. 11th ed. Baltimore: The Williams & Wilkins Co., 1949.

**MEDICAL ETYMOLOGY, THE HISTORY AND DERIVATION OF MEDICAL TERMS FOR STUDENTS OF MEDICINE, DENTISTRY, AND NURSING** By O. H. Perry, M.D. Philadelphia, London: W. B. Saunders Co., 1949.

**OPERATIVE TECHNIQUE IN GENERAL SURGERY** By Warren H. Cole, M.D., F.A.C.S. Introduction by H. Lahey, M.D., F.A.C.S. New York: Appleton-Crofts Inc., 1949.

# CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

DALLAS B. PHEMISTER, Chicago, *President*  
FREDERICK A. COLLIER, Ann Arbor, *President-Elect*

## PRELIMINARY PROGRAM FOR THE 35th CLINICAL CONGRESS—THE STEVENS, CHICAGO OCTOBER 17 TO 21, 1949

**A**LWAYS an outstanding international event, the Clinical Congress of the American College of Surgeons will in 1949 be exceptionally world-wide in representation because it will include the Sixth Inter-American Congress of Surgery and because many delegates from the thirteenth Congress of the International Society of Surgery which meets in New Orleans the previous week are planning to attend the Chicago Congresses. The Sixth Inter-American Congress of Surgery will actually be a seven-day meeting, extending from October 17 through 23, since it is meeting concurrently with the Clinical Congress of the American College of Surgeons and will continue in session two days after its close. Headquarters for both meetings will be at The Stevens.

Through the membership of the American College of Surgeons in the Association of Inter-American Congresses of Surgery, every Fellow is a member of the latter group and is entitled to attend its scientific and social sessions on Saturday and Sunday. The members of the signatory societies of the Association are likewise entitled to attend the Clinical Congress clinics and sessions. These facts should be borne in mind in making hotel reservations. The Inter-American Congress offers an excellent opportunity to enhance the international prestige of the American College of Surgeons, as well as to familiarize North American Fellows and overseas guests with surgical progress in the other Americas.

Preliminary plans for the Sixth Inter-American Congress of Surgery are described in a separate article which follows. It will be noted that the inaugural session, open to delegates only, will be held on Friday morning, October 21. The scientific sessions on Saturday and Sunday, and the official banquet on Saturday evening, are open to

all Fellows, whose presence will help to demonstrate how deeply interested the American College of Surgeons is in the cultivation of mutually beneficial professional and social relationships among surgeons throughout the Americas.

### PRELIMINARY PROGRAM

A varied and comprehensive program of meetings will be held at the headquarters hotel. A general assembly for both surgeons and hospital personnel will be the opening session on Monday morning, October 17. Scientific sessions, official meetings, hospital conferences, showings of medical motion pictures, and telecasts will follow during the five days of the Clinical Congress. The special sessions of the Sixth Inter-American Congress of Surgery on Friday, Saturday, and Sunday, will, according to present plans, be held in the John B. Murphy Auditorium of the College. All registrants for both Congresses will be interested in the extensive display of technical and scientific exhibits in the exhibition hall.

### CLINICS

Operative and nonoperative clinics will be held in some twenty hospitals in the Chicago area each day during the Clinical Congress. The hospitals which will participate in the clinical program, and which are listed later in this article, are approved by the American College of Surgeons for graduate training in surgery. The schedule of clinics, which will cover general surgery, obstetrics and gynecology, fractures and other traumas, orthopedic surgery, thoracic surgery, plastic surgery, neurosurgery, genitourinary surgery, and ophthalmology and otorhinolaryngology, will be published in a *Daily Clinical Bulletin* which will be issued each day during the Clinical Congress. The clinic schedules will also be posted on bulletin boards.



## TELEVISION

Operations will be telecast, in color, to the hotel from St. Luke's Hospital at scheduled periods each day. The television program will be over a closed circuit, impossible to pick up on public sets. The operations and demonstrations will be transmitted to about twenty color transmission receivers in the hotel. The engineers anticipate excellent reception since the hospital is in a direct line of vision from the roof of The Stevens. The television will be sponsored by Smith, Kline & French Laboratories.

The successful demonstrations of television at the Clinical Congress in New York in 1947, and at the Clinical Congress in Los Angeles in 1948, make it highly desirable to continue the use of this medium. Even when limited to black and white images, as it was then, the surgeons were most enthusiastic.

Television has proved to be an ideal means of furthering the "Show me" purpose which was the main incentive for the founding of the Clinical Congress of Surgeons of North America in 1910, three years before the American College of Surgeons was organized. That first Clinical Congress was held in Chicago. The 1949 meeting will be the ninth held in that city.

## PRESIDENTIAL MEETING

The Presidential Meeting will be held on Monday evening, October 17. At this meeting the officers-elect, consisting of Dr. Frederick A. Collier of Ann Arbor, president, Dr. Donald G. Tollefson of Los Angeles, first vice-president, and Dr. Robert M. Moore of Galveston, second vice-president, will be installed. The outgoing president, Dr. Dallas B. Phemister of Chicago, will preside and will deliver the Presidential Address. His subject will be "An Evaluation of Fulltime and Group Practice for the Clinical Faculty of a Medical School."

Sir James R. Learmonth of Edinburgh will deliver the fourth Martin Memorial Lecture. His subject will be "Collateral Circulations, Natural and Artificial."

## CONVOCATION

The formal initiation ceremonies for the new Fellows will be a colorful feature of the annual Convocation which will be held on the final evening, Friday, October 21. Honorary fellowships will also be conferred on this occasion. Lord Webb-Johnson of London, president of the Royal College of Surgeons of England, will deliver the Fellowship Address. His subject will be "Science in Surgery: Stop, and Look, and Listen."

EVENING SCIENTIFIC SESSIONS—  
GENERAL SURGERY

The program and speakers for the Tuesday evening general surgery session will be as follows:

Symposium—Acute Surgical Emergencies in Gynecology and Obstetrics

General Introduction NEWELL W. PHILPOTT, M.D., F.A.C.S., Montreal

Tubal Pregnancy, Its Diagnosis and Treatment LEWIS C. SCHEFFEY, M.D., Philadelphia

Pelvic Peritonitis Occurring in the Obstetrical or Gynecological Patient FRANK GIEN, M.D., F.A.C.S., New York

Emergency Cesarean Section WILLIAM L. STUDDIFORD, M.D., F.A.C.S., New York

The program and speakers for the Wednesday evening general surgery session will be as follows:

Fracture Oration: Fracture Hazards OTTO J. HERMANN, M.D., F.A.C.S., Boston

Symposium—Blood Coagulation and the use of Anticoagulants

The Significance of Different Methods for Prothrombin Estimation and their Relative Values JOHN H. OLWIN, M.D., Chicago

Studies on Antithrombin and Etiologic Factors in Phlebothrombosis JOHN H. KAY, M.D., New Orleans

A Further Report on Dicumarol Prophylaxis against Venous Thrombosis in Women Undergoing Surgery GEORGE VAN S. SMITH, M.D., F.A.C.S., Brookline, Massachusetts

The program and speakers for the Thursday evening general surgery session will be as follows:

Symposium—Malignant Disease

Chemotherapy in Malignant Neoplastic Disease CARL V. MOORE, M.D., St. Louis

Hormone Therapy of Cancer CHARLES H. HUGGINS, M.D., Chicago

The Use of Radioactive Iodine in Studying the Pathologic Physiology of Thyroid Cancer RULON W. RAWSON, M.D., New York

What We Have Learned from Isotopes Concerning Depletion and Repair in Surgical Patients FRANCIS D. MOORE, M.D., F.A.C.S., Boston

## GENERAL SURGERY PANEL DISCUSSIONS

General surgery panel discussions will be held on Monday, Tuesday, and Wednesday afternoons from 1:30 to 3:00 and from 3:30 to 5:00 p.m. The subjects and the names of the members will follow.

*Monday—1 30 to 3 00 p m*

Surgical Lesions of the Breast GEORGE G  
FINNEY, M D , F A C S , Baltimore

*3 30 to 5 00 p m*

Fractures of the Skull ELDRIDGE H CAMPBELL,  
M D , F A C S , Albany

*Tuesday—1 30 to 3 00 p m*

Massive Upper Abdominal Hemorrhage JOHN H  
MULHOLLAND, M D , F A C S , New York

*3 30 to 5 00 p m*

New Surgical Techniques in Drug Treated Infec-  
tions CHAMP LYONS, M D , New Orleans

*Wednesday—1 30 to 3 00 p m*

The Management of Acute Emergencies Occur-  
ring During Operations I MIMS GAGE, M D ,  
F A C S , New Orleans

*3 30 to 5 00 p m*

Preoperative and Postoperative Care and Anes-  
thesia for Infants THOMAS H LANMAN, M D ,  
F A C S , Boston

#### SPECIAL FIELDS OF SURGERY

*Friday 1 30 to 4 45 P M*

On Friday afternoon there will be panel discus-  
sion sessions for six special fields of surgery as  
follows

#### *Orthopedic Surgery*

GUY A CALDWELL, M D , F A C S , New Orleans,  
*Moderator*

*1 30 to 3 00 p m*

Management of Established Non-Union of the  
Long Bones

*3 15 to 4 45 p m*

Indications and Technique for Arthrodeses of the  
Joint of the Foot and Ankle in Post-traumatic  
Conditions

#### *Plastic Surgery*

JEROME P WEBSTER, M D , F A C S , New York,  
*Moderator*

*1 30 to 3 00 p m*

Plastic Surgery and the Treatment of Malignant  
Skin Disease

*3 15 to 4 45 p m*

The Use of Skin Homografts

#### *Urology Surgery*

GEORGE F CAMILL, M D , F A C S , New York,  
*Moderator*

*1 30 to 3 00 p m*

Hydronephrosis Due to Upper Ureter Obstruction

*3 15 to 4 45 p m*

Ureteral Intestinal Transplantation

#### *Thoracic Surgery*

BRIAN B BLADES, M D , F A C S , Washington,  
*Moderator*

*1 30 to 3 00 p m*

Surgery of the Heart and Great Vessels

*3 15 to 4 45 p m*

Intrathoracic Tumors

#### *Neurological Surgery*

ALFRED W ADSON, M D , F A C S , Rochester,  
Minnesota, *Moderator*

*1 30 to 3 30 p m*

Chemical and Physical Diagnostic Aids in the  
Localization of Brain Tumor

*3 30 to 4 45 p m*

Diagnosis and the Localization of Intraspinal  
Tumors

#### *Obstetrics and Gynecology Surgery*

FRANKLIN L PAYNE, M D , F A C S ,  
Philadelphia, *Moderator*

*1 30 to 3 30 p m*

Carcinoma of the Uterine Cervix—Modern Con-  
cepts in Diagnosis and Treatment

*3 15 to 4 45 p m*

Cesarean Section—Should the Latitude of its  
Indications be Broadened?

#### OPHTHALMOLOGY AND OTOLARYNGOLOGY

On Tuesday, Wednesday and Thursday sepa-  
rate programs are being planned for specialists in  
each of these two fields of surgery Special em-  
phasis will be given this year to hospital operative  
clinic programs The detailed programs for the  
Ophthalmology section and for the Otolaryn-  
gology section will be announced later

#### FORUM ON FUNDAMENTAL SURGICAL PROBLEMS

The Forum on Fundamental Surgical Problems  
will be held on Monday through Thursday after-  
noons, and Tuesday through Friday mornings  
Brief reports of original clinical and experimental  
observations relating to the broad aspects of sur-  
gery and the surgical specialties will be presented,  
under the general direction of Dr Owen H Wan-  
gensteen, chairman of the committee, Forum on  
Fundamental Surgical Problems

The Thursday afternoon session will be conducted by Dr I S Ravdin of Philadelphia as a seminar on "Nutritional Problems Including a Consideration of Fluids and Electrolytes"

#### SYMPOSIUM ON CANCER

On Wednesday afternoon, from 2 00 to 5 00 o'clock, a Symposium on Cancer will be held. Speakers will include Dr Hamilton Montgomery, of Rochester, Minnesota, Dr Murray M Copeland, of Washington, D C, Dr Herman L Kretschmer, of Chicago, Dr Arthur Purdy Stout, of New York, and Dr Hayes Martin, of New York. Dr Grantley W Taylor, of Boston, chairman of the Cancer Committee, will preside.

#### SYMPOSIUM ON TRAUMA

An interesting program for the Symposium on Trauma on Tuesday afternoon, from 2 00 to 5 00 o'clock, is being developed under the direction of Dr Robert H Kennedy. Among the speakers will be Dr Mather Cleveland, of New York, Dr Harrison L McLaughlin, of New York, and Dr James Barrett Brown, of St Louis.

#### HOSPITAL CONFERENCES

The twenty-eighth Hospital Standardization Conference will be held during the first 4 days of the Clinical Congress. Its opening meeting will constitute the first formal session of the Clinical Congress and will be for both surgeons and hospital representatives. Dr Dallas B Phemister, president of the College, will preside.

Hospital administrators, trustees, members of medical staffs, nurses, technicians, dietitians, and heads of the various hospital departments and their personnel, are invited to participate in the discussions at the hospital conferences which will be directed by leading authorities in the hospital field in the United States and Canada. The program will include formal sessions, panel discussions, round table conferences, symposia, and forums.

#### COMMITTEE ON ARRANGEMENTS AND EXECUTIVE COMMITTEE

The Chicago Committee on Arrangements and Executive Committee for the Clinical Congress are actively at work on arrangements for the program. The membership of these Committees follows:

##### *Committee on Arrangements*

Warren H Cole M D, F A C S, Chairman  
Lester R Dragstedt M D, F A C S, Vice Chairman  
Michael L Mason, M D, F A C S, Secretary  
Dallas B Phemister, M D, F A C S, President and Regent of the College

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Warren H Cole, M D, Chairman  
Lester R Dragstedt, M D, Vice Chairman  
Michael L Mason, M D, Secretary  
Dallas B Phemister, M D, President and Regent of the College  
James J Callahan, M D  
Loyal Davis, M D  
Walter G Maddock, M D

#### PARTICIPATING HOSPITALS AND HOSPITAL CLINICS COMMITTEE

A list of the participating hospitals and hospital clinics committee follows:

Augustana Hospital OSCAR I NADAU M D, F A C S  
Children's Memorial Hospital PAUL I LOX M D, F A C S  
Cook County Hospital MANUEL I LICHTENSTEIN M D, F A C S  
Evanston Memorial Hospital FREDERICK CHRISTOPHER M D, F A C S  
Illinois Eye and Ear Infirmary MAURICE D PEARMAN M D  
Lewis Memorial Maternity Hospital HERBERT I SCHMITZ, M D, F A C S  
Mercy Hospital Loyola University Clinics JOHN I O'DONOGHUE, M D, F A C S  
Michael Reese Hospital MORRIS I PARKER M D, F A C S  
Mount Sinai Hospital DAVID A WILLIS, M D, F A C S  
Passavant Memorial Hospital WALTER W CARR M D, F A C S  
Presbyterian Hospital FRANCIS H STRAU M D, F A C S  
Provident Hospital ULYSSES GRANT DUFFY M D, F A C S  
Research and Educational Hospitals (University of Illinois) JOHN T REYNOLDS M D, F A C S  
St Elizabeth's Hospital MARTIN GIBBY M D, F A C S  
St Joseph Hospital LEONARD KRAITZ, M D, F A C S  
St Luke's Hospital FOSTER I McVILL M D, F A C S Assistant JOHN T REYNOLDS M D, F A C S  
St Mary of Nazareth Hospital ANTHONY S. SAMPSON M D, F A C S  
University of Chicago Clinics  
Albert Merritt Billings Hospital J GARRETT ALLEN M D, F A C S

# AMERICAN COLLEGE OF SURGEONS

Bobs Roberts Memorial Hospital for Children J  
GARROTT ALLEN, M D, F A C S  
Chicago Lying in Hospital and Dispensary WILLIAM  
DRECKMANN, M D  
Home for Destitute Crippled Children J GARROTT  
ALLEN, M D, F A C S  
Wesley Memorial Hospital EARL O LATIMER, M D,  
F A C S  
Hines Veterans Administration Hospital CHARLES B  
PUESTOW, M D, F A C S Assistant JAMES H CROSS,  
M D, F A C S

Auditorium of the College at the time of the Con-  
gress in October

TECHNICAL AND EDUCATIONAL EXHIBITION  
The Technical and Educational Exhibits will  
be held in the Exhibition Hall on the lower level of  
The Stevens There will be represented leading  
manufacturers of surgical instruments, of x-ray  
apparatus, of sterilizers, of operating room lights,  
of ligatures, of dressings, of hospital apparatus and  
supplies of all kinds, and of pharmaceuticals, and  
publishers of medical books  
There will also be presented exhibits depicting  
the work of the College

SPECIAL COMMITTEE ON TELEVISION  
Foster L McMillan, M D, F A C S, St Lukes Hospital,  
Chairman  
Burton C Kilbourne, M D  
Charles E Shannon, M D, F A C S

GENERAL AND PROGRAM COMMITTEES  
The Clinical Congress general committee which  
operates under the Administrative Board of the  
College, consists of Dr Malcolm T MacEachern,  
chairman, Miss Eleanor K Grimm, secretary,  
Doctors Bowman C Crowell, Charles F Branch,  
George H Miller and H Prather Saunders, and  
Mr Edward G Sandrok, Mr James S Shannon,  
and Miss Laura G Jackson  
The Clinical Congress Committee on Program  
consists of Dr Frederick A Collier, chairman, and  
Doctors Henry W Cave, Evarts A Graham, and  
Alton Ochsner

The Advisory Committee on Programs consists  
of Dr George H Miller, chairman, and Doctors  
Warren H Cole, Sumner L Koch, Michael L  
Mason, Charles B Puestow, Bowman C Crowell,  
H Prather Saunders, Charles F Branch, and  
Malcolm T MacEachern

## MEDICAL MOTION PICTURES

The showing of medical motion pictures each  
day will again be a popular feature of the Clinical  
Congress The latest available films on surgery  
and related subjects will be presented Special  
showings will be arranged of medical motion pic-  
tures in the fields of ophthalmology and otorhino-  
laryngology Both sound and silent films will be  
shown, all of which will have been approved by  
the Committee on Motion Pictures

Some of the newer medical motion pictures  
which have been or are being produced under  
Directing Committees of the College, will be pre-  
sented during the Clinical Congress Among these  
will be the film entitled "Injuries of the Peripheral  
Nerves" directed by Dr Loyal Davis, under a  
grant from the Johnson & Johnson Research  
Foundation A premiere showing of this particu-  
lar film will take place in the Murphy Memorial

## ADVANCE REGISTRATION

Surgeons who wish to attend the Congress  
should register in advance Advance registration  
will greatly expedite the procedure of registering  
No registration fee will be charged Fellows whose  
dues are paid to December 31, 1948 For endorsed  
Junior and Senior Candidates, the fee will be  
\$5 00 Non-Fellows who after individual consid-  
eration are permitted to register, will pay a fee of  
\$10 00 No registration fee will be required of  
initiates of the class of 1949

## HOTEL RESERVATIONS

It is desirable to make hotel reservations as  
early as possible In making these, communica-  
tions should be addressed to the Convention  
Housing Bureau, 105 West Madison Street,  
Chicago, stating that you will be attending the  
Clinical Congress of the American College of  
Surgeons All hotel reservations, both for sur-  
geons and hospital representatives, are to clear  
through this Bureau No correspondence should  
be sent directly to the hotels A form for reserva-  
tions was enclosed in the letter recently sent to  
Fellows Choice of hotels may be designated  
A list of the principal participating hotels and  
minimum rates follows

	Single	Double
Chicago Hotels	\$3 50	\$5 00
Atlantic	5 00	8 00
Bismarck	3 50	6 00
Brevort	3 75	5 50
Chicagoan	4 50	7 50
Drake	3 50	5 50
Eastgate	4 00	6 00
Hamilton	3 00	4 00
Harrison	5 00	8 00
Knickerbocker	4 00	6 00
Maryland	3 85	7 00
Midland	4 50	
Palmer House		
Sheraton		
Stevens		

## SIXTH INTER-AMERICAN CONGRESS OF SURGERY

Chicago, Illinois, October 17 to 23, 1949

Separate Sessions—October 21, 22, and 23

THE Sixth Inter-American Congress of Surgery will meet as a part of the Thirty-fifth Clinical Congress of the American College of Surgeons from October 17 to 21, with headquarters at The Stevens in Chicago, and will continue on October 21, 22, and 23 with its own business, scientific, and social sessions, most of which will be held in the John B. Murphy Memorial Auditorium of the College at 50 East Erie Street.

The surgical societies of the following countries, in addition to the United States, are members of the Association of Inter-American Congresses of Surgery: Argentina, Bolivia, Brazil, Chile, Cuba, Ecuador, Mexico, Panama, Paraguay, Peru, and Uruguay. The American College of Surgeons joined the association by vote of the Board of Regents on June 27, 1943. This action was preceded by an invitation from Dr. Luis Vargas Salcedo of Santiago, Chile, to send two delegates as guests of honor to the First Inter-American Congress of Surgery, held in Santiago November 15 to 19, 1942. Dr. Leo Eloesser, of San Francisco, attended as delegate, and it was upon his enthusiastic recommendation that the College joined the association. He also attended the second Congress, in Buenos Aires, October 10 to 15, 1943. Dr. Alton Ochsner, of New Orleans, was delegate to the third Congress, in Montevideo, Uruguay, October 1 to 6, 1946. No delegates were sent to the fourth Congress, held in Rio de Janeiro in 1947. Dr. E. Payne Palmer, of Phoenix, and Dr. Hu Crim Myers, of Philippi, West Virginia, were delegates and co-relators at the fifth Congress, held in La Paz, Bolivia, October 17 to 21, 1948.

Dr. Frederick A. Collier, who will be inducted on October 17 as President of the American College of Surgeons, will, as President of the signatory society of surgeons in the host country, serve as President of the Sixth Inter-American Congress of Surgery. Dr. Arnaldo Cavigha, of Buenos Aires, is Secretary-General of the association, and will set up an office in Chicago prior to and during the meeting. The following committees will aid in the arrangements:

COMMITTEES ON INTER-AMERICAN RELATIONS,  
AMERICAN COLLEGE OF SURGEONS*General Committee on Inter-American Relations*

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DALLAS B. PHEMISTER, Chicago

## THE PROGRAM

A preliminary outline of the program for the Sixth Inter-American Congress of Surgery follows:

*Friday morning, October 21*

Inaugural Ceremony

*Friday afternoon, October 21*

Delegates may attend the specialty panels of the Clinical Congress

*Saturday morning, October 22*

Main Theme Acute Cramocerebral Trauma  
Relator E JEFFERSON BROWDER, M D ,  
F.A.C S , Brooklyn, New York, U S A  
Co-relators To be appointed by each member  
country

*Saturday afternoon, October 22*

Main Theme Treatment of Injuries in the Re-  
gion of the Ankle with Complications and Se-  
quelae  
Relator HARRISON L McLAUGHLIN, M D ,  
F A C S , New York, New York, U S A  
Co-relators To be appointed by each country

*Saturday evening, October 22*

Official Banquet

*Sunday morning, October 23*

Business Session

*Sunday afternoon, October 23*

Main Theme Pulmonary Carcinoma  
Relator EVARTS A GRAHAM, M D , F A C S ,  
St Louis, Missouri, U S A  
Co-relators To be appointed by each member  
country

# THIRTEENTH CONGRESS, INTERNATIONAL SOCIETY OF SURGERY

(Société Internationale de Chirurgie)

New Orleans, Louisiana, U S A , October 9 to 15, 1949

**T**HE following announcement has been received from Dr L Dejardin, Secretary-General of the International Society of Surgery

Plans for the Thirteenth Congress of the International Society of Surgery, which will take place in New Orleans, Louisiana, under the Presidency of Professor George Grey Turner, of London, England, are now in course of preparation

The scientific program was settled by the General Assembly at the last Congress in London, held in September, 1947. This body, at the recommendation of the Scientific Committee, also accepted two additional subjects, and decided who should open each discussion. The final arrangements were as follows

- 1 Surgery and Pathology of the Pancreas, Especially in Relation to Its Endocrine Function. Opened by PROFESSOR IAN AIRD, London
- 2 Surgery of the Parathyroid Glands. Opened by DR PAOLUCCI, Rome
- 3 Surgery of the Suprarenal Glands. Opened by DR M R MONTAINE, Strasburg
- 4 Pathology and Surgery of the Pituitary Glands. Opened by DR M P MARTIN, Brussels
- 5 Treatment of Postoperative Thrombosis and Its Sequelae. Opened by DR ALTON OCHSNER, New Orleans, and DR. MICHAEL DE BAKEY, Houston
- 6 Causes of Recurrence after Operations on the Biliary Tract. Opened by DR. M R DEMEL, Vienna

In addition, the American Organizing Committee has arranged that two or three days of the meeting shall be devoted to the presentation of shorter papers on subjects of immediate interest

The complete program, both scientific and social, will be circulated in due course

The program is being formulated by Vice President Evarts A Graham, of St. Louis, Missouri

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G SPEHL, Brussels, Belgium, *Editor, "Journal International de Chirurgie"*  
I MIMS GAGE, New Orleans, Louisiana, *Secretary of the 13th Congress*

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FREDERIC W BANCROFT, New York, New York, *Treasurer*  
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IRVIN ABELL, Louisville, Kentucky  
DANIEL C ELKIN, Atlanta, Georgia  
ALTON OCHSNER, New Orleans, Louisiana

Inquiries should be directed to

DR L DEJARDIN, *Secretary-General*  
International Society of Surgery  
141, Rue Belliard, Brussels, Belgium

August, 1949

**SURGERY**  
**GYNECOLOGY AND OBSTETRICS**  
*Supplement*

**INTERNATIONAL ABSTRACTS**  
**OF SURGERY**

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# INTERNATIONAL ABSTRACTS OF SURGERY

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## COLLECTIVE REVIEW

### COLONIC AND PROCTOLOGIC DISEASES

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**T**HIS review covers some of the pertinent papers which appeared in the literature between January, 1946 and August, 1948. It also includes a number of reports published in 1945 which were omitted from our last review (273). In this article consideration is confined to the presentation of the more recent knowledge, both the advances and the retreats, in the study of function and diseases of the anorectocolonic tract. We have also summarized some of the recent information which has a bearing on colonic and anorectal surgery, such as chemotherapy and hemostasis.

#### BASIC INVESTIGATIONS

Lannon and Weller observed on dissection that the parasympathetic nerve fibers of the distal colon arise from the second and third sacral nerves and are distributed directly to the descending colon, although they send communicating branches to the hypogastric plexus. In general, the parasympathetic distribution does not follow the arterial blood supply. Because of the sacral origin, a parasympathetic function is attributed to these basic independent fibers. The parasympathetic nerve supply of the lower colon consists of from three to six fibers on each side of the bowel. The authors supported their thesis with clinical, physiologic, and roentgenologic evidence, as well as with the work of Lawrentjew who showed that each parasympathetic fiber on entering the wall of the intestine branches out and unites with a great number

of ganglion cells in the colonic enteric plexuses. Because of this multiplication phenomenon only a few parasympathetic fibers are necessary to transmit impulses up and down the entire lower colon.

The practical implications are as follows:

1 The pelvic parasympathetic nerves are interrupted in resection of the rectum and lower pelvic colon.

2 Resections of the colon proximal to the midpoint of the descending colon (point of entry of the highest sympathetic colonic fibers) will cause a break in continuity of the colonic plexuses at the point of resection. It remains to be demonstrated whether this interruption of sacral sympathetic pathways will result in functional disturbance of clinical importance of that portion of the colon between the point of resection and the distal point of vagal supply which is in the proximal transverse colon (see Arendt's discussion).

3 Perarterial stripping of the inferior mesenteric artery advocated for the treatment of megacolon will cause no parasympathetic dysfunction since the authors have shown that the colonic parasympathetic nerve supply does not follow the arteries.

4 Presacral neurectomy would not result in vital damage to the parasympathetic function of the rectum or lower colon because the parasympathetic nerves do not have a close association with the hypogastric plexuses.

Kratzer and Dockerty confirmed the presence of preformed anal ducts in monkeys, human embryos, and adult human beings. The anal ducts course outward and downward from the

This review originated from the Surgical Services of Dr. Leon Ginzburg, Beth Israel Hospital and Dr. John H. Garlock, Mount Sinai Hospital, New York, New York.



emerging at the anus to become continuous with the stratum corneum of the skin was described by Duran-Jorda. Because of the rapid autodigestion this layer can be visualized microscopically only on freshly removed surgical specimens. These anatomic studies are discussed in relationship to the histopathology of ulcerative colitis.

The employment of orally administered slightly soluble sulfonamides as adjuvants to colonic surgery is almost universal. Collier, who in the past had not utilized these drugs, stated in his most recent paper on colonic cancer that the advent of sulfonamide drugs made possible the safe return to the one-stage colonic resection. This view coincides with the expressed opinion of Behrend and others. However, it should be remembered that for unexplained reasons even large doses of these drugs may be ineffective in the occasional patient (219).

Poth (210) has recently stated that when the slightly soluble sulfonamides are properly administered they will modify the bacterial flora of the colonic contents, allow a satisfactory preoperative mechanical preparation of the large intestine, favor early healing at the line of the suture or anastomosis and reduce the incidence of postoperative peritonitis and wound infection. He (209) stated that on the third postoperative day the control animals showed edema, extensive polymorphonuclear infiltration, but no evidence of revascularization or fibroplasia, while in the treated animal, healing and orderly fibroplasia, revascularization, slight edema, and moderate polymorphonuclear infiltration were discernible. Advanced healing of the intestine following open suture was noted by the fifth postoperative day in the treated experimental animals, while little evidence of healing was discernible in the control animals. Bell in a comparative study showed that the incidence of infection and mortality rate were lower in patients in whom a slightly soluble sulfonamide drug was employed preoperatively than in those in whom the drug was not used. Also, by lowering the incidence of infection the recovery period was shortened. Pemberton (204) revealed that at the Mayo Clinic the fatality rate before 1939 varied between 15 and 20 per cent. A slight decrease occurred in 1939, the year in which the sulfonamide drugs were first casually or intermittently used, and then in 1940 there was a precipitous decrease to around 5 per cent where the rate has since remained. With this decline in mortality rate there was an appreciable increase in the surgical resectability rates of colorectal lesions. Furthermore, before the "sulfa" era about 6 per cent of the patients died

of postoperative peritonitis, whereas with the employment of the sulfonamide compounds the mortality rate from peritonitis has been reduced to about 1.7 per cent. Similarly, the mortality from postoperative bronchopneumonia was reduced from 2.2 to about 0.6 per cent. A 50 per cent reduction of fatal pulmonary embolism during the period of sulfonamide chemotherapy has also been observed. Pemberton believes that the changes in colonic surgery since the introduction of chemotherapy have been as spectacular and revolutionary as those produced by iodine therapy in the surgery of exophthalmic goiter.

The healing time of anorectal wounds was not influenced by these drugs (248).

Because of the occasional tendency toward bleeding during the administration of the slightly soluble sulfonamide drugs, as observed by Sanders and Halperin, and Bell, it is advisable to administer vitamin K preoperatively and postoperatively. The bleeding may be caused by a disturbance in the prothrombin time as a result of the interference with synthesis of vitamin K in the intestinal tract. These remarks are true also of the oral administration of streptomycin (219).

A fatal reaction to sulfathalidine has been reported (251) in a woman aged 28 years who developed acute myocarditis; the pathologist described the myocarditis as "probably due to sulfathalidine" after the administration of a total dose of 32 gm. This solitary case serves as a reminder that this drug, in common with other sulfonamides, may be dangerous.

Sodium phthalylsulfacetimide, the newest of the slightly soluble sulfonamide drugs, is now being subjected to clinical investigation (238).

Boyd and Dingwall (38) showed that the oral administration of a suspension of microcrystalline sulfadiazine, a soluble sulfonamide, has an advantage over tablets in that higher concentrations of the drug in the blood were attained more quickly. These authors (39) also showed that lactates accelerated the absorption of sulfadiazine microcrystals from the gastrointestinal tract and gave higher initial concentrations of the drug in the whole blood and in blood plasma. Lactates also accelerated the output of total and free sulfadiazine in the urine and increased the urinary pH. Lactates are preferred to other salts. No signs of renal damage or other untoward clinical reactions were observed.

Lehr investigated the toxicity, absorption, and secretion of combinations of sulfadiazine-sulfathiazole, sulfadiazine-sulfamerazine, and sulfadiazine-sulfathiazole-sulfamerazine in albino rats. These combinations of partial dosages were de-



prior to streptomycin, its toxicity in experimental animals, however, is greater than that of penicillin or streptomycin

Duca and Scudi observed that methenamine mandelate is not much different from sulfathiazole and streptomycin in its activity against organisms isolated from infections of the urinary tract. Resistance to methenamine mandelate, in contrast to resistance to streptomycin and sulfathiazole, is either absent or insignificant. Furthermore, micro-organisms that become resistant to sulfathiazole or streptomycin are susceptible to methenamine mandelate. These facts appear to be of importance in the treatment of urinary tract infection following proctectomy.

With regard to new hemostatic agents, Correll and Wise showed that thrombin and penicillin are rapidly destroyed by oxidized cellulose, but that their potency was not affected by solutions in which absorbable gelatin sponges were suspended. The destruction or inactivation of thrombin by oxidized cellulose was also observed by Olwin and Wahl. This destructive effect is believed to be produced by the extreme acid character of oxidized cellulose which may cause local annoying irritation when applied to anal wounds (274). Streptomycin was found to be stable and ascorbic acid showed little deterioration in the presence of either of these hemostatic agents (62). Rosser (227) discussed the use of oxidized cellulose and the absorbable gelatin sponge as dressings in anorectal wounds. He believes that both of these hemostatic agents satisfy the criteria for desirable postoperative anal dressings. They should be applied as small single dressings to individual wounds and should not be used as an occluding pack. Pruitt seems to favor oxidized cellulose, while Kerr, and Turell (274) prefer the gelatin sponge.

Laufman and Method studied the effects of absorbable hemostatic agents on colonic anastomosis of dogs unprotected by sulfonamides or antibiotics. In most dogs they observed that when the hemostatic substances were applied to anastomoses of the descending colon there resulted a deleterious local reaction which caused disruption of the anastomosis and eventuated in fatal peritonitis in most of the experimental animals. In the few dogs in which the anastomosis was unaffected there was evidence of a greater peritoneal reaction than in the control animals. It is suggested that when absorbable hemostatic agents are used in open intestinal surgical procedures they should be eliminated before the peritoneum is closed or other means of hemostasis should be utilized.

It remains to be determined whether sulfonamides or antibiotics will overcome the deleterious effects of the hemostatic agents and render these substances useful in colonic anastomoses.

#### NEOPLASMS—BENIGN

An adenoma is a glandular structure showing proliferation of the colonic epithelium without invasion of the wall of the bowel. This lesion is generally regarded as a benign tumor. Helwig (119) reported a comprehensive investigation of adenomas based on a study of 1,460 consecutive autopsies in which the entire colon was available for examination. The problem of evolution of adenomas and their relation to carcinoma received special attention. He believes that adenomas are not the result of a reaction consequent to an inflammatory process although many may contain inflammatory cells. Also, lymphoid nodules are not prerequisites to the development of adenomas. The incidence of polyps increases with age. The small adenomas preserve a regular outline, while the larger ones may be lobulated or villous. Most adenomas are pedunculated. Close scrutiny will disclose short stalks that are missed on routine examination. Microscopic studies reveal structural variations among different adenomas as well as in single adenomas.

The incidence of adenomas has been reported as high as 69 per cent (13). Exclusive of the first year of life, approximately 3 per cent of children have adenomas (118).

Helwig is of the opinion that the colonic carcinomas usually develop in adenomas. In this opinion he is joined by many authorities (13, 57, 120). In agreement with Swinton and Warren (*J Am. M. Ass.*, 1939, 113, 1927), Helwig considers anaplasia, irregularity of architecture, and invasion as the microscopic criteria for determination of the fact whether a cancer arises from an adenoma. Atwater and Bagen believe that a benign adenoma is but "one stage in the pathogenesis of a carcinoma." In advanced lesions the progression of a malignant process may destroy the original adenomatous architecture beyond histologic recognition (119, 269).

On the other hand, Colvert and Brown believe that rectal adenomas are either malignant in the beginning or tend to become malignant very early; they found no evidence that malignancy tends to develop in benign adenomas with the passage of time.

It is generally conceded that when a single adenoma is found, the entire colon should be examined by all means at our disposal in a search for additional polyps. This includes sigmoidos-



be extirpated effectively by electrothermy or local excision. Adenomas showing invasion into the rectal wall should be regarded and treated as frank carcinomas.

There still is a need for unanimity of nomenclature or classification of colonic polyps.

Lymphomas are always benign, often polypoid in character, resembling adenomas, and usually appear as solitary nodules. They are free from associated generalized lymphoid disease, the main associated lesions are hemorrhoids and prolapse. Li studied 26 benign lymphomas of the rectum seen during the period from 1920 to 1946 and reviewed 23 additional cases reported in the literature. Her histopathologic description is as follows: "It is a noncapsulated yet well-circumscribed and often lobulated nodular growth which is composed exclusively of lymphoid tissue. This in turn is framed or supported by reticular tissue. The submucosal nodule often extends through the muscularis mucosae and involves the mucosa. Invasion of the underlying muscular coat has never been observed. The nodule is made of units of lymph follicles which contain all the cellular elements normally found in the lymphoid follicles of the intestine. Mitotic figures, regardless of their number, remain well within the limit of the germinal center. The number of mitoses varies among different follicles from the same case as well as from one case to another. A diffuse infiltration of different forms of wandering cells in varying intensity is many times encountered. The overlying mucosa suffers from compression of the underlying nodular growth, becomes, therefore, thin and straightened, and is thus exposed to mechanical injury." Lymphomas are differentiated from adenomas and lymphosarcomas by histologic and cytologic means. Lymphosarcomas are composed of small lymphoblasts in the case of the lymphocytic cell lymphosarcoma or of large cells in the case of reticulum cell lymphosarcoma. The differentiation is difficult when the tumor contains giant follicles. There is no evidence to support the view that lymphosarcomas can develop from lymphomas. It has not yet been determined whether lymphomas are true neoplasms or simple localized hyperplasias.

It is worth emphasizing that in addition to enumerating the histologic features of lymphomas, Li considers lymphomas as benign because recurrences were not observed in 33 of 49 patients who had been followed up for various periods of time.

Ehrlich and Hunter (85) reported 53 instances of benign lymphoid polyps of the rectum which

they considered as belonging to the lymphoma group. These tumors responded well to local excision, no later recurrences or transformations into malignant states have been observed.

Carcinoids are most commonly confused with adenocarcinomas. None of Ehrlich's 10 carcinoids in the rectum was treated by radical measures, however, Jackman (134) regards carcinoids as a low grade type of malignant lesion which may be invasive locally and in some instances may show extensive metastasis. The first case of multiple carcinoids of the rectum was recently reported (225).

To date only 32 carcinoid tumors of the rectum have been reported. Of these, 4 have been associated with distant (liver, kidney, thyroid, and distant lymph nodes) metastases (Pearson, C, and Fitzgerald, P. J. *Ann Surg*, 1948, 128: 128).

Lazarus and Marks reviewed 37 benign tumors of vascular origin arising within the intestinal tract and reported 1 personal case. Eight vascular tumors occurred in the colon alone. The pathologic diagnoses were as follows: 6 nevi, 11 angiomas, 11 cavernous angiomas, 5 capillary angiomas. Associated skin nevi were present in 3 instances. The tumors occurred singly or multiply. Profuse intestinal bleeding was the outstanding symptom. Single tumors that were amenable to resection yielded the most satisfactory therapeutic results, the prognosis for multiple tumors was poor.

Intestinal endometriosis can best be diagnosed microscopically (See also gynecologic aspects). Endometriosis may coexist with cancer, and sometimes may undergo malignant degeneration. It has been estimated (261) that from 2 to 4 per cent of all women during active menstrual life have some degree of rectosigmoidal invasion or infiltration of endometrial tissue. Castration without intestinal resection will cure intestinal endometriosis. McGuff believes that discreet endometrioma of the bowel causing intestinal obstruction in young women in whom the pelvic organs are essentially normal calls for a radical bowel operation with a conservative genital procedure.

Tenner reported an experience with 12 intestinal lipomas. The colon is a frequent site of lipoma, which is a differentiated benign neoplasm. Ulceration of the mucous membrane covering the lipomas was observed in 11 instances. The ulceration is ascribed to pressure injury as in intussusception, to trauma as in partial obstruction, or to infarction as from pressure on the blood vessels from the growth and development of the tumor. A preoperative





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Tenner reported an experience with 12 intestinal lipomas. The colon is a frequent site of lipoma, which is a differentiated benign neoplasm. Ulceration of the mucous membrane covering the lipomas was observed in 11 instances. The ulceration is ascribed to pressure injury as in intussusception, to trauma as in partial obstruction, or to infarction as from pressure on the blood vessels from the growth and development of the tumor. A preoperative

diagnosis of a malignant lesion is frequently made largely because of the obstructive nature of the disease and the age of the patient, the average age of this group of patients was 53 years. Intestinal obstruction may be produced directly by the lipoma or indirectly by intussusception due to the tumor. Lipomas may originate submucously, intramuscularly, intermuscularly, or subserously. The treatment is surgical, local excision through a colotomy is the procedure of choice. Occasionally, resection of the segment of bowel containing the lipoma is performed. Occasionally lipomas are expelled spontaneously.

Jackman (134) stated that although most submucosal nodules are benign, some of the asymptomatic submucosal ones of the rectum discovered on routine proctoscopic examination may be malignant or may possess malignant propensities. These isolated nodules are covered by normal mucous membrane and may vary in size from a few millimeters to 3 or 4 cm in diameter. These lesions may be confused with mucosal or anal polyps, or extrarectal masses. At the Mayo Clinic the exact nature of such nodules in 87 consecutive patients was determined by excision and microscopic examination. Among the benign lesions there were 49 chemical tumors which resulted from the therapeutic submucous injection of sclerosing solution (a history of antecedent injectional therapy is helpful in the differential diagnosis), 3 fibromas with adherent overlying mucosa, 3 lipomas with a freely movable overlying mucosa, 2 leiomyomas with a freely movable mucosa, 24 inflammatory lesions (8 phlebotomias, 1 fecalith, 2 enlarged lymph nodes, 3 mucous cysts, 2 enlarged lymph follicles, 4 inflammatory reactions about cholesterol crystals, and 4 other examples of an inflammatory process). The other lesions consisted of 2 lymphosarcomas and 4 carcinoids.

#### NEOPLASMS—MALIGNANT

The importance of an expert knowledge of the blood supply of the colon in the presence of malignant tumors was stressed by Hinton and Localio. They presented color illustrations of the blood supply of the colon and indicated which vessels are to be preserved at the various levels of resection of segments of the colon. Thus, in resection of the right colon, when the terminal ileum, cecum, ascending colon, and hepatic flexure are removed, the right colic artery is ligated but the middle colic artery is preserved. The colon is sectioned at a 45 degree angle in order to insure an adequate blood supply at the antemesenteric border. In resection of the

transverse colon the left colic artery is preserved. In some instances, the middle colic artery may also be preserved. Wangenstein and Toon (280) divide the middle colic artery when the marginal vessels are well developed. In resection of the splenic flexure, branches of the middle and left colic arteries are ligated, but the main arteries are preserved. In resection of the rectosigmoid, the superior hemorrhoidal artery is ligated, and the upper sigmoidal, middle, and inferior hemorrhoidal arteries are preserved.

Bacon and Smith (22) described and correlated the pattern of the arterial blood supply of the sigmoid and upper rectum with their technique of abdominoperineal proctosigmoidectomy.

Wangenstein and Toon (280) pertinently pointed out that the term rectosigmoid is a rather arbitrary and not strictly anatomic designation. The present arbitrary upper limit of the rectum is at the level of the third vertebra and the segment of colon between this upper rectum and the distal sigmoid is termed rectosigmoid. However, this anatomic designation is not accepted by all surgeons.

Some describe the rectosigmoid as the point at which the sigmoid loses its mesentery. The bowel below this level is considered to be the rectum.

The most common type of malignancy encountered in the colon is adenocarcinoma which may occur in a nodular, scirrhous, colloid, or papillary form (27, 57). The neoplasm may be single or multiple (about 5 per cent are multiple). Rewell reported 2 rectal cancers in sisters, one had multiple colonic polyposis and the other had multiple telangiectasis. Mider recorded 21 patients with multiple carcinomas of the colon. Ehrlich and Hunter (85) stated that the carcinomas of the colon and rectum make up 80 per cent of all neoplasms of the intestinal tract.

A study of the site of the growth of 1,457 carcinomas of the colon by Boehme and Hanson showed that about 75 per cent of these lesions were located in the sigmoid, rectosigmoid, and rectum. It also showed that about 70 per cent of the colonic cancers can be palpated digitally or detected sigmoidoscopically. This is in agreement with Jackman, Neibling, and Waugh (136) who found that of 817 patients studied 54.3 per cent had malignant lesions palpable digitally, and in an additional 16.2 per cent the lesions could be detected sigmoidoscopically. It is also of interest to note that of the remaining 29.5 per cent of patients, 28.4 per cent had carcinomas that were detectable on roentgenography and only 1.1 per cent had malignancies which were discovered at abdominal surgical exploration.

The spread of carcinoma occurs by direct local extension and through the blood or the lymphatic streams. It is emphasized that the colonic lymphatic vessels usually follow the arteries. Miles, as early as 1908, stated that cancer of the rectum may spread upward, laterally, and downward. Subsequently it was shown that the downward spread is uncommon and occurs only when the lymphatics above the tumor are blocked by metastasis. It was also believed that the intramural spread of cancer cells occurs rarely below the lower margin of the tumor. Gilchrist and David (100) in a recent article again showed that the lymphatic spread is primarily embolic, and that further spread is checked in the lymph node until it is completely overwhelmed by carcinoma. Then further embolic spread may continue through the collateral channels, spread from node to node is uncommon. They also reported retrograde metastases in nodes 1 to 5 cm below the lower border of the neoplasm in 7 of 153 cases of malignant lesion situated below the promontory of the sacrum. Connell and Rottino studied the intestinal segments below the border of the malignancy by making hundreds of serial sections of the bowel wall in each of the 9 specimens studied, clearance of the lymph nodes alone was not relied upon. They found malignant tumor cells in lymph channels of one specimen as far downward as 7 cm from the lower border of the neoplasm. Intramural tumor cells were found in 4 additional specimens. Bacon and Rowe (19) reported that 146 specimens of bowel removed at operation were sectioned serially at 2, 4, and 6 cm below the neoplasm with the finding of invasion in only 1 instance at a 6 cm level. Venous invasion was also observed in 12.9 per cent.

Also, it has now become increasingly appreciated that carcinomas situated in the region supplied by the inferior and middle hemorrhoidal blood vessels, particularly neoplasms in the ampulla, spread laterally along the vessels, the levator ani muscles, and sometimes caudally through the ischiorectal fossa. This lateral lymphatic spread of rectal carcinoma demands radical surgical procedures and imposes definite restrictions on operations that do not remove the perirectal structures with the associated lymphatics (see later discussion).

The content of potassium and calcium in colonic carcinomas and papillomas was studied by Dunham, Nichols, and Brunschwig. They observed that the carcinomatous mucous membrane contains less calcium and more potassium than the adjacent normal mucosa. In papillomas

the potassium content was similarly increased, but the degree of reduction of calcium was less marked than in the carcinomas.

Herly, by introducing methyl-cholanthrene into the abdominal cavity of young male mice, produced ascites in 50 days and sarcomas in those mice which survived for 90 days. This ascitic fluid, when introduced intra-abdominally into other mice of the same strain, produced ascites and malignant tumors. When the ascitic fluid of the second series of mice was introduced intra-abdominally into a third series, ascites and sarcomas again were produced. The undetermined active tumor-producing agent could be destroyed by ether and by exposure to a temperature of 90° C.

Rabinovitch, Grayzel, Swyer, and Pines reported a study of 5 cases of sarcoma of the colon and 9 of the small intestine. Their comparative studies showed that the relative proportion of sarcoma to carcinoma of the small intestine is approximately 1 to 5.5, of the large intestine 1 to 275, and of the rectum 1 to 577. They emphasized that, contrary to the general belief, carcinoma of the small intestine occurs more frequently than sarcoma.

Sarcomas arise from specific constituents of the intestinal wall. The lymphosarcomas resemble lymphoid tissue normally present in the intestinal wall. The reticulum-cell sarcomas resemble the large pale-staining cells forming the reticulum of the lymph follicles. Thus, this tumor is also believed to arise from lymphoid tissue. The leiomyosarcomas resemble the smooth musculature of the intestine. The neurofibrosarcomas consist of nerve fibers and connective tissue and originate from the nerve elements of the intestinal wall. Apparently complete resection of these lesions offers the best prognosis.

The occurrence of lymphosarcoma in a pedunculated rectal polyp was reported by Harris and Feigen. This polyp was successfully removed with a high frequency diathermy snare followed by desiccation of the base. No recurrence was observed after a lapse of 5 years.

Goldman and Marbury described a spindle-cell sarcoma of the rectum which was treated by perineal resection of the rectum and the establishment of a permanent abdominal artificial anus (Lockhart-Mummery procedure). They stated that the incidence of true primary rectal sarcoma is rare, one of 200 rectal malignancies is a sarcoma. The treatment of choice is early radical resection because local excision, irradiation, and radium are followed by frequent recurrence.

Many years ago Curtice Rosser (*Am J Surg* 1931, 11 328) called attention to the occasional development of malignant tumors in anal fistulas. To the growing record of case reports, Skir (247) added 3 cases of mucinous carcinoma which were associated with anal fistulas. Skir believes that the preformed anal glands may be the origin of the glandular elements of these neoplasms. Dukes reported 2 cases of colloid cancer of the anorectal region extending deeply along the track of an anal fistula without the formation of a tumor in the rectum or anal canal. Pearse added another case of cancer of the rectal colloid type associated with a fistula-in-ano without rectal involvement. Harvey called attention to the relation of anal fistulas and other causes of chronic irritation about the anus to the occurrence of anal epitheliomas.

As noted in the discussion of adenomas, many investigators believe that carcinomas frequently originate or develop in adenomas. Mider, in a study of 726 cases of colonic cancer, showed that 17 per cent of the patients with single cancers and 38 per cent of the patients with multiple cancers had polyps elsewhere in the colon but more usually near the site of the cancer.

Thomas, Kline, and Seed stated that an appreciable loss of weight occurs early in the course of rectal carcinoma and that a history of alternating diarrhea and constipation, a supposed frequent accompaniment of cancer of the rectum, is found only in 5 per cent of patients, although a change in bowel habit, either diarrhea or constipation, is observed often. Collier and Berry found that all of their patients who had alternating diarrhea and constipation had the carcinoma in the sigmoid colon. Jones, Robinson and Meads (140) pointed out that there is no standard set of symptoms for rectal carcinoma and that the patient's history alone is unreliable.

Most writers agree that well over 70 per cent of the patients with rectal and colonic carcinoma have symptoms for 9 months or longer before a correct diagnosis is made. Jones *et al* (140) believe that the duration of symptoms depends on three factors: (1) the patient's failure to consult a physician before the condition is in a far advanced stage, (2) disregard of medical advice, and (3) improper diagnosis of the lesion in its early stages.

Practically all writers agree that a high incidence of hemorrhoids is observed in association with carcinoma of the terminal portion of the large intestine. Hemorrhoids are often observed 6 months before the correct diagnosis of cancer is made, and about 75 per cent of the patients

undergo hemorrhoidectomy (57, 140). To avoid this serious error, no hemorrhoidectomy is performed at the University of Michigan Hospital until a sigmoidoscopy and roentgenography (double contrast barium enema) are performed. A summary of the diagnostic errors of carcinoma of the colon has been reported by Jackman *et al* (136).

Jones *et al* (140) claimed to be able to make a correct diagnosis on the gross appearance of the lesion and therefore believed that biopsies are unnecessary. Furthermore, they stated that biopsy may be misleading since "biopsies of superficial tissue do not reveal the disease when a biopsy of tissue from deep in the tumor would." In this connection it should be pointed out that a properly performed biopsy aims at securing fragments of tissue from the deep as well as the superficial components of a tumor. Also, it has generally been considered good practice to obtain histologic confirmation of a clinical diagnosis before a patient is subjected to a major surgical procedure of a radical scope, especially one necessitating an artificial anus. Only thus can an error of mistaking an inflammatory or benign lesion for a malignancy be avoided (185). Wakefield stated that a malignant lesion should not be recorded in the history sheet without histologic substantiation.

Preoperative rehabilitation in the unobstructed patient may be accomplished in from 5 to 10 days and this program may be begun at the patient's home (113, 174, 186).

The value of antibiotics and sulfonamides is discussed separately elsewhere in the text. Suffice it here to report that Jones (140) is among the very few surgeons who does not employ these agents preoperatively.

Vitamin B complex is needed because of its influence upon carbohydrate metabolism. Vitamin C is essential to the effective healing of the wounds (186). These and other available vitamins may be given orally and parenterally in maximum dosages. It should be remembered that in the presence of hypoproteinemia, vitamins are poorly absorbed and utilized.

A desirable diet is one of low residue containing 100 or more grams of protein and 500 or more grams of carbohydrate (186). In the event that the patient cannot handle such large quantities of protein, in the form of natural foods, protein digests may be administered (56, 125, 185, 198). These products are highly digestible and provide but little bulk. When the oral or orogastric methods of feeding are contraindicated resort may be made to jejunal feeding.

When none of these routes can be utilized, intravenous injections are used as the sole source of dietary intake (185, 255)

Meyer and Kozoll (185, 186) prefer whole blood to other proteins for transfusion because of (1) its more rapid effect upon the raising of the circulatory protein levels, (2) its provision of both plasma and hemoglobin as protein metabolites, and (3) its inclusion of many immunologic factors that are vital to the resistance of infection. They advocate the administration of a minimum of 2000 cc of blood before and during an intestinal resection. Blood transfusions are combined with the administration of amino acids. This program also corrects anemias that might be masked by dehydration, increases the oxygen carrying capacity of the blood, and tends to prevent the occurrence of shock during or after operation.

Enemas consisting of 6 gm of succinylsulfathiazole and 10 gm of sodium carbonate per 1,000 cc of warm water are given by Meyer and Kozoll (185) the day preceding surgery and are repeated until the rectum is absolutely clear. Allen *et al* (3) believe that vigorous cathartics should not be used as perforation and peritonitis may occasionally result from their use. It may also be added that preoperative purges may contribute to postoperative distention.

It is generally agreed that the presence of colonic obstruction calls for decompression by cecostomy or transverse colostomy prior to the institution of rehabilitating measures. Allen *et al* (3) condemn exteriorization procedures as well as exploration of the abdominal viscera in the presence of complete acute obstruction because manipulation of the bowel may lead to fatal peritonitis.

Millet has recently suggested a method of cleansing the colon through a tube colostomy opening (Gibson's technique) by means of a Miller-Abbott tube which is carried gradually by peristalsis to the point of obstruction. Solutions introduced through one lumen are removed by suction through the other lumen and the bowel is thus thoroughly cleansed in about 5 days. Millet's procedure is claimed to enhance the value of tube cecostomy and to be preferable to transverse colostomy because secondary closure is usually avoided. This procedure has also been found useful for the postoperative decompression of the anastomosis.

The present day tendency in many clinics in the treatment of colonic carcinoma is definitely toward the return to the one-stage resection with primary anastomosis, (3, 57, 125, 163, 180, 182,

185, 186, 187, 219, 278, 282). There still is a lack of unanimity of opinion concerning the open versus the closed method of anastomosis, and the desirability of a proximal vent.

The proponents of primary resection believe that a more radical technique of resection is possible than in the exteriorization resection procedures because more of the lymphnode-bearing area and of bowel adjacent to the tumor can be excised, also, that primary resection eliminates the necessity of several operations and, thus, prolonged hospitalization is avoided, and that the complications of exteriorization, such as retraction of either or both of the loops, prolapse, infection or disruption of a wound, and incisional hernia are eliminated (57, 186).

The open type of intestinal anastomosis is vigorously championed by Meyer (186), McNealy (180), and their associates. Recently, Allen *et al* (3) and Fansler have abandoned the aseptic method of anastomosis in favor of the open technique, this seems to be a current trend in many clinics. The most important arguments in favor of the open procedure are the established safety as based on the actual performance of large numbers of open anastomoses, the precision and accuracy with which the sutures may be placed, and the opportunity that is afforded for the direct inspection of the interior of the ends of the bowel that are to be anastomosed. Thus, the presence of polyps that may have been missed or obscured by the neoplasm, as well as the character of the bowel adjacent to the neoplasm, can be established.

Stanton (252) described a device for the elimination of unequal diameters of the 2 colonic segments to be anastomosed with a view to simplifying the procedure of end-to-end anastomosis.

The construction of a proximal vent in unobstructive lesions is considered unnecessary by many surgeons (57, 180, 187, 282).

Interrupted sutures of fine stainless alloy steel wire or silk for the serosal layers are favored by Meyer, Sheridan, and Kozoll (187). They believe that wire sutures are less likely to form a sinus through which infection might drain. Hoxworth (129, 130) stressed the fact that serosal sutures should catch the submucosa but must not penetrate the mucous membrane, and that these sutures should be tied tight enough to hold the serosal surfaces in apposition without strangulation of the involved tissue in order to avoid tissue necrosis, thus re-emphasizing Halsted's original teachings which constitute the beginning of modern gastrointestinal surgery (*Am J M Sc*, 1887, 94 436).

Of the 250 described methods of intestinal anastomosis, 45 are said to be aseptic or nearly aseptic. Hinton and Localio advocated an aseptic closed method of intestinal anastomosis utilizing the Furniss clamp. Collier and Berry reported a postoperative period of hospitalization of 17.2 days for the closed type of anastomosis as against 27.4 postoperative hospital days for the open method. This, however, is at variance with Meyer *et al* (185, 186) who reported a postoperative hospital sojourn of an average of only 13 days. Parenthetically, by way of contrast, Collier and Berry reported an average period of 55.9 postoperative days following obstructive resection procedures.

The mortality following primary anastomosis is around 5 per cent (57, 187, 219, 282).

The case for the obstructive resection procedure for colonic cancer is again presented by Jones (138). He believes that this procedure is as adequate for cure of cancer as is resection with immediate re-establishment of intestinal continuity. Following obstructive resection performed by him, Jones has never seen a single case of local recurrence in the abdominal wall, which he interprets to mean a thorough elimination of the involved mesenteric glands. Jones believes that because he does not have to worry about the blood supply he can do a more radical procedure with the Rankin type of resection than he could with an end-to-end anastomosis. This is in agreement with the experience of Garlock and Klein (95). Allen *et al* (3) have minimized the fear of compromising the blood supply in any colonic resection by first removing the neoplasm and then determining by visualization whether the blood supply of the ends of the bowel to be anastomosed is adequate.

Garlock and Klein list four situations in which obstructive resection is to be preferred to primary anastomosis: (1) great disproportion in the size of the bowel proximal and distal to the lesion, accompanying chronic obstruction, (2) pericolic abscess or infection, (3) excessively fat mesentery obscuring the vascular pattern, and (4) poor general condition incident to advanced age.

Other surgeons are supplanting obstructive resection techniques with resection and primary anastomosis (57, 186, 187, 219). The factors that made this possible are the employment of sulfonamide drugs and antibiotics, the copious use of blood and blood substitutes, the correction of malnutrition, and the improved techniques of anastomosis. Both types of procedures have their place, although more and more cases are being found suitable for primary anastomosis.

A great controversy is now raging concerning the merits and demerits of operations that aim to conserve sphincter control, particularly of the so-called "anterior resection," in cases of rectal carcinoma. This procedure implies primary anastomosis of peritoneum-covered colon to the nonperitonealized rectum (31, 174) with division and ligation of the superior hemorrhoidal artery, and excludes anastomoses between peritonealized segments of the bowel. The anterior resection operation is predicated on the assumption that the downward lymphatic spread of rectal carcinoma occurs rarely or only for a few centimeters below the growth (102). Some investigators have challenged this assumption (61, 100). The fact that important lateral spread occurs from ampullary carcinoma, especially when situated at the level of the levator ani muscles, has influenced some surgeons to avoid the performance of anterior resection. Because abdominoperineal resection is the most radical cancer operation, it is preferred to the sphincter-saving operations by many surgeons (2, 47, 100, 138, 150, 152, 217, 254). This orthodox operation not only removes involved lymph nodes and perirectal structures, such as the levator ani muscles, but also excises the venous channels which may be left behind in the anastomotic procedures. The findings by Gilchrist and David (100) of 23.2 per cent of local recurrence following the Miles procedure for cancer of the extraperitoneal part of the rectum indicates that the more radical the removal of the rectum the greater the chance of cure. Rankin agrees with Gilchrist and David "that the sphincter-saving operations are little more than local excisions for all cancers situated below the peritoneum." Stewart (254) believes that "some rectal cancers can be cured by resection and end-to-end anastomosis," but that "a far higher percentage will be cured by the combined abdominoperineal excision which includes lymph nodes and blood vessels in the zone of spread of the disease." Allen (2), Mad dock, and others justify the sphincter-saving procedure if the patient has hepatic metastases at the time of operation.

Wangensteen (280), who has been among the earliest proponents of anterior resection, in his latest and very frank and instructive paper, has summarized the present status of this operation.

1. Lesions situated at 8 cm or less from the anus should not be treated by this procedure because of the high incidence of local recurrence. He has given up the anastomotic procedure for these low-lying malignancies in favor of the abdominoperineal resection of the rectum. He also pointed out that local recurrence has not been

invasion of the surrounding tissues only 15 per cent were well 5 years, and 11 per cent were well 10 or more years after operation Colcock also noted that 60 per cent of the patients with rectal carcinoma without local invasion or nodal metastasis were well 5 years and 51.6 per cent were well 10 years after operation Only 30.2 per cent of patients with rectal carcinoma associated with nodal metastasis or local invasion of the surrounding structures were well 5 years, and 23.2 per cent were well 10 or more years following resection of their malignant lesions. It was further noted that although some patients with cancer of the colon and rectum survive 5 years, they will ultimately die of their disease, but more than 50 per cent of the survivals in whom nodal metastasis and local invasion of the surrounding tissues are absent may expect a permanent "cure" of their malignant disease if they are subjected to radical surgical resection.

Gilchrist and David (100) observed the survival of 114 of 200 (57 per cent) patients with cancer of the colon for from 5 to 10 years. In their experience, 78.5 per cent of the patients without nodal metastasis had a survival rate of from 5 to 10 years, this figure could be increased to 90.9 per cent if the patients who were lost to the follow-up and those who died postoperatively of other causes after leaving the hospital were taken into account. Of 125 patients with nodal involvement, 56 (44.8 per cent) lived 5 years, this survival varied with the location of the colonic cancer. Thirty-seven per cent of the patients with a lesion in the middle and left colon or the extraperitoneal portion of the rectum survived 5 years, a 61.5 per cent survival was noted in patients with lesions in the right colon, and a 51.4 per cent survival, in patients with a lesion in the sigmoid and intraperitoneal portion of the rectum. Local recurrence developed in 23.2 per cent and liver recurrences developed in 15.9 per cent in neoplasms of the extraperitoneal portion of the rectum, in the remainder of the bowel local recurrences were either not easily demonstrated or developed less frequently. The rate of hepatic metastasis varies from 10 to 15 per cent and usually results when cancerous emboli travel up the liver via the hemorrhoidal blood vessels.

That a routine autopsy examination may fail to demonstrate small retroperitoneal nodal metastasis is indicated by Gilchrist's findings of the presence of metastases in the nodes of the peritoneal tissues in 4 of 11 patients who had had previous routine postmortem examinations. In 3 of these patients complete removal of all in-

volved nodes would have been possible if the field of resection had been 1.5 cm wider.

Gilchrist and David reported that 2 of 3 of their pregnant patients with carcinoma of the colon lived more than 5 years. This experience is in contrast to the gloomy prognosis usually given. Bacon and Rowe (18) reported their recent experience with 4 patients with carcinoma of the rectum occurring during pregnancy. An uneventful recovery followed the performance of an abdominoperineal proctosigmoidectomy with preservation of the sphincter muscles.

The majority of anal carcinomas are squamous-celled epitheliomas, while a small number consist of basal-celled carcinomas and epidermoid cancers (see also section on anal fistulas). Cannon treats such lesions in other parts of the body by desiccation which is carried widely beyond the border of the lesions, the charred material is removed with curette or scalpel, 1,800 roentgens of irradiation are given in 3 divided doses. In 1 case of basal carcinoma, Gross successfully employed wide local excision of the lesion, including adjacent and subjacent tissues. Meland believes that since this type of tumor in other locations of the body is successfully treated by irradiation, this form of therapy should be applied to the anal lesion as well, particularly since irradiation causes no immediate mortality. The period of recovery without recurrence in the successful cases lasts well beyond 5 years. The unsuccessful cases behave like the uncontrolled adenocarcinoma. The minority of the patients develop metastases in the inguinal glands, whereas the majority show metastatic spread to the retroperitoneal glands, the liver, and even the brain.

Sweet studied the comparative merits of surgery and irradiation. He stated that although irradiation was applied to the small and locally favorable (noninvading) lesions and surgery was applied to the large and advanced (invasive) tumors, the results both as to cure and good palliation were superior in the surgically treated group. Radical surgery produced cures in 12 of 48 cases (25 per cent), whereas irradiation produced a cure in 1 of 19 cases (5.2 per cent). The degree of relief from local symptoms is greater and the duration of the relief is longer in the surgically treated cases as evidenced by the fact that 41.6 per cent of the patients experienced complete relief from local discomfort as compared with 15.8 per cent of the patients (exclusive of the recurrent cases) who obtained similar palliation after irradiation. Sweet naturally concluded that irradiation is inferior to surgical



Glass and Garlock described 13 instances of radical resection of the colon and rectum together with the involved adjacent viscera with a mortality of only 15 per cent. The uterus, vagina, the urinary bladder, the stomach, the ureter, loops of ileum, and the abdominal wall were the structures involved. The survival period was surprisingly long, and the patients were saved the complications incident to the spread of the neoplasm. Sugarbaker presented his experience with 42 cases in which additional organs were removed in order to accomplish the eradication of the neoplasm of the rectum and colon. Dixon and Benson (74) perform extensive resections of the urinary bladder when it is involved in the sigmoid area. Brunschwig and Morton reported on the feasibility of resecting colonic neoplasms and secondarily involved livers and spleens.

Dunphy (81) believes that patients with recurrent colonic and rectal cancer associated with involvement of neighboring but nonvital structures, but in the absence of distant metastases or generalized peritoneal seeding, should be reoperated upon regardless of the extent of previous resection, the size of the lesion, or its apparent fixation. Gratifyingly long periods of arrest after block excision of recurrent lesions may follow reoperation for locally recurrent and apparently hopeless cancer.

Binkley and Deddish (32) outlined in detail the complications of abdominoperineal resection for carcinoma of the rectum and reported a significant reduction of these complications during the past 5 years. Infection of the urinary tract and retention of urine were the most troublesome and consistent of the postoperative difficulties. Bacon and McCrea (17) believe that the preoperative administration of slightly soluble sulfonamide drugs (not employed by Binkley or Jones) exerts a bacteriostatic effect on organisms found in the urinary tract.

Marshall *et al* have stated that bladder dysfunction occurs more commonly after perineal excision of the rectum, and that they have been unable to demonstrate neurogenic dysfunction as the underlying cause. On the other hand, Bacon and McCrea (17) believe that injury to the nerve supply (trauma or severance of the sympathetic and parasympathetic nerve fibers—see Lannon and Weller's paper) is responsible for the vesical dysfunction. Marshall believes that in the absence of bladder neck obstruction the dysuria is caused by sagging of the bladder, vesical neck, and prostate into the hollow of the pelvis following the removal of the support af-

forded by the terminal bowel. For this group of patients he advises elevation and fixation of the bladder and urethra. Vesical neck obstruction responds to the surgical removal of obstructing tissue.

Fallis described a technique of transverse colostomy in which no sutures are used to attach the bowel to any of the layers of the abdominal wall. Closure of the colostomy is effected by the intraperitoneal end-to-end open method of anastomosis. Wangenstein (279) described a loop colostomy which, he believes, secures complete fecal diversion. Two glass rods are drawn through the mesentery and maintained in position until the wound is healed. The colon is opened by a slit in the axis of the bowel and the proximal orifice is unroofed by cutting away a small portion of the antemesenteric intestinal wall. Rank and Smith described a colostomy which utilized a buried inverted skin tube and a mechanical plug.

Lahey (153) believes that the perineum is a poor place for colostomy and prefers the abdominal artificial anus. Rankin stated that the majority of experienced surgeons agree with Pfeiffer that "the uncontrollable perineal colostomy is infinitely inferior to the abdominal anus in all respects except sentimental nonsense." The well functioning colostomies have the mucosal level well above the skin level. A colostomy should be inspected daily for several days after operation to make sure of the blood supply. Should an accident to the blood supply occur within 4 days after operation the wound can be opened and a longer segment of bowel pulled out. After 4 days the unnourished segment of bowel becomes necrotic with the attendant danger of rupture and contamination.

The management and complications of permanent colostomy are well described by Jones and Kehm (139). In 76 of 100 patients studied good fecal control was obtained by regular irrigations. Gabriel opposes, but Gordon Watson and Milligan (189) advocate daily irrigations if a natural rhythm does not develop after a short trial. It may be added that a newly designed Ray Patten irrigator is one of the best now available.

Colcock (55) observed that 64.3 per cent of 81 patients with carcinoma of the colon without nodal metastasis or local invasion of the surrounding tissues survived 5 years without recurrence of the neoplasm, and that 57.1 per cent were well 10 or more years after the successful radical extirpation of the malignant neoplasm. Of the patients with lymph node metastasis 0

fective obliteration of the dead space with fine cotton sutures, and (5) complete closure of the mucosal defect Kenney reported that in 11 of 12 patients the wound healed by primary union without complications or recurrence during a period of observation ranging from 2 to 6 months

The experience of one of us (R T) with primary closure of anal fistulas was not as successful as Kenney's and this procedure was therefore abandoned

The occurrence of malignancy in an anal fistula is discussed in the chapter on malignancy

Jackman and Buie (135) studied 600 patients with anal fistula and found an incidence of 11.5 per cent of tuberculosis somewhere in the body This observation, they believed, justifies a suspicion of tuberculosis in every patient with an anal fistula About 7 to 8 per cent of their material was tuberculous but their data do not permit an opinion as to whether the tubercle bacillus is a primary or secondary invader of anal fistula A properly performed but negative guinea pig test excludes tuberculosis A positive test and a negative histologic examination suggests that the tested tissue was contaminated

Ditmore still advocates digital dilatation under anesthesia for the cure of the painful lesion of fissure (ulcer), but adds that "the fissure should be relatively small, the base should be smooth and there should be a minimum of scar or any other elastic tissue" In our experience this type of acute anal lesion usually responds to the topical application of a bland ointment and to hot hip baths alone Occasionally the oil-soluble "anesthetic" solutions are employed If these measures fail, we employ surgical therapy Because of the smooth convalescence and good results which follow operative treatment the latter is preferable to dilatations which are traumatic in character and result in tears of the muscle fibers and extravasation of blood into the sphincter muscle which may become secondarily infected

Turell (274) described a rational surgical procedure for the eradication of chronic anal fissure The operation includes wide excision of the ulcer-bearing area, the extirpation of the involved anal crypt or crypts with the sentinel pile and polyps, and the performance of a posterior sphincterotomy A subcutaneous portion of the external anal sphincter muscle, which in many instances of chronic anal fissure is fibrosed and indurated, is incised at right angles to its fibers If considerable fibrosis exists, a small part of this muscle is excised in order to prevent early reapposition and to insure ample drainage

Kornblith claimed that sulfonamide drugs administered orally and Frei antigen given intravenously to patients with venereal disease in the prestricture stage produce beneficial clinical effects in the acute and subacute states Improvement in the anatomic changes as observed sigmoidoscopically were slow until many months of treatment had elapsed Healing was delayed because of the accompanying acute pathologic process in the pelvic lymph nodes

Costello and D'Avanzo advised periodic proctoscopic examinations in all cases of venereal lymphogranuloma in order that the development of anorectal involvement may be discovered promptly They also advised the performance of an intracutaneous test with Frei antigen in all cases with prolonged and obscure rectal complaints

Neither sulfonamide drugs nor Frei antigen exert a therapeutic effect on fibrosis which is the end stage of the local inflammatory process and a formidable complication of venereal lymphogranuloma

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Wright *et al* believe that only surgical treatment is of value once an extensive fibrous stricture has developed Colostomy helps by lessening secondary infection and by overcoming the effects of chronic bowel obstruction Warthen's technique of obliterating the pouch of Douglas offers the possibility of lessening the chance of anterograde and retrograde herniation of the colostomies This operation, however, cannot prevent constriction of the colostomy stoma, which often occurs in cases of venereal lymphogranuloma Strictures low in the rectum were treated successfully by Wright *et al* by means

excision either as a method of cure or as a palliative procedure for relief of the local symptoms. The surgical methods which he employed were (1) local excision in 2 cases, (2) combined abdominoperineal resection in 28 cases, (3) colostomy with posterior resection in 20 cases, and (4) colostomy for obstruction in 3 cases. Bernstein strongly endorsed the radical form of surgical therapy as described by Miles (*Surg Gyn Obst*, 1931, 52:350).

Muller stated that in the gastrointestinal tract the anal region is the most common site of melanomas. These tumors constitute from 2 to 3 per cent of all malignant neoplasms. This author believes that melanoblasts are derived from the ectoderm which is the probable origin of melanomas. The tumors occurring near the anus are the most heavily pigmented. Melanomas are solid and tend to infiltrate the rectal wall. Ulcerations are superficial without necrosis or deep crater formation. Metastases occur frequently and extensively. About 87 per cent spread to the liver and 50 per cent to the lungs and pleura. Significantly, the retrorectal lymph glands are involved much more frequently than the inguinal glands. Radical surgery is mandatory because of (1) the infiltrative nature of the neoplasm and the necessity for the extirpation of the regional lymph nodes, even if they show no clinical signs of involvement, and (2) the marked radioresistance of this tumor. The mortality rate is about 78 per cent with the possibility of a 5 year cure in about 13 per cent.

Pack *et al* used the term "melanoma" to designate the malignant tumor, and the term "pigmented nevus" or "neuronevus" to indicate the benign variety. Their reported experience with 13 anorectal melanomas is probably the largest single collection on record. None of their patients survived 5 years. Pack *et al* advised wide and deep excision of the primary lesion, which consists of the removal of from 6 to 10 cm of adjacent skin with a still wider area of the deep structures en masse. The involved regional lymph nodes are removed preferably "in continuity" at the time of the initial operation or about a fortnight later. Apparently, these authors, unlike Muller, do not remove the retrorectal lymph nodes. Radiation therapy is considered completely ineffective.

#### INFECTIONS

Courtney (64, 65) presented original anatomic studies based on the dissection of 8 human cadavers and elucidated the complex pathways of infection of the deep perirectal and posterior

levator spaces. The reader is referred to his original papers for study of the important illustrations. It is apparent from these studies that the primary source of infection, in the vast majority of instances, resides within the anorectum (anal duct). In other cases infection may originate in the anal glands, secondarily extending into the anal crypts via the preformed anal ducts. The location of the primary crypt opening can usually be accomplished with relative ease either by observing the discharge of purulent material or by gently probing the crypt with a ball-pointed flexible metal probe from within the anus. If these maneuvers are unsuccessful the abscess cavity is incised, unroofed, and gently explored digitally. An attempt is then made to pass a probe without force from the abscess cavity into the suspected anal crypt. Under certain circumstances it is safe to perform a simultaneous fistulectomy. However, large or deep abscesses with fistulas are best treated by staged operations. In general, McGivney (1,6), Wenzel (286), and Whitney (289) are in agreement with the foregoing.

The embryologic considerations of pyogenic anal fistulas were ably discussed by Young (295). He restated the concept that vestigial anal glands and ducts (in common with the prostatic glands and paraurethral glands in women) originate from the cloacal membrane. The anal crypt and the associated intramuscular sinuses of Herrmann are foci and precursors of anal fistulas. Young believes that anal cryptitis precedes perianal and rectal abscess with resulting fistula, and that it is "detonated" by a precipitating cause such as trauma or diarrhea. He proposed a surgical treatment consisting of (1) severance of the fibers of the sphincter muscle over the fistulous tract at right angles to their course, (2) wide "paring back" of the rapidly regenerating anal epithelium away from the severed ends of the sphincter muscle in order to allow sufficient time for the sphincter to re-establish its continuity completely, and (3) removal of a sector of anal epithelium as well as of any hemorrhoidal elements opposite the fistula wound. Young believes that a redundant contralateral surface of the anal canal may stimulate the ill-advised gauze pack by wedging the sphincter wound during healing. By utilizing this surgical procedure the seton will not often be necessary.

A primary closure technique of anal fistulas was presented by Kenney. This operative procedure consists of (1) careful anatomic dissection of the tract, (2) infiltration of the wound with penicillin solution, (3) good hemostasis, (4) ef-

fective obliteration of the dead space with fine cotton sutures, and (5) complete closure of the mucosal defect Kenney reported that in 11 of 12 patients the wound healed by primary union without complications or recurrence during a period of observation ranging from 2 to 6 months

The experience of one of us (R T) with primary closure of anal fistulas was not as successful as Kenney's and this procedure was therefore abandoned

The occurrence of malignancy in an anal fistula is discussed in the chapter on malignancy

Jackman and Bue (135) studied 600 patients with anal fistula and found an incidence of 11.5 per cent of tuberculosis somewhere in the body This observation, they believed, justifies a suspicion of tuberculosis in every patient with an anal fistula About 7 to 8 per cent of their material was tuberculous but their data do not permit an opinion as to whether the tubercle bacillus is a primary or secondary invader of anal fistula A properly performed but negative guinea pig test excludes tuberculosis A positive test and a negative histologic examination suggests that the tested tissue was contaminated

Ditmore still advocates digital dilatation under anesthesia for the cure of the painful lesion of fissure (ulcer), but adds that "the fissure should be relatively small, the base should be smooth and there should be a minimum of scar or any other elastic tissue" In our experience this type of acute anal lesion usually responds to the topical application of a bland ointment and to hot hip baths alone Occasionally the oil-soluble "anesthetic" solutions are employed If these measures fail, we employ surgical therapy Because of the smooth convalescence and good results which follow operative treatment the latter is preferable to dilatations which are traumatic in character and result in tears of the muscle fibers and extravasation of blood into the sphincter muscle which may become secondarily infected

Turell (274) described a rational surgical procedure for the eradication of chronic anal fissure The operation includes wide excision of the ulcer-bearing area, the extirpation of the involved anal crypt or crypts with the sentinel pile and polyps, and the performance of a posterior sphincterotomy A subcutaneous portion of the external anal sphincter muscle, which in many instances of chronic anal fissure is fibrosed and indurated, is incised at right angles to its fibers If considerable fibrosis exists, a small part of this muscle is excised in order to prevent early reapposition and to insure ample drainage

Kornblith claimed that sulfonamide drugs administered orally and Frei antigen given intravenously to patients with venereal disease in the prestricture stage produce beneficial clinical effects in the acute and subacute states Improvement in the anatomic changes as observed sigmoidoscopically were slow until many months of treatment had elapsed Healing was delayed because of the accompanying acute pathologic process in the pelvic lymph nodes

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of endoanal excision with preservation of the sphincter. A preliminary colostomy was usually employed. When the entire rectum was involved or the disease was high in the rectum, abdominoperineal extirpation of the rectum was employed. In the cases with involvement of the descending colon, a permanent transverse colostomy was advocated.

Superimposed carcinoma occurred frequently enough to be of clinical importance.

Kaiser and King reported their experience with 38 deliveries in the presence of pelvic venereal lymphogranuloma with rectal stricture. Three cesarean sections were performed because of widespread scarring of the soft tissue in the pelvis. The mortality among the reported 162 cases in the literature was 6 per cent. Force in delivery played a large role in the reported fatalities. Version and extraction is absolutely contraindicated. Death is usually due to rupture of the rectum or uterus. Hence, these patients should be observed diligently for signs of peritoneal irritation or shock. Colostomies present no special obstetric problems.

Steer believes that the gravity of the possible complications warrants advice against pregnancy in a patient with active disease or a rectal stricture, and furthermore suggests consideration of termination of pregnancy if it has occurred. In the presence of rectal stricture, cesarean section is the method of choice for delivery.

Berkowitz mentioned the rare location of granuloma inguinale in the anal region. This lesion is caused by a gram-negative, nonmotile bacillus identifiable by smear or biopsy in the state of encapsulation, known as a Donovan body. Streptomycin appears to be effective (24, 28, 143), but must be continued for a prolonged period of time (41 days in 1 case).

Bacon and Gass (15) discussed all phases of syphilis of the anorectum. It should be noted that the addition of antibiotic therapy has exerted a very beneficial effect in this disease.

**Diverticulosis and diverticulitis.** The problem of diverticulosis and diverticulitis of the entire gastrointestinal tract was discussed by Nash and Palmer and Gerwig. This lesion is most commonly found in the sigmoid. Anderson ascribes the preponderance of diverticula in the left colon to the solidity of the fecal stream, the smaller diameter of the bowel and the occasional presence of fecaliths in the diverticula which obstruct drainage. Defecation occurs when the fecal mass fills the rectum and creates a pressure of between 40 and 50 mm of mercury. It is the sigmoid that bears the brunt of the effects of this pressure.

The familial aspects of diverticulosis are discussed by Schlotthauer who described a family of 7 brothers who had this condition although their 2 sisters did not. The occurrence of the lesion in 100 per cent of the male members and 78 per cent of the entire family suggests the consideration of heredity as an additional etiologic factor to the known causes such as physical forces, degenerative changes in the muscular layer incident to age and trauma, diet, and congenital defect in the intestinal wall.

Cohen and Matthews reported a heretofore undescribed form of diverticulum which began as a herniation of the lumen into the wall of the colon and burrowed its way along the wall. The authors apply the term "dissecting or intramural diverticulitis" to this lesion. The details of a report of a 60 year old patient are presented in which the sequence of events were sacculization, intramural diverticulum, isoperistaltic propagation, diverticulitis, dissecting diverticulitis, tension pneumodiverticulum, and ileus.

Morton stated that diverticulitis with spasm should be treated conservatively, treatment in general calls for good judgment and patience on the part of the physician and the patient. Pemberton *et al* (205) stated that surgical treatment is determined by the presence or absence of obstruction, the extent of peridiverticulitis and inflammation of the mesocolon, and the accessibility of the affected section of the colon. The safest procedure is the formation of a colonic stoma orad to the lesion with exteriorizing resection performed at the later date. Primary resection and anastomosis without preliminary colostomy may occasionally be performed in the absence of obstruction when the inflammation is subacute in character and only a small segment of the colon is involved. It should, however, be added that a concomitant colostomy is a good safeguard. The diverticular segment of the colon should be excised prior to closure of the colostomy. Cave and Alsop (49) prefer cecostomy to colostomy in acute obstruction, while Pemberton (205) prefers a colostomy. Abscess formation may be prevented by early diversion of the fecal stream. Localized abscess is best treated by incision and drainage.

The treatment of acute perforation usually varies between (1) drainage of the area of rupture with or without closure of the opening, and (2) exteriorization and resection of the colon. Proximal colostomy or cecostomy (98) is often combined with these procedures.

The surgical treatment of fistulas secondary to diverticulitis requires individualization. The be

method is one that employs preliminary diversion of the fecal stream, preferably a transverse colostomy, and resection of the fistula-bearing bowel after the inflammatory process has completely subsided. Sabeti has stated that sigmoidovesical fistulas are best treated by a three-stage operative procedure, namely, (1) the construction of a diverting proximal colostomy, (2) separation of the diseased bowel from the urinary bladder with repair of the vesical opening and resection of the diverticular segment of the bowel, and (3) closure of the colostomy. The bladder should be drained during the second stage either by the suprapubic route or via an indwelling urethral catheter.

In elective surgery the preoperative preparation and the postoperative care should be the same as in cases with colonic neoplasms.

The coexistence of carcinoma with diverticulosis was discussed by Oren who reported 2 personal instances in which a correct diagnosis was made preoperatively. Pemberton *et al* (205) pointed out that the 2 conditions are grossly similar and at times resection of the diverticular mass is essential for the establishment of a correct diagnosis. There is still considerable uncertainty as to what extent diverticulitis is incidental or etiologically directly contributory to the rare occurrence of carcinoma in diverticula.

Dixon and Benson (75) outlined the principles which are employed in the management of external fecal fistulas, based on the experience with 65 cases. There were 2 hospital deaths (3 per cent). Early operation is avoided both because many fistulas close spontaneously and because acute inflammation must subside before operation can be successful. Before institution of surgery several conditions should be met if possible: (1) the causes of the fistula should be determined, (2) the segment of intestine from which the fistula arises should be ascertained, (3) the patency of the bowel distal to the lesion should be known, (4) an adequate trial of conservative management should have been made, (5) the general condition of the patient should be improved, and (6) all evidence of acute inflammation should have subsided.

In this series, the causes were diverticulitis, regional enteritis, intestinal cancer, chronic ulcerative colitis, tuberculous enteritis, actinomycosis, pelvic inflammatory disease, extraintestinal tuberculous abscess, osteomyelitis, foreign bodies, and contraction of scar tissue with encroachment on the lumen of the bowel.

Conservative surgical treatment may consist of simple curettage of the tract (occasionally

successful) or short circuiting procedures. These sidetracking operations are very valuable as (1) a preliminary procedure to aid in the resolution of inflammation, (2) a first step in improving the nutritional state of a patient in poor general condition, (3) a palliative procedure in cases of large, perforating, inoperable cancers, and (4) a form of definitive treatment which can result in complete subsidence of the fistula. Sidetracking procedures consist in ileocolostomy for fistulas arising in the right colon and ileum, ileostomy for those with ulcerative colitis, and proximal colostomy for lesions in the left colon. The colostomy is best placed at a distance from the diseased site. Usually a preliminary transverse colostomy is necessary before any resecting procedure for perforating diverticulitis of the sigmoid is done.

In planning a resection (either following a sidetracking operation or as a one stage procedure) the type of incision is important. Dixon and Benson favor an incision surrounding the fistulous tract rather than a remote approach through a clean field, as the latter leaves the fistulous tract intact and requires reperitonealization of the raw surface in the abdominal wall from the inside. In the majority of cases, the peritoneum should be opened and the intestine mobilized. Extrapertoneal procedures have a limited usefulness in the occasional accidentally produced fistula with mucous membrane of the bowel and skin in close continuity. The extent of resection depends on the amount of diseased tissue, all of which must be removed. This may include bowel resection or resection of only a small rim of normal intestinal wall. An adequate intestinal lumen must be provided for.

The most difficult types of external fistulas to treat are those associated with (1) pelvic inflammatory disease, (2) severe diverticulitis, (3) bone infection, and (4) abdominal actinomycosis. (Also see section on gynecologic injuries elsewhere in the text.)

#### MECHANICAL AND DEGENERATIVE CONDITIONS

Clardy believes that the anorectum has received less consideration by general surgeons than any other part of the body. He condemns instrumental or digital avulsion of the anal sphincter muscles, clamping of large masses of tissue, burning or cauterization with hot irons, unnecessary suturing, and the removal of great areas of mucosa and skin. He described a simple technique of hemorrhoidectomy. The hemorrhoidal mass is grasped at each end with an Allis forceps. The mucosa and skin are incised on both sides and are pulled toward the base. The

Excision of the intervening and adjacent scar and reapproximation of the freshened muscle ends with a Bunnell-like tendon suture of No. 0 chromic catgut are advocated by Turell, Gordon, and Davis (276). In addition, a few interrupted sutures are introduced into the tissues under the muscle to obliterate possible dead space and to relieve tension on the sphincter muscle stitch. The subcutaneous tissues are approximated with interrupted sutures and the skin is left unsutured. Sulfonamide and antibiotic therapy is employed before and after operation.

Zager reported the histories of 3 workers in whom anorectal symptoms appeared after heavy lifting or pulling. These individuals were granted compensation since the causes for awards under the Workmen's Compensation Act include aggravation of the symptoms as well as direct cause of the symptoms. Since massive rectal prolapse is considered a form of sliding hernia, it is reasonable to parallel its compensatory features to those of inguinal hernia.

There is a need for comprehensive study of the relation of physical strain and increased intra-abdominal pressure to the development of hemorrhoids and prolapse. Many medical officers serving with the Armed Forces during World War II believed that (1) there was a definite increase in the incidence of hemorrhoids in the military personnel as compared to civilians of the same age, and (2) that this increase was due to accelerated physical activity and muscular strain.

Simon *et al.* (245) noted backache and an ineffectual urge to defecate without abdominal pain, tenderness, and distention as a common symptom of volvulus of the colon.

Griffin *et al.* distinguished 2 types of sigmoidal volvulus, (1) the acute and (2) the subacute varieties. The acute cases run a fulminating course as gangrene develops early, while the subacute forms usually occur in the older age group and run a moderate course. Because of the tendency toward recurrence following detorsion, exteriorization followed by resection as a second stage is advocated. Recently, Bruusgaard has stated that primary resection with anastomosis after detorsion is an effective elective method of treatment and may be carried out after proper intestinal preparation. Gilchrist (99) believes that obstructive resection is the surgical procedure of choice.

A successful nonsurgical method of treatment was described by Bruusgaard who believes that in most cases of sigmoidal volvulus there is torsion of the sigmoid with obstruction of the lumen, but without strangulation or serious cir-

culatory disturbances. He employed proctoscopy and intubation with a rectal tube 60 cm. long and from 6 to 10 mm. in diameter, in 123 patients suffering from acute volvulus without evidence of serious circulatory disturbances in the sigmoid. A sigmoidoscope was introduced to the site of the torsion with the aid of careful insufflation. The site of torsion was easily recognized by the characteristic screwlike or spiral folds and a lubricated soft rubber rectal tube was introduced without force past the site of obstruction. Following the passage of the tube prompt evacuation of flatus and soft feces occurred with instant relief. The tube was left indwelling for 2 or 3 days and was held in place by a suture to the perianal skin. In 9 instances, attempts at intubation by proctoscopy were unsuccessful, probably because of the firmly fixed twist of the sigmoidal loops. It should be pointed out that this method of therapy has no effect on the tendency toward recurrence of this lesion, and is therefore not a definitive treatment. Other authors (293) consider conservative decompression as an emergency measure that will make possible subsequent elective resection of the redundant sigmoid colon.

Spontaneous untwisting of the sigmoid colon may occur when torsion is less than 360 degrees, in torsion of 360 degrees the twisted loop is usually held fast between the anterior and the posterior abdominal wall. Detorsion may occasionally follow a simple enema or a diagnostic barium enema (181).

Andresen reported a series of 46 cases of perforations of the rectosigmoid resulting from sigmoidoscopy, which had been gathered by questionnaire. These were compared with 48 cases collected from the literature. About 50 per cent of these 94 cases resulted in death. Spontaneous recovery occurred in 9 cases, in these a walling off of the perforation may have occurred. Conservative treatment is advocated for cases in which the perforation is not recognized within 24 hours or in which the patients are poor risks. In the early cases, closure of the rent of the bowel should be performed as soon as the patient has recovered from shock.

Walker reported 1 instance of rectal perforation after sigmoidoscopy in a patient with amebiasis. The injury was repaired but the postoperative convalescence was stormy. The peritoneal drainage yielded cysts of *Endamoeba histolytica* (*Brit. M. J.*, 1946, 1:434).

Andresen pertinently emphasized that the sigmoidoscope should always be passed under visual guidance, and if sigmoidoscopy is not possible



because of persistent angulations of the bowel, fecal accumulation, bloody or other discharges, the presence of new growths or other objects obstructing the lumen, or the struggles of a nervous, unco-operative patient, the endoscopic examination should be discontinued immediately.

Pratt and Jackman collected 20 reported cases of perforation of the rectum due to the enema tube, and to these they added 2 personal cases. The perforations apparently occur most often either in pregnant women at term or in persons over 50 years of age, and are usually found on the anterior rectal or rectosigmoidal wall. The normal bowel of a conscious individual can be perforated without the use of much force, and the colon of an older person is particularly vulnerable to tears. The best treatment is prompt surgery (identification and repair of the injury) as the mortality rate rises in the first 4 or 5 hours. Location of the rent at the time of operation is facilitated by the insertion of a catheter into the rectum to mark the approximate level of the tear.

Davis reported 3 cases of perforation of a colostomy loop caused by an enema tube used for irrigation. Two patients were operated upon on the day of the injury, while the third patient was explored 3 weeks following the perforation. All survived. Davis believes that an enema tube should not be inserted into the colostomy loop farther than the depth of the abdominal wall. This may be accomplished by the employment of David's method, in which an inverted rubber nipple (similar to the type used on a baby's bottle), with a catheter through its center, is inserted into the colostomy. This provides a water-tight compartment and allows hydrostatic distention of the bowel, which avoids pressure necrosis and perforation incident to direct pressure of the enema tube on the bowel wall.

Shidler reported his experience with perforations of the colon and rectum in Navy personnel, stating that death usually occurs if the time interval between bowel injury and definitive surgery is more than 18 hours. Colcock (54) described experiences with 120 soldiers who sustained perforating colonic and rectal wounds. He ascribed the decreased morbidity and mortality during World War II to adequate transfusions of blood, antibiotics, and the skill of the operating surgeon. Welch reviewed at length reports in the literature dealing with abdominal war wounds. (Also consult our last review, 273.)

Blaisdell discussed the causes and treatment of traumatic injuries of the rectum in civilians. McLanahan and Johnson described the seventh

case in the literature of spontaneous rupture of the lower colon with evisceration of the small intestine through the anal orifice.

Falk and Hochman reported on intestinal injuries in 42 women which occurred during gynecologic laparotomies. Usually these injuries are recognized at the time of operation and are repaired successfully. In some cases trauma to the intestine results in necrosis and in fecal fistula or fatal peritonitis. Fistulas of the colon or terminal ileum usually heal spontaneously. The authors advise that sufficient time be allowed for the fistula to close spontaneously before surgical repair is attempted.

Spackman called attention to the late effects upon the intestinal tract of irradiation therapy for uterine cancer. Incomplete or complete intestinal obstruction may be produced by vascular changes and cicatricial contraction fibrosis. Usually the sigmoid is involved, but any segment of the small intestine lying low in the pelvis or in the area of active irradiation may be affected.

Leiter and Lyons reported an unusual case of persistent postoperative paralytic ileus that responded to cecostomy after all other available conservative therapeutic measures had failed. The successful result may have been due to improvement in the circulation of the colon resulting from the elimination of retained fluid and gas, which broke the cycle of colonic distention, stasis, and impaired circulation.

Remington *et al* reported 2 cases of stenosis of the colon secondary to chronic pancreatitis. This cause of colonic stenosis is rare, therefore, all colonic strictures should be suspected as being of malignant origin until pathologically they are proved otherwise.

#### SYNDROMES

The role of allergy in pruritus is apparently little understood, but it is frequently incriminated. The importance of the allergic cause of anal pruritus was discussed by Rugeley, and Whitney (287). Regarding food sensitization, Sulzberger pertinently pointed out that a sharp differentiation should be made between anal itching caused by a contact type of sensitization produced by a food and a pruritus due to an atopic or urticarial type of sensitization to food. The former type of sensitization occurs rather infrequently, whereas the latter type, although frequent, is not generally recognized.

Much has been written about the antihistamine drugs. Ratner stated that neither benadryl nor pyribenzamine are antihistamine chemically or pharmacologically. Feinberg and Bernstein be-



lieve that pyribenzamine applied topically, preferably in a water-soluble base, affords symptomatic relief in the treatment of pruritus ani and in cases of atopic dermatitis. However, Sulzberger *et al* failed to confirm their results in the treatment of atopic dermatitis, but noted alleviation of anogenital pruritus in some cases. In our experience, this form of local therapy is effective in a small but definite number of cases of regional pruritus that is recalcitrant to antecedent nonradical methods of therapy. We have, however, also observed the infrequent occurrence of acquired local sensitivity to these drugs with an aggravation of pruritus.

Hoelzel in an experiment performed on himself noted that following the ingestion of cotton fiber and fruit juice he developed anal leakage of fluid and pronounced pruritus ani. Without determining the chemical nature of this fluid he reasoned that a tryptic corrosive (enzymatic) action on the anoperianal skin caused the anal itch. Friedman *et al* carried this work a step further. They made chemical determinations of the anal discharge in 56 individuals and found that the drainage of the patient with moist pruritus contained enzymatic properties similar to trypsin which was probably responsible for the pruritus. The local application of a paste made with aluminum hydroxide gel produced prompt and sustained relief in about 95 per cent of the patients with moist pruritus. This therapeutic agent is believed to inactivate the proteolytic enzyme and other chemical irritants.

With regard to biochemical factors, Bacon and Hardwick (16) postulated that on the basis of recorded studies in the literature, anal pruritus may be caused by disturbances in the gastrointestinal secretions resulting in a change in the bacterial flora and in an elevation of the pH of the rectal mucous membrane. In an attempt to reduce the pH of the rectal mucosa they instituted a regimen consisting of an acid-ash diet and glutamic acid hydrochloride. Gelatin and lactose suppositories were added in an attempt to reduce anal leakage during the night.

The recent introduction of fatty acid drugs (propionates, caprylates, and undecylenates) has improved the therapeutics of fungous infection of the anogenital area (5). These drugs are also bactericidal to a host of nonfungous organisms. Pruritus caused by monilia responds promptly and for a long time to these drugs. In our experience a small number of patients with anal pruritus, suspected but not proved to be due to fungous infection, responded to the fatty acid drugs whereas they had been refractory to other

forms of nonradical therapy, these favorable effects have been sustained. One of the best ointments for the treatment of fungous infection elsewhere in the body contains 5 per cent of undecylenic acid and 20 per cent of zinc undecylenate (258).

Leucoplakia vulvae is included here because of its frequent occurrence in association with anal pruritus. Miller *et al* studied extensively the clinical, histopathologic, and therapeutic aspects of this lesion. Hyams and Bloom have observed little or no free gastric hydrochloric acid in their patients with leucoplakia. Because of the known relationship existing between gastric anacidity and a low plasma level of vitamin A, they administered orally from 250,000 to 500,000 units of vitamin A daily, supplemented by injections of 50,000 units twice weekly. In addition, they gave each patient 1 c.c. of diluted hydrochloric acid 3 times daily. Fourteen of 18 treated patients showed subjective and objective improvement in their condition, the 4 patients who were not benefited suffered from some constitutional disease. It was concluded that this lesion is of metabolic origin and not a neoplasm.

Wilson modified Jelks' procedure which consists of a radial incision through the anoperianal skin to the dentate line without removal of skin. The entire undercut surface is covered with one piece of oxidized cellulose packing. This operative procedure is combined with a partial sphincterotomy and is followed by postoperative digital dilations.

Turell (275) has evaluated the results obtained with tattooing with mercury sulfide. Tattooing with mercury sulfide is advocated for the treatment of intractable anal pruritus which is associated with definite characteristic cutaneous changes in the absence of anorectal colonic disease. It may also be given a trial in cases of persistent pruritus without cutaneous changes, when other radical procedures, such as a subcutaneous injection of ethyl alcohol or the radical excision of anoperianal skin, are being contemplated.

D'Antoni distinguished between the terms "diarrhea" and "dysentery." Both types of stool may show mucus, blood, and pus, but the dysenteric stool also contains cellular debris with little fecal material and its passage is associated with tenesmus, while the diarrheal stool is mainly fecal in composition.

Any continuous or recurrent diarrhea which lasts longer than a month is arbitrarily considered chronic diarrhea. Almost 75 per cent of chronic diarrheas are caused by amebiasis, shigellosis,

and brucellosis, singly or in combination, all three types of intestinal infection may coexist in one patient. The exact diagnosis is established by appropriate laboratory procedures. Amebic cysts or trophozoites are detected on microscopic examination. Shigellosis is diagnosed by repeated cultures of enema specimens, especially of 5 c c specimens collected from the final portion of a second enema. Brucellosis is diagnosed by special tests.

Silverman and Leslie also emphasized that enteric infections caused by *Endamoeba histolytica*, *Bacillus dysenteriae*, and *Bacillus paratyphosus* may exist with a history of minimal or no diarrhea.

The initial treatment of all enteric infections calls for a multiple vitamin preparation of high potency. Shigellosis and brucellosis are treated for a long time with vaccines as in the chronic form these lesions are unaffected by the sulfonamides or antibiotics. Shigellosis is best treated by an autogenous vaccine for over a year as results are not apparent for 6 months. Amebiasis is treated with available amebicides. Resistant amebiasis is treated with a combination of amebicides, penicillin, and sulfonamides.

Levinson and his collaborators (240) found that a vaccine which produced a high degree of immunity in mice failed to protect human beings against experimentally produced bacillary dysentery. These enteric infections were quite severe but were effectively controlled by sulfadiazine, which also rapidly suppressed the carrier state. It appears that the many contradictory reports on the merits of sulfonamide drugs in bacillary dysentery may be due in part to the fact that dysentery is a self-limited disease.

Kiefer pointed out that the present methods of medical therapy for ulcerative colitis are often inadequate except in the milder cases, although severe and complicated cases are occasionally controlled by medical measures.

The successful employment of sodium phthalyl-sulfacetamide in ulcerative colitis has been reported (Heineken, T. S., and Seneca, H. *Rev Gastroenter*, 1948, 15 611).

Recently, Ehrlich (86) introduced extract of hog stomach as an addition to the therapeutic armamentarium. He believes that because of intestinal hypermotility there is an increased concentration of the proteolytic enzymes in the colon and rectum which predisposes the colonic mucous membrane to autolysis. To make up for the loss or deficiency of an assumed antiproteolytic intestinal substance, Ehrlich administered from 30 to 60 gm of desiccated extract of hog stomach, in

divided doses, daily before meals to 15 patients for a few weeks to 3 months. Inflammation, ulceration, and spasm disappeared and resulted in an intact mucous membrane. Because of secondary infection, 4 patients were treated with sulfonamide drugs. Another 4 patients suffered a relapse and required repetition of this form of treatment.

Haskell and Friedman reported that the oral administration of a duodenal substance, defatted and desiccated without autolysis, gave beneficial results in patients with nonspecific ulcerative colitis by reducing the frequency of bowel movements, increasing the stool consistency, and causing the disappearance of gross blood in the feces.

The etiologic role of lysozyme (a mucolytic enzyme) in ulcerative colitis is under intensive study in many clinics. At present it is known that (1) lysozyme is present in increased amounts in the stool of patients with ulcerative colitis, and (2) that perfusion of lysozyme through the colon of experimental animals is capable of causing severe ulcerations.

Machella and Miller have treated 12 patients by means of a "medical ileostomy." This consisted in the intubation of the bowel by means of a double-lumened Miller-Abbott tube with constant suction and the oral administration of a protein hydrolysate—dextrimaltose mixture. This therapeutic method aims at providing a temporary period of rest for the diseased colon and at the same time improving the nutrition of the patient.

During the past 10 years, Cave (50) has operated upon 101 patients with intractable ulcerative colitis with 20 immediate or early fatalities. Gain in weight, averaging 45 pounds, was noted in 50 patients. In 2 patients intestinal continuity was re-established by ileosigmoidostomy. Prolapse of the ileum through the stoma is a disabling and serious complication. Acute obstruction due to adhesions or volvulus has also been observed. Following proctectomy the ileostomy assumes, to some degree, the functions of the rectum—the ileal contents become more solid, the lumen enlarges, and the walls thicken.

The technique of the construction of a single-barreled, skin-grafted ileac stoma after the method of Dragstedt was described and utilized successfully in 4 cases by Black and Thomas.

Vagotomy, as the only surgical form of therapy, was introduced by Dennis and Eddy as a means of decreasing intestinal muscular activity without significantly increasing the transit time of the fecal material through the bowel. Pus in the stool disappeared or was diminished. The

general health of the patient improved. It is to be noted, however, in the section on anatomy (elsewhere in the text) that the vagal innervation of the large bowel ends in the transverse colon. It is therefore difficult to understand how a vagotomy can affect the function of the left side of the colon or of the rectum, which are the most common sites of ulcerative colitis. Vagotomy therefore probably produces its effects by decreasing activity of the small intestine and the right colon.

Smith lists polyps, malignant lesions, strictures, perforation, hemorrhage, massive phlebitis, uveitis, arthritis, and cutaneous lesions as complications of ulcerative colitis. Polyps, pseudopolyps, and true adenomas, single or multiple, occur frequently. Polyps are believed to result from the continued attempt of the colon to overcome its destruction. Malignancy seems to occur a long time after the onset of the inflammatory disease. This is in agreement with the experience of Cattell and Boehme (48). These authors emphasize that carcinoma arising on ulcerative colitis is highly malignant and metastasizes early. Strictures of the colon develop even after the performance of ileostomy or colostomy. Perforation and massive hemorrhage are the result of destruction of the intestinal wall by the severe inflammatory process.

Ricketts *et al* reported that 60 of 156 patients with clinical evidence of ulcerative colitis showed a normal colon on roentgenography. This, the authors emphasize, showed that anatomically ulcerative colitis may remain a relatively superficial process in many patients with symptoms of long duration. Variations in the clinical manifestations may take place independently of the roentgenographic pattern. The extent of the roentgenologic involvement cannot be correlated directly with (1) the type of onset, (2) the duration of symptoms, and (3) the clinical severity of ulcerative colitis.

The survival time of the *Endamoeba histolytica* in the feces in dysentery has been studied in Jerusalem by Gurevitch and Delightish. They noted that actively motile trophozoites of *Endamoeba histolytica* survived from 5 to 8 hours in the fecal specimen left at room temperature, but at 37 degrees centigrade the ameba survived only from 2 to 4 hours. These authors agree that the best method for the diagnosis of amebas is the microscopic examination of a fresh fecal specimen, but they believe that the results of the examination are reliable enough if it is performed within 6 to 8 hours. In cases in which immediate examination cannot be made it is advisable to

preserve the feces in the refrigerator. D'Antoni stated that the examination of a single stool following purgation is as effective as the examination of 3 normally passed stools. Hargreaves, and Albright and Gordon deprecated the term "cyst carrier" because every individual who passes cysts must have vegetative amebas living on the tissues of the intestinal wall and completing their development. Cysts from asymptomatic carriers are pathogenic. The development of amebic hepatitis in about one-third of the patients without a history of diarrhea or dysentery suggests that the "carrier" state is a pathologic condition and that it represents an active stage of the disease. Ellenberg (87, 88) believes that the basic pathologic pattern is identical in symptomatic and asymptomatic cases of *Endamoeba histolytica* infection, and that secondary invasion of amebic ulcers by bacterial pathogens is a decisive determinant in the symptomatology in amebic infection.

Proctosigmoidoscopy (and occasional biopsy) is essential in the study of amebiasis. It was pointed out again (Schroder, S, *Proc Am Fed Clin Res* 1948, 4: 47) that some patients with trophozoite in the stool present no intestinal lesions while other patients with suggestive colorectal lesions show no trophozoites in the feces or on smear but respond well to antiamebic therapy. Before instituting treatment, however, we prefer to do a biopsy of the lesion as the trophozoite is frequently found on histologic examination.

The therapeutic armamentarium for amebic infection includes the available amebacides, namely, diodoquin, chinofon, carbarsone, and vioform. Recently bacitracin, chloroquine (59, 60), and para-aminobenzoic acid (*sodium salt*) (84) have received therapeutic trials. The sulfonamides (87, 88) and the antibiotics (111) are employed in refractory cases, especially in the presence of secondary infection.

D'Antoni believes that diodoquin is the most effective amebacide, although for some unexplained reason this drug seems less effective than it formerly was. Ellenberg (87) noted good results from carbarsone. In general, the amebicides act on the trophozoites and cysts within the intestinal lumen. However, emetine hydrochloride, given parenterally, acts on the trophozoites within the tissues and is effective against amebas and extraintestinal amebiasis. However, chloroquine (60) has been found to be an effective substitute for emetine in the treatment of extraintestinal amebiasis and particularly in amebic hepatitis. Furthermore, it lacks the toxic centralities, for which reason it is preferable.

emetine Recently, emetine has been employed orally in the treatment of intestinal amebiasis. The enteric coating made possible the oral administration of this drug, which is given in dosages of 0.120 gm daily to adults and of 0.060 gm daily to children for a period of 12 days. These amounts provide a concentration of emetine in the intestinal tract which closely approaches the amebicidal concentration necessary to eradicate the amebas without producing toxic side effects (243).

The toxic action of emetine on the myocardium was studied by Dack and Moloshok. The principal signs of the toxic effects were dyspnea, tachycardia on mild exertion, fatigue, and electrocardiographic changes generally involving the T waves.

The extraintestinal complications of amebic infections consist mainly of suppurations in the liver, the lungs, brain, urogenital organs and skin, especially in the perianal region. Pericarditis is occasionally produced.

In the discussion of the surgical aspects of intestinal amebiasis, Hawe advised conservatism, as surgery may be followed by acute exacerbation of amebic dysentery, local and distant septic complications, intestinal hemorrhage, and delay or failure of normal repair processes. When an exploratory operation is absolutely necessary as in the case of possible appendicitis, the handling of the cecum should be avoided as much as possible. Surgery is indicated for intestinal obstruction or perforation and suppurations. When a rectal ameboma resembles carcinoma, biopsy is necessary as the parasite is usually demonstrable in the specimen.

The treatment of anorectal lesions, such as hemorrhoids, fissures, and fistulas, should be delayed until the underlying disease is eradicated (249). Rarely, a colostomy is of value in the treatment of anorectal fistula.

Rectalgia associated with diarrheal disease may be relieved by a suppository containing ethylaminobenzoate (benzocaine) 3 to 4 times daily (23).

Crohn stated that marriage of patients with ulcerative colitis may be consummated, but that pregnancy should be avoided. It is generally agreed that these patients do well during the period of gestation but often develop severe recurrences a short time after parturition. Cave (50) advised therapeutic abortion after proper consultation for pregnant patients with ileostomy.

Marriage of a man with a permanent ileostomy is possible and many have been successfully married. Prospective marriage of a woman with

a permanent ileostomy is unlikely to be successful, according to Crohn. This also holds true for already married women as an ileostomy is usually repugnant to romance and sex. Fear of infidelity on the part of the husband often leads to anxiety and a fear neurosis in the wife.

However, successful marriages have been consummated by women with ileostomies (A S L).

More and more references to the emotional factors in chronic ulcerative colitis are appearing in the literature. Daniels (69) reiterated the psychiatric factors previously discussed by him and which were discussed in our last review (273). He believes that over 75 per cent of the patients with this lesion have an emotional conflict as a primary causative factor.

Groen attempted through an elaborate biographical anamnesis to establish what had taken place in the emotional life of his patients before the onset of an initial or recurrent attack of ulcerative colitis. This method differs from psychoanalysis in that it does not rely too much on free association or dream-analysis and is also less time-consuming than an analysis. It is the examiner who controls the conversation and sees that the history is related in a chronologic order, the examiner must objectify the findings.

The special peculiarities of character observed and described in detail by Groen are

- 1 A well developed intellect
- 2 Carefulness and neatness, often exaggerated. These patients dislike vulgar or obscene expressions and hate coarse jokes. They are neat in dress and choice of clothes. Some have a flair for fashion. They try to associate with people of a higher social status, thus acquiring a stamp of distinction and respectability. The women have a great sense of cleanliness, are conscientious in the performance of domestic duties, and often continue the meticulous housework long after the disease has undermined their physical strength.
- 3 Extreme sensitiveness, even oversensitiveness. These patients are easily offended and do not get over things of minor importance. They feel ill-treated and fret about it.
- 4 They frequently display hesitation and an unbalanced attitude toward the value of their own personality. While, on the one hand, they have an inferiority complex, on the other hand, they may give the impression that they have a high opinion of their own qualities. Inwardly they are full of criticism of others. The more their confidence is gained, the more they dare to criticize. A strong, but frequently hidden, narcissism is always apparent after prolonged search.

5 Egocentricity is very marked. They may talk about helping other people but actually they are doing nothing outside of their immediate circle. They hardly ever possess political or humanitarian ideas.

6 A passive attitude toward life is frequently exhibited. These patients talk much about what they would like to do but never do anything. They are usually ambitious but to a limited degree.

7 Fear is a dominant feature. In an emergency situation they usually retreat or fail. In any difficult situation they preferably choose the path of least resistance, this attitude may be hidden under a show of manly independence.

8 Lack of aggressive tendencies in behavior is present in most but not in all patients.

9 Love, sympathy and affection, and harmonious surroundings are sought for by these patients. If they do not receive love from others they become utterly helpless and unhappy.

10 They possess an exaggerated, idealistic, frequently naive, and infantile conception of love. They think of love as a sublime adoration, attachment and harmony between husband and wife but consider the bodily sexual contact as something inferior. They cannot establish a normal harmony between their practical erotic and their ideal love life and, consequently, they seldom are capable of normal sexual relationships. Many never marry or marry only after long hesitation. Loss of libido or impotence occurs frequently in male patients. Many of the married female patients have never experienced a normal orgasm as frigidity frequently precedes the onset of colitis. These patients, even the adult ones, frequently practice masturbation which is a marked contradiction to the purity and idealism of their love ideal.

11 Abnormally strong fixation on the mother frequently combined with fear of the father is observed in all male patients. There is no woman who can equal their mother. Some of the male patients have an "instinctive" liking for elderly women. Their attitude toward other men is often reminiscent of the fear or hate they feel toward their father. Some female patients exhibit a strong fixation on the father and an aversion to the mother.

12 These patients repress and worry much more than is apparent, it is difficult to induce them to speak about their inner life. Sometimes they are ashamed of not being able to manage their conflicts themselves.

Individuals with a character structure just described may live undisturbed as long as their

special wishes and desires are satisfied, or as long as they live a sheltered life. However, this sheltered or special life may be easily upset. If a situation arises with which the patient cannot cope and from which he cannot escape, he will conceal it, and in a few days ulcerative colitis will be present.

Treatment consists of 2 parts, namely, an emotional catharsis and simple encouragement of the patient. As a result of this superficial type of treatment the colitis clears up, but the patient remains a neurotic.

Ginsberg and Ivy (*Gastroenterology*, 1946, 7, 67), however, have stated that to date no clearcut evidence has been produced to show that ulcerative colitis is the end result of functional, vascular, or neurotropic derangement, although they concede that emotional factors may play a part in the onset of this condition.

Mucous colitis is very probably merely an expression of or a somatic response to nervous tension, such as anxiety states, submerged fear, guilt, and so forth. Gauss believes that in this disease the life conflict of the patient is mediated through the sympathetic nervous system and is localized in the colon. Psychotherapy combined with somatic treatment is of value. Cures are few, recurrences frequent, and fatalities absent.

It would probably be better to abandon the term "mucous colitis" because the ending "itis" connotes inflammation which is usually absent in this disease.

Lyons demonstrated that sigmoidal carcinoma and diverticulitis are frequently the cause of right-sided symptoms which simulate appendicitis. He suggested the following probable reasons for the contralateral symptomatology: (1) position of the sigmoid on the right of the midline due to mobility or anatomic variation, (2) perforation of the right border of sigmoid or rectosigmoid with spillage of fluid into the right iliac space, (3) extension of perisigmoidal abscess to the right, (4) adherence of right sided structures to the sigmoidal lesion, (5) marked distention of the cecum, and (6) situs inversus.

Jones (137) advocated thorough surgical intra-abdominal exploration for cases of rectal bleeding of unknown origin. Through a low midline incision he visualizes and palpates all of the small intestine beginning at the ileocecal junction. If the small intestine is normal, the colon is then examined in a similar manner. If this examination gives negative results, the stomach and duodenum are explored through an upper midline incision. This order of exploration was adopted because roentgenography is usually re-

liable for the detection of gastric and colonic lesions, but is of no value in the small intestine except in cases of obstruction

Wilkinson reviewed the literature and presented the surgical anatomy as well as his personal experience with 23 cases of coccygodynia. The pain in this lesion is said to be due to tonic spasm of the pelvic floor or paracoccygeal muscles. Massage of these muscles in the long direction of their fibers, as advocated many years ago by Thiele (*J Am M Ass*, 1937, 109 1271), is often effective. Wilkinson feels that coccygodynia is seldom, if ever, a manifestation of hysteria or psychoneurosis, the apparent neurosis is more likely the result of this painful lesion.

#### GYNECO-OBSTETRIC ASPECTS

Marbury and Goldman reported 2 cases of suppuration with fistulas following episiotomy, and a third case of anal pain without a definite fistula. While episiotomy constitutes a definite advance in the prophylaxis of rectal injuries due to extensive lacerations of the perineum, it may, however, cause perianal suppuration later and lead to fistulas-in-ano, rectovaginal fistulas, and painful scars. Nicholson believes that whereas the old median episiotomy is subject to the complications described by Marbury and Goldman, the mediolateral episiotomy or perineotomy eliminates anorectal complications since the incision avoids the close neighborhood of the rectum.

Garlock (94) described a plastic procedure which is applicable to the repair of recurrent rectovaginal fistulas associated with extensive scarring. Through a transverse incision in the posterior fourchette a flap of vaginal mucosa is dissected away from the rectum to a level above the fistulous opening. The rectal opening is closed with interrupted sutures of fine chromic catgut with the knots facing the rectum. Each levator ani is mobilized and a flap is cut from the anterior edge of each muscle, to leave a pedicle at the lower end. The right flap is placed across the repaired rectal wall and sewn into place with interrupted sutures of fine silk, the left flap is sutured over the right. Bleeding is controlled and the vaginal mucosa is closed vertically with fine chromic catgut. Complete healing takes place in about a fortnight. This plastic repair eliminates the rigid, poorly vascularized scar tissue and substitutes normal soft muscle. The preoperative regimen is similar to that employed for colonic surgery. Postoperatively, the bowels are kept inactive by a liquid diet and tincture of opium for 9 days. The rectum may then be irrigated. (Also see chapters

dealing with endometriosis, carcinoma during pregnancy, strictures caused by venereal lymphogranuloma, perforation caused by enema tips, intestinal injuries occurring during gynecologic operations, and effects of irradiation)

#### PEDIATRIC ASPECTS

The anatomic peculiarities of the terminal portion of the colon of the newborn (from birth through the first 3 months), of the infant (from 4 months up to 3 years), and the child (3 years and older) are reviewed by Schapiro. The anal canal of infants and the newborn, as well as the surrounding musculature, is quite elastic and distensible. The infant's rectum is practically vertical in position. The sigmoid is very long and coiled. A well lubricated small finger can be inserted easily in the anal canal of the newborn, while an index finger may be introduced with ease into the anal canal of infants and children. Proctosigmoidoscopy should be performed in an extreme inverted position because of the vertical position of the rectum and the necessity of straightening the coiled segments of the long sigmoid. An adult-sized proctosigmoidoscope is well tolerated by children 3 years of age or older. It is emphasized that in the newborn the anterior peritoneum extends to within 1.25 cm (0.5 inch) of the anus, whereas posteriorly the peritoneal reflection is rather high.

The embryologic, pathologic, and clinical features as well as the treatment of imperforate anus are well discussed by Arnheim, and Rosenblatt and May, and Brynjulfson, who believe that an operation should not be delayed too long in the uncomplicated cases. On the other hand, Rhodes re-emphasized his former teachings (*Am J Surg*, 1934, 24 828) that operation for imperforate anus should be delayed for several days to give the terminal bowel sufficient time to descend as far as possible. In some cases the utmost descent takes place in 48 hours, while in others it will not occur until the infant is 5 days old. Rhodes also believes that virtually all of the newborn can be operated upon successfully through the perineal approach, "perhaps there may be a thousandth case that will require colostomy." It should be pointed out that colostomy is generally advised if the rectal pouch is more than 2 cm above the perineum or when a fistula to the urinary tract exists. Liburt reported a successful anorectoplasty with a 3-year follow-up, in which he utilized the sigmoid colon as a new rectum and anus.

Rhoads (*Ann Surg*, 1948, 127 552) reported 2 instances in which the simultaneous abdominal

and perineal operation for imperforate anus of Type III of the Ladd and Gross classification (*Am J Surg*, 1934, 23: 167) was successfully performed.

A case of complete congenital atresia of the transverse colon was reported by Potts. A successful side-to-side isoperistaltic anastomosis was performed with No. 00000 silk used throughout. The patient made a smooth recovery. Roentgenography by means of an opaque enema performed on the nineteenth postoperative day showed that the lumen of the colon had enlarged considerably. Potts believes that his is the first instance of this anomaly in which the infant survived surgical interference.

A case of duplication of all segments of the colon (colon duplex), including the cecum and rectum, was reported by Weber and Dixon. Both colons seemed to be complete morphologically and had a common mesentery. The colon without external communication was filled with fluid and calcareous material, displacing the other colon and rectum.

Duplication of the colon is rare as contrasted with the relative frequency of duplication of the small bowel (77). Parenthetically, only 1 case of triplication of the colon has ever been reported (Gray, A. W., *Arch Path*, 1940, 30: 1215).

Scott and Serenati believe that megacolon is a symptom complex rather than a disease entity. Mecholyl bromide was successfully employed by Peterman in 11 of 12 children with congenital megacolon. Swarts believes that conservative medical therapy should be maintained for a year in this condition and that no patient under 5 years of age should be treated surgically. Scott, utilizing the spinal anesthetic motor test, believes that when this test is effective, previous conservative therapy should be continued. In a few selected patients sympathectomy was advised if spinal anesthesia brought about a dramatic temporary effect. When the spinal anesthetic test is ineffective, the condition is classified as dolichocolon and colonic resection is carried out. Scott prefers a left hemicolectomy and a lateral anastomosis in order to produce the widest possible stoma. Swarts, and Dixon and Benson (76) do not consider sympathectomy a good operative procedure, but regard colectomy the surgical procedure of choice. Dixon favors the exteriorization procedure, and calls attention to the temporary distressing intestinal dysfunction which may appear several weeks after operation. Plain roentgenograms of the abdomen show moderate dilatation of both the small and large bowel which is often segmental. This condition seems to be pro-

duced by spasm and functional derangement of the normal peristaltic activity of the intestine. The administration of belladonna in adequate dosage affords early and adequate relief. At the Mayo Clinic belladonna is given routinely for several months after this type of operation.

D'Antoni encountered 73 juveniles ranging from 6 months to 12 years with amebiasis who presented manifestations differing from those of adults. These children had (1) a muddy or yellowish-tinged complexion, (2) large and tender liver, (3) changes in personality (well behaved children became irritable, sullen and unmotivated), and (4) capricious and sometimes insatiable appetites. Slight constipation was frequent. Diarrhea was present in a few patients and mild dysentery in a few others. The diagnosis was made in the laboratory in all 73 patients, with a doubtful case. Usually, the diagnosis was made from aspirated material secured at sigmoidoscopy. Parents or others in close contact with the children were always found to have amebiasis. Adequate therapy produced prompt improvement in the symptoms (see chapter dealing with diarrhea and dysentery).

D'Antoni also indicated that amebiasis may be associated with neurosis, anxiety states, cholecystitis, appendicitis, and peptic ulcer.

As stated in the chapter dealing with large bowel neoplasms, exclusive of the first year of life, approximately 3 per cent of children have adenomatous polyps (118). Occasionally, the familial type of adenomatosis is observed in juveniles (76).

Bonelli reviewed the literature and found 14 cases of carcinoma and 76 cases of sarcoma of the small and large bowel in individuals up to 10 years of age. Sarcomas occurred predominantly in the small bowel and infrequently in the colon and rectum, they also occurred in the duodenum. Carcinoma was prevalent in the colon especially in the rectum (70 cases). Carcinomas of the colon and rectum ranked first among the malignancies of the alimentary tract. Of the carcinomas were polypoid, ulcerative, infiltrative, and stenosing. Microscopically, the carcinomas were adenomatous, scirrhous, and undifferentiated.

The diagnosis of colonic neoplasms was based on history, physical examination, dental roentgen examination, anoproctosigmoidoscopy, and roentgenography. About 75 per cent of the lesions were visualized instrumentally and the lesions situated above the reach of the sigmoidoscope were diagnosed with the aid of a contrast barium enema. The treatment was surgical resection with immediate anastomosis or colostomy followed by resection.



## MISCELLANEOUS

Sullivan and King (259) confirmed the efficacy of resin of Podophyllum for the eradication of condylomata acuminata. However, they changed the original method of treatment recommended by Kaplan (*N Orleans M & S J*, 1942, 94 338), using 20 per cent of the drug in 95 per cent of alcohol instead of in the suspension of oil. Marks uses a 15 per cent concentration of Podophyllum in compound tincture of benzoin. Sullivan and Blanchard (257) believes that resin of Podophyllum exerts its action on the cell metabolism (in contrast to drugs which produce a fixing or coagulation effect) and that podophyllotoxin is probably the substance responsible for the cytotoxic effect.

Kushlan presented a historic and clinical review of hereditary hemorrhagic telangiectasia, as well as its successful treatment with rutin which is supposed to act by decreasing capillary fragility and by increasing the strength of the muscular endothelial wall of the telangiectases.

Marshak discussed the extracolonic pelvic pathologic processes which because of their proximity may produce roentgenologic defects in the rectosigmoid.

Browne pointed out that mineral oil interferes with the absorption of vitamins and minerals, with normal physiologic processes of the intestinal tract, and with anal hygiene. Alvarez (7) called attention to the fact that when mineral oil is administered in the form of a fine emulsion about one-half of it goes through the wall of the bowel and goes on into the liver. It appears that the indiscriminate use of mineral oil can be dangerous and one should be aware of its possible deleterious effects.

In the past there have been reported several fatal accidents in which death resulted from an explosion of intestinal gas during electrocoagulation procedures. To eliminate the dangers of explosions, Marchand described a method of electrosurgery which could safely be used in the terminal portion of the colon. The essential feature is contact coagulation by means of an instrument which is fastened in place before the current is turned on and is not withdrawn until the current has been turned off, this averts the possibility of a spark at the making or breaking of the contact. It should be noted that Bierman's coagulation electrodes which are fastened to the lesion by means of suction accomplish the same purpose. Furthermore, it is believed that explosions of intestinal gases can be avoided easily by the employment of suction simultaneously with electrocoagulation. Arnous designed an in-

genious proctoscope through which an incombustible gas (nitrogen or carbon dioxide) is made to pass through a 3 way stopcock, flooding the region of the spark. This gas is said to form a barrier between the intestinal gasses and the external air (creating an inert atmosphere) and thereby prevent the formation of an explosive mixture.

## PILONIDAL (SACROCCYGEAL) DISEASE

Certain facts about pilonidal disease which became evident during World War II and trends in the choice of surgical procedures for this condition were discussed by Turell (272). It is now apparent that trauma plays an important role in the activation of pilonidal lesions. Hyperhidrosis and lack of ideal personal hygiene imposed by training and battle conditions have been important in the initiation of pilonidal infection. Surgical specimens removed at initial operation yielded hemolytic and nonhemolytic staphylococci and streptococci, whereas organisms of the colon bacillus group were almost never found. Similar findings were obtained when the subcutaneous tissue juices of the buttocks, as far out as 2 cm from the line of excision of pilonidal cysts, were studied bacteriologically. These observations suggested that sulfonamides and antibiotics have a definite place as an adjunct to surgery.

A comparative study of chemotherapeutic agents in the primary closure of pilonidal wounds by Hamilton and Cattanach showed that the best results were obtained with locally applied penicillin combined with orally administered sulfadiazine. Successful healing was noted in 93.8 per cent of 32 patients so treated. Patients receiving penicillin intramuscularly in doses between 20,000 and 25,000 units every 3 hours showed no significant superiority in wound healing over those who received no chemotherapy. However, in a few cases of incipient postoperative wound infection, a dosage of from 60,000 to 80,000 units of penicillin, administered parenterally every 3 hours, was effective in aborting infection when smaller doses of this antibiotic were ineffective. Turell (272) reported that penicillin administered early and in large doses may have been effective in preventing abscess in some cases of cellulitis in the pilonidal area.

In cases of abscess the best results have followed a simple surgical procedure (272) which consists of the evacuation of pus, necrotic material, and, frequently, tufts of hair through a generous incision, as well as irrigation of the abscess cavity with normal saline solution. The



roof of the cavity is then removed, hemostasis is obtained by gentle pressure, and the cavity is packed lightly with gauze (or gelatin sponge) which has been previously soaked in a solution of penicillin. By comparison with the method of crucial incision and drainage only, the wide unroofing of the abscess cavity is believed to be a far superior procedure.

Good results from conservative sclerotherapy in acute, chronic, and recurrent cases of abscess were reported by Shafiroff and Doubilet who employed a penicillin-sodium morrhuate solution (100,000 units of penicillin to 5 c.c. of 5 per cent solution of sodium morrhuate).

The marsupialization (Buie) technique for cysts and sinuses was discussed by Henning and Dempsey, and by Todaro and Prag.

A cutaneous flap procedure utilizing a transverse or lateral incision was described by Berman. After proper scrubbing of the operative area with soap and water, the sinus was excised widely and completely through an elliptical or longitudinal incision. Transverse incisions were then made through the wound and the flaps undermined. The longitudinal or horizontal wounds were closed. The lateral wounds were left open for drainage in infected cases, while in clean cases the wounds were closed loosely. Berman believes that his cutaneous flap technique permits mobility of the wound at a higher level, and releases all tension on the longitudinal suture line. This, in turn, puts the suture line of the 2 lower flaps at rest and allows these flaps to move as a unit, this prevents poor healing of the caudalmost angle of the horizontal or longitudinal wound. This technique aims to combine some of the desirable features of the closed techniques and the open procedures.

A method of primary closure without flap formation is described by Larkin. A narrow strip of skin is excised in the midline which includes the ostia of the cyst as well as scars from previous incision and drainage procedures. The cyst and adjacent subcutaneous tissues are removed to denude the sacrococcygeal and gluteal fascia bilaterally and undermine the skin widely. Number 30 stainless steel sutures are placed through the skin 0.5 inch apart on the gluteal and sacrococcygeal fascia, which when tied over a gauze dressing tend to close the dead space. The skin is reapposed with No. 30 stainless steel wire vertical mattress sutures. All sutures are removed on the seventh postoperative day. Primary healing was obtained in 90.9 per cent of 66 patients who had not been operated upon previously and in 71 per cent of 21 patients with re-

current lesions. All patients had received penicillin parenterally.

For the treatment of uninfected pilonidal cysts the musculofascial flap techniques with primary closure of the wound came into vogue during World War II, although the theoretic advantages of such procedures were apparent to Ottenheimer in 1933 (Ottenheimer, E. J. *Ann. J. Surg.*, 1933, 2: 120). Pope described a sliding gluteus maximus muscle graft technique, and Ziegler *et al.* described a sliding fascia procedure. For the details and illustrations of these operations the reader is referred to the drawings of the original article.

Holman has simplified the musculofascial techniques. His procedure is quite akin to the one described by Shute *et al.* (*Ann. Surg.*, 1941, 118: 706). In short, the pilonidal cyst is excised en bloc through an elliptic incision directed lateromedially. The fascia overlying the gluteus maximus muscle on both sides, together with a thin layer of muscle tissue, is mobilized sufficiently to permit approximation of the outer flaps without tension. The outer musculofascial flaps are united in the midline overlying the coccyx and the lower sacrum by from 4 to 8 interrupted No. 0 chromic catgut sutures. These sutures include bites of the midprecoccygeal and presacral fascia with a view to obliterating the dead space. Nonabsorbable sutures are not used as these are undesirable in this area. The skin is approximated by a continuous subcuticular stitch of nonabsorbable suture material which is removed in 7 or 8 days. The inferior angle of the wound is closed meticulously (epithelial edge to epithelial edge), while 2 cm. of the cephalad portion of the wound are left open for the escape of blood and serum. This is an important point of the technique. One of us (272), in performing the Shute procedure, meticulously closed the inferior angle of the wound and left the remainder of the wound open for a period of about 48 hours with the insertion of a gauze wick. This gauze packing was placed between the skin edges following the introduction of the skin sutures which were left untied from 36 to 48 hours. After the removal of the gauze the sutures were tied to approximate the skin edges. It was surprising to observe a large amount of hemorrhagic serum in the dead space at this time. The application of the primary closure to the middle and cephalad portions of the wound had not increased the time of effective healing.

During operation trauma to the tissue was meticulously avoided, even retractors were used so as not to injure the delicate and valuable adipose tissue. Clamp on bleeding vessels

are rarely used. Patience and digital pressure usually stop the bleeding. Chemotherapy is used before and after operation. The patient lies on his abdomen or sides and may stand to urinate, lying on the back and sitting is forbidden for over a week.

The occurrence of a rare complication, namely, subphrenic abscess, following primary closure for pilonidal cyst was reported by Hurwitt.

Holman called attention to the acquired type of recurrence. Dimpling of the skin with a subcutaneous sinus penetrating the deep tissues may occur in the scar. Hairs from the walls of the dimple are directed inward which act as a foreign body perpetuating infection. Simple excision of such dimples is curative.

Skin grafting of the wound, employing an intermediate or a split-thickness skin graft after excision of large recurrent pilonidal cysts, may be done advantageously (131, 272). The freshly exposed area apparently is a good base on which to place a skin graft. It should, however, be pointed out that the grafted skin in the sacrococcygeal area is affected easily by slight trauma to present excoriation or fissures.

On the basis of prewar civilian and considerable military experience during World War II, one of us (R. T.) believes that the open operation with excision en bloc is the safest procedure in the hands of the average surgeon. However, this surgical procedure leaves a thin and wide scar over bone structures without an intermediate protective subcutaneous layer of fat. This in turn renders the scar vulnerable to trauma.

On the other hand, the primary closure techniques are still in the process of perfection. At the present the musculofascial techniques, such as that described by Holman, are the preferred procedures especially for treatment of the large cysts or sinuses. The complications following primary closure, which appear to be due to bleeding, infection, and to the use of nonabsorbable suture material, can be dealt with easily by converting the closed wound into an open one. Experience has shown that when these wounds are laid open they heal exceedingly fast (healing is much more rapid than that following primary open technique excision en bloc), probably because of the increased vascularity of the muscle and the mobilization of the gluteal fascia which allow faster cicatricial contracture of the wound. The reconstructive primary closure of the pilonidal wound is a useful procedure when properly indicated and performed (228).

Smith (*J Am M Ass*, 1948, 136: 973) is apparently the first to report the occurrence of

"true" pilonidal cysts in the anterior part of the perineum.

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# ABSTRACTS OF CURRENT LITERATURE

## SURGERY OF THE HEAD AND NECK

### HEAD

**Epithelial Tumors Associated with Developmental Cysts of the Maxilla** EDWARD C STAFNE *Oral Surg*, 1948, 1 887

Cysts of the jaws that are of developmental origin are most often lined with a fairly even, uniform layer of epithelium. In a few instances variation from this smoothness of the wall may be manifested by the occurrence of thickening or the presence of mural or papillary growths of the inner wall of the cysts.

In the 3 cases reported in the complete paper, the entire cavity of the cyst had become filled with an epithelial tumor. Two of these epithelial tumors occurred in dentigerous cysts and 1 occurred in what appeared to be a globulomaxillary cyst.

Some of the results of the study of 3 epithelial tumors in the maxilla have been given. These 3 tumors presented many similar features. Two of them occurred within the fibrous tissue capsule of dentigerous cysts and the third occurred in the interseptal bone between the maxillary lateral incisor and the canine tooth. The location of the third at once aroused speculation as to whether it was derived from epithelial remnants in the closure of the globular and maxillary processes, similar to those from which globulomaxillary cysts are derived.

A glandular arrangement and formation of acini were common to all 3 tumors, but the presence of mucin was not demonstrated. A clearly defined hyaline-like ring was seen about many of the glandular spaces. The nature of the substance of these rings was not determined. The thought was entertained that the rings might be evidence of an attempt to form an enamel matrix.

The roentgenologic findings were of interest in that they suggested conditions other than those found. Radiopaque objects which one would ordinarily presume to be calcified dental structures proved to be calcareous deposits in the stroma.

Although the 2 tumors that developed within the dentigerous cysts no doubt had their origin from odontogenic epithelium, they lacked the typical features of epithelial tumors derived from that source. What inhibitory influence the fluid of the cyst may have had on the tumor growth is problematic.

### EYE

**The Fascia of the Orbit: Its Anatomy and Clinical Significance** RICHARD G SCOBEE *Am J Ophthalm*, 1948, 31 1539

The fascia of the orbit is more or less continuous. The dura mater investing the optic nerve divides at the apex of the orbit into an outer layer, the perior-

bita, and an inner layer which continues along the optic nerve. The periorbita is confluent with the periosteum of the facial bones and at their junction they form a ridge known as the arcus marginale. The septum orbitale extends from this ridge around the orbit to the palpebral fissure.

The annulus of Zinn is intimately fused with both the periorbita and dura at the apex of the orbit. The dura which ensheaths the optic nerve in its orbital course fuses with the fascial capsule (Tenon's) which encases the globe at the point of exit of the optic nerve. The middle third of the capsule is pierced by the oculomotor muscles passing toward their scleral insertion. The capsule is prolonged backward at these points along each muscle. This muscular fascia ensheaths each muscle completely and stretches as a membrane between adjacent margins of the rectus muscles. Division of this membrane is necessary to obtain the maximal effect in recession operations. Offshoots of the muscle sheaths become attached to the periorbita to form check ligaments. These must be sectioned to assure satisfactory results in muscle surgery.

FRANK W NEWELL, M D

**Horizontal Concomitant Strabismus** EDMUND B SPAETH *Am J Ophthalm*, 1948, 31 1553

True horizontal concomitant squint is the classical, alternating type wherein the patient has the same degree of squint for near and for distance with the objective and subjective angles being the same, the refractive error practically equal in each eye, and not related to the squint or to the convergence-accommodation ratio. Except in this pure type of strabismus congenital disturbances of the vertical rotators play a profound role in the development of convergent and divergent squints of all types. The unmasking of the vertical component and the identification of muscles involved is basic to the diagnosis.

Inferior oblique muscle overaction may occur in accommodative strabismus without demonstrable paresis of the contralateral synergist. Oblique muscle overactions are more common than similar involvement of the vertical rectus muscles. It is not always possible to state that the lateral concomitant deviation is due to a paresis of a vertical acting muscle, or secondary deviation of the synergist, or overaction of the direct antagonist of a paretic muscle. In such cases in which the vertical anomaly is contributory to the lateral concomitant strabismus, treatment by orthoptics is not indicated and the treatment is surgical, preferably before the age of four. The greater deviation, whether horizontal or lateral, should be first corrected. Satisfactory single binocular vision with fusion cannot be obtained as long as the vertical component is present to an ap-

preciable degree. The sequence of surgical procedures of the vertical methods which gives the best results is as follows: (a) a recession of the overacting synergist or a resection of the paretic muscle, (b) reversal of the sequence of (a), (c) recession of the overacting direct antagonist.

FRANK W. NEWELL, M.D.

### Operative Treatment of Vertical Tropias B. I. PAXNE *Am J Ophth*, 1948, 31: 1217

The author cites that the surgical relief from the discomfort of vertical tropias has progressed remarkably since Duane and his pupil, White, performed one of the first tenotomies on the inferior oblique muscle. He stresses the necessity of an accurate diagnosis of the muscle or muscles involved in vertical tropias. To arrive at the proper outcome of surgery he suggests a routine examination consisting of:

1. History—general and ophthalmic
2. Visual acuity and accommodation determinations without and with glasses
3. Muscle balance and fusion tests
4. Refraction and correction with glasses
5. Orthoptic treatment
6. Operation and follow up

He stresses the value of the estimation of the phoria or tropia in the primary position and in the 6 cardinal directions of gaze. Eye dominance is determined because most surgeons prefer to operate on the nondominant eye. Orthoptic exercises should follow surgery if the degree of fusion warrants it.

The author also stresses the point that if the patient has no symptoms and is content with his appearance he should be let alone.

The operative objective in the correction of vertical tropias is to give horizontal alignment to the visual axes of the two eyes. This may be done in one of three ways or a combination of the three:

1. By strengthening the weak or paralyzed muscle by a shortening operation
2. By weakening the contralateral synergist by tenotomy or recession
3. By weakening the antagonist of the same side by recession or tenotomy

The author states, after citing 6 cases, that each millimeter of recession of the inferior oblique muscle gives approximately 2.5 prism diopters of correction. In conclusion he states that:

1. Carefully planned operations for the relief of vertical tropias are successful if the diagnosis is correct
2. A clear understanding of the muscle or muscles involved is essential
3. The type and extent of operation will be determined by the points brought out in examination
4. Injury to the neighboring structures should be avoided

J. WOODRILL OVERTON, M.D.

### Implant of a Vitallium Tube in the Treatment of Stenosis of the Lacrimal Duct VITO L. ROCCA *Arch Ophth*, Chic, 1948, 39: 657

The author advocates the insertion of a vitallium tube into the bony lacrimal duct through the lower part of the sac.

Under local anesthesia an incision is made 1 cm. long, beginning at the lower edge of the inner canaliculal ligament and curving downward. A probe is used as a guide. An incision is made in the sac and the bony canal curetted. The tube is inserted and secured to the periosteum by suture.

The operation is simple, it can be performed despite of mucosal atrophy or infection and gives excellent results.

EARL H. MERZ, M.D.

### Intravitreal Injection of Penicillin: Study on the Levels of Concentration Reached and Therapeutic Efficacy ARNOLD SORSBY and JOSEPH L. CAR *Brit J Ophth*, 1948, 32: 857

The authors discuss the intravitreal injection of penicillin. Their studies were conducted with a view to assessing the levels and persistence of penicillin injected intravitreally and to determine the efficacy of this procedure in controlling experimental infection of the vitreous.

In the early days of penicillin therapy direct injection of penicillin into the vitreous was considered as a possible method of treatment because it was believed that penicillin injected systemically did not penetrate into the interior of the eye. Early reports of penicillin destroyed the eye but crystalline penicillin was well tolerated (although damage to the retina did ensue).

The results of the authors' experiments, however, were not encouraging. Only 2 of the 3 rabbits which were treated 3 hours following infection, and only 1 (or possibly 2) of the 3 which were treated immediately after infection can be regarded as having eyes with good function, clinically. In all the remaining animals the infected eyes were lost. Although penicillin influences the course of the infection, once a vitreal injection of 5,000 units is not sufficient to overcome fully a heavy experimental infection even when it is administered 3 hours following infection or at the time of infection. If treatment is begun 3 hours after infection, panophthalmitis can be prevented, but organization of the vitreous destroys the function of the eye.

It is concluded that adequate antibacterial levels persist in the vitreous for 36 hours and possibly 48 hours after direct intravitreal injection of 5,000 units of crystalline penicillin in 0.05 ml. of vitreous.

In these experiments the vitreous was infected with 1,000,000 organisms of staphylococcus aureus.

Briefly stated, the authors conclude that 5,000 units of crystalline penicillin injected into the vitreous had some slight effect if administered 2 hours following infection, panophthalmitis was prevented but the vitreous became organized and infection was begun 3 hours after infection or at the time after infection. 3 (and possibly 4 or 6) treatments could be considered as clinically functional.

It has not been determined that the therapeutic level in the vitreous can be maintained by conjunctival injection so that direct intravitreal injection of penicillin is necessary.

JOSEPH L. CAR

**The Control of Experimental Infections of the Anterior Chamber and of the Vitreous by Subconjunctival and Retrobulbar Injections of Crystalline Penicillin in Doses of 1,000,000 Units**  
ARNOLD SORSBY and JOSEPH UNGAR *Brit J Ophth*, 1948, 32 873

The authors' report concerns the control of experimental infections of the anterior chamber and of the vitreous by subconjunctival and retrobulbar injections of crystalline penicillin in doses of 1,000,000 units, the object being to determine whether more consistent results can be obtained, and whether the frequency of injection can be reduced. Infection was induced by introduction into the anterior chamber or into the vitreous of a suspension of 50,000 staphylococcus aureus organisms in 0.05 ml of saline.

It was found that infections of the anterior chamber can be controlled by subconjunctival injections of penicillin if adequate doses are administered. With doses of 20,000 units, injections at intervals of about 6 hours were necessary. With doses of 1,000,000 units, two or three subconjunctival (or possibly retrobulbar) injections at intervals of 24 hours were required to control a fairly severe, although not fully established, infection of the anterior chamber.

The following results were obtained after experimental infection.

**Infection of the anterior chamber.** Of 9 rabbits with infection of the anterior chamber, 5 were treated by subconjunctival injection—3 within 4 hours after infection and 2 within 24 hours after infection, 4 rabbits were treated by retrobulbar injection—2 within 4 hours after infection and 2 within 24 hours after infection. The 3 rabbits treated by subconjunctival injection 4 hours after infection made an uninterrupted recovery, the 2 rabbits treated 24 hours after infection responded satisfactorily, but the infection was more prolonged and the sequelae was more marked. Of the 2 rabbits treated by retrobulbar injection 4 hours after infection, one recovered completely, the 2 treated 24 hours after infection did not recover well.

**Infection of the vitreous.** Of 9 rabbits with intravitreal infection, 4 were treated by subconjunctival injection and 5 were treated by retrobulbar injection. The doses and time intervals were all similar to those employed for infection of the anterior chamber. The course in all control rabbits was unfavorable. Two rabbits first treated by subconjunctival injections 4 hours after infection responded quite well, however, in the 2 rabbits first treated 24 hours after infection, disorganization of the eyeballs resulted. Three rabbits first treated 4 hours after infection by retrobulbar injection also responded to treatment, but 2 rabbits which were first treated 24 hours after infection failed to respond to treatment.

Rabbits which had been treated 4 hours after infection were given a second dose of penicillin 20 hours later, rabbits treated 24 hours after infection were given subsequent doses at 48 hours and again at 78 hours. The results in all control animals were unfavorable.

JOSHUA ZUCKERMAN, M D

**Distribution of Penicillin in the Eye After Injections of 1,000,000 Units by the Subconjunctival Retrobulbar and Intramuscular Routes**  
ARNOLD SORSBY and JOSEPH UNGAR *Brit J Ophth*, 1948, 32 864

Studies have been carried out on the distribution of penicillin in the eye after injections of 1,000,000 units by the subconjunctival, retrobulbar, and intramuscular routes. Adequate therapeutic levels could be obtained intraocularly by the injection of large doses of penicillin subconjunctivally, or by systemic administration of massive doses. The levels reached and maintained by subconjunctival injection were higher than those obtained when the drug was administered by other routes. Subconjunctival injections yielded higher and more persistent levels when the penicillin was dissolved in a 1 to 1,000 solution of epinephrin hydrochloride instead of in water.

The administration of a dose of 50,000 units subconjunctivally yielded not only higher but more persistent intraocular levels of concentration than a dose of 20,000 units.

The investigation proved that penicillin administered systemically penetrates the interior of the eye in adequate therapeutic levels if sufficiently massive doses are employed. However, local administration of penicillin by the retrobulbar or subconjunctival route yields distinctly higher intraocular levels and better maintenance than injection of a corresponding dose intramuscularly. Moreover, when epinephrine is used as a solvent higher intraocular levels of concentration are maintained.

Experimental investigation with rabbits proves that when a dose of 1,000,000 units of crystalline penicillin in a 1 to 1,000 solution of epinephrin is injected subconjunctivally, an adequate level is reached and maintained not only in the aqueous but also in the vitreous for at least 48 hours. The high level reached and maintained in the vitreous by this dose and mode of administration is noteworthy, for neither massive intramuscular injections nor injections of 50,000 units (in adrenalin) subconjunctivally give high or persistent levels of penicillin in the vitreous. Direct intravitreal injection of penicillin is unnecessary.

JOSHUA ZUCKERMAN, M D

**Controversial Points in Penicillin Therapy of Ocular Diseases**  
LUDWIG VON SALLMANN and JEANETTE DI GRANDI *Arch Ophth*, Chic., 1948, 39 752

The present study extended over several phases of the parenteral and local use of penicillin in ophthalmology. The failure of penicillin to pass the blood-aqueous barrier in adequate amounts during systemic therapy could not be related to a selective transfer through the ciliary epithelium or to a restraining effect of the epithelial membrane, it was shown, rather, to be related to the functional states of the capillary wall, to the steep decrease in the drug level in the blood by rapid renal excretion and, in a moderate degree, to the speed of absorption of the substance from the aqueous.





sensitivity is decreased. A diffuse opacity resembling a spider occupies the entire cornea, with exception of the peripheral 1 or 2 mm. In early cases, interlacing gray lines and fine nodules can be seen with the unaided eye or with the loupe. The biomicroscope reveals many lines, with a myriad of fine deposits in their interstices. All the layers of the cornea are affected but there is a greater preponderance in the anterior third. During the acute stage, ulceration of the epithelium may be present. In uncomplicated cases no blood vessels are present in the stroma.

Pathologic examination reveals a hyalinlike material deposited within and outside of the corneal lamellae and in the epithelium. The intralamellar deposits are tiny, extralamellar deposits are larger. The deposits are concentrated in the anterior layer of the corneal stroma. Bowman's membrane is usually missing. The epithelium is disorganized.

The lattice type of dystrophy is differentiated from the granular type of familial dystrophy by the presence of "lines" in the lesion, by the relatively early loss of vision, and by the defective corneal sensitivity. It is differentiated from the macular types of corneal dystrophy by the lines and the nodules, its central location in the cornea, and its dominant inheritance. There is no satisfactory treatment for corneal dystrophy, but keratoplasty may prove effective.

To the report of 100 cases in the literature, the author adds 5 cases, one of which occurred in a patient 2 years of age, the youngest patient with this condition whose case has been reported up to the present time.

JOSHUA ZUCKERMAN, M D

#### The Rupture of the Zonule in Intracapsular Cataract Extraction—A New Method DANIEL B KIRBY *Brit J Ophth*, 1949, 33 3

In intracapsular extraction of cataracts the break in the zonule occurs at its union with the lens capsule. Pressure and traction are best applied simultaneously. Pressure should be applied by a relatively pointed instrument such as the Jamison hook, which he has adapted for this purpose. After the incision, sudden sharp point pressure is made just inside the limbus at equidistant points (6, 8, and 4 o'clock), indenting the cornea 2 to 3 mm., and causing the incision to gape diametrically opposite.

Since Kirby believes the sliding or, even better, the rotational delivery of the lens is less disturbing than the tumbling procedure, he prefers the grasp above just anterior to the equator. This requires a well dilated pupil or a complete coloboma of the iris. A horizontal tangential application is made which allows ready rotation to either side along the curve of the equator. With this method the surgeon can see better what he is doing, particularly when the corneal flap is lifted, and he can lift the lens away from the hyaloid and vitreous. With such direct vision, pressure can be directed to the area of zonule under tension, rupturing it more easily than if more pressure was directed to a relaxed area.

In subluxation of the lens, or in cases in which the zonule proves resistant or resilient, it can be stripped from its attachment by direct rupture. With the capsule grasped above, vertical traction lifts the zonule 3 mm. away from the relaxed hyaloid. This may be combined with downward traction for better exposure, then a light touch or two with the blunt elbow of the lens hook will cause the zonule to rupture in part, producing a dehiscence at the equator which is extended by rotation of the lens. This new maneuver is indicated when pressure, traction, and rotation are insufficient. Proper illumination should be secured by a parallel beam spotlight, and the corneal flap should be elevated to afford a direct view of the lens equator.

Kirby uses his own special instruments which are described and illustrated.

JAMES E. LEBENSOHN, M D

#### Preliminary Note on the Treatment of Hypopyon Ulcer with Crystalline Penicillin in Adrenalin in Doses Exceeding 50,000 Units Injected by Subconjunctival or Retrobulbar Routes ARNOLD SORSBY and JOSEPH UNGAR *Brit J Ophth*, 1948, 32 878

The authors present a preliminary report on the treatment of hypopyon ulcer with crystalline penicillin in adrenalin in doses in excess of 50,000 units which are injected by the subconjunctival or retrobulbar routes. It was found that doses greater than 50,000 units have the advantage of giving a higher concentration of penicillin intraocularly and that this concentration persists for a longer period of time than when smaller doses are given. With subconjunctival injections of 1,000,000 units in adrenalin the intervals between doses could be increased from 6 to 48 hours. Doses of 500,000 units of crystalline penicillin in adrenalin can be used safely at intervals of 24 hours.

It is concluded that results in the treatment of hypopyon ulcer with crystalline penicillin are distinctly promising, both as to a satisfactory end result and to rapidity of cure, when the drug is administered in doses of 500,000 units in 0.5 milliliters of (1:1000) epinephrine solution at intervals of 24 hours.

Although theoretically less effective, the injection of such doses by the retrobulbar route appears to present clinical possibilities.

JOSHUA ZUCKERMAN, M D

#### Miotic and Antiglaucomatous Activity of Tetraethyl Pyrophosphate in Human Eyes W. MOR-TON GRANT *Arch Ophth*, Chic., 1948, 39 579

Tetraethyl pyrophosphate is a new anticholinesterase chemical which is a colorless, water soluble, lipid soluble liquid.

In normal eyes it was found to be comparable to physostigmine in miotic activity. In glaucomatous eyes, it lowered the intraocular tension when used in the strength of 0.1 per cent, the vehicle being peanut oil.

When renal clearance was prevented, a high and sustained penicillin content of the blood secured satisfactory concentration of the drug in the aqueous. The importance of capillary permeability was shown by the great change in the aqueous-blood ratio of penicillin in various stages of a nonbacterial endophthalmitis.

The best opportunity for utilizing the benefits of systemic penicillin treatment of severe ocular infections is offered in the administration of massive doses in the acute stages, aided by the simultaneous local instillation of vasodilators in cases of less violent inflammations, as an adjuvant, may be considered the use of substances which decrease the renal output of the antibiotic by competing for the same excretory mechanism. General treatment may effectively supplement local penicillin therapy when the infective foci are not easily accessible by local methods.

In the study of the surface application of penicillin, the continuance of penicillin activity was usually observed in the tears for 8 hours after one instillation of drops or ointment, suggesting that the frequency of treatment of external infections can be reduced without excessive tearing or secretion.

Several aspects of ocular iontophoresis with penicillin were studied. The claims of poor conduction of the compound and of a substantial destruction of the antibiotic by the shift of the hydrogen ion concentration, due to the products of electrolysis, were disproved in regard to corneal iontophoresis with applicator tubes of sufficient capacity. It was shown that the high penicillin content of the cornea and aqueous was procured by the effect of the flow of the current from the cathode on the barrier properties of the epithelium. When solutions of low tonicity were employed, much more of the substance was observed in the aqueous, both after iontophoresis and after corneal bath, owing, however, to damage to the corneal epithelium.

In vitro and in vivo experiments gave evidence that better results could be expected from transient high peak drug levels when the infecting organism was of medium sensitivity to penicillin. The observations appear applicable to iontophoresis, as well as to other means (cotton packs, injections) of obtaining a high penicillin content in the eye.

The superiority of introducing penicillin directly into the vitreous in the treatment of infections of the posterior segment was demonstrated. A dose equivalent to 1,000 units of the commercial crystal line penicillin was used, without causing histologically recognizable retinal lesions. A dose of 1,000 units is about ten times the amount which was effective in checking various experimental infections of the vitreous.

FRA F W NEWELL, M.D.

**Infection of the Cornea Due to Herpes Simplex**  
An Experimental Study. JAMES L. MCGRAW.  
*Arch Ophth*, Chic, 1948, 40: 531.

The lesion of herpes simplex on the cornea is characterized by the formation of minute opacities of the

epithelium, which may lead to vesiculation and necrosis, and the ultimate typical picture of a dendritic ulcer. The infection may accompany herpetic lesions in other parts of the body—the lips, genital area, etc. There is a decided tendency toward recurrence.

The usual onset is acute, with pain in the eye and the appearance of a haze of fine granular spots in the epithelium. This is associated with a fine bed of opacities of the epithelium and the development of craters, fissures, surrounded by closely packed punctate opacities. The lesion may assume a form similar to superficial punctate keratitis or dendritic keratitis. The epithelium in the region of the lesion may peel loosely on Bowman's membrane, and may be broken away (epitheliolysis). The process may persist for several days or weeks, and finally clear, leaving no trace. The lesions, however, may recur and coalesce to form an irregular ulcer, the dendritic ulcer. The zigzag line of ulceration rarely exceeds 1 mm in breadth and shows many side branches at the ends of which have beadlike nodes. At the end of its development, the process may recede, and complete healing may take place without a scar. In all herpetic involvement of the cornea, there is hypoaesthesia.

The present investigation has the primary purpose of determining the effect of penicillin, streptomycin, and tyrothricin on the virus of herpes simplex. Special reference is made to its manifestations in the eye. The study was carried further in the attempt to corroborate or disprove some of the other advocated therapeutic measures.

Penicillin is ineffective in combating the virus of herpes simplex in mice, in vivo and in vitro. Streptomycin in high concentrations seems to have a slight inhibitory effect on the virus of herpes simplex in vivo. However, it fails to destroy the virus completely. Tyrothricin, in dilution of 33 mgm per 100 cc, is not a beneficial therapeutic agent. Ineffective also are hyperimmune serum, intravenous iodine, and cathode iontophoresis of sodium iodide. Contraindicated are anode iontophoresis of 1 per cent zinc sulfate, and the local application of 1 per cent iodine in 70 per cent alcohol. Caution is advised in the dendritic ulcers, with 20 per cent zinc sulfate of definite value in the healing of dendritic ulcers in rabbits.

MICHAEL FOURMAYAN, M.D.

**Lattice Type of Hereditary Corneal Degeneration**  
Report of 5 Cases, 1 of Which Occurred in a Child of 2 Years. FREDERICK C. SHERMAN.  
*Arch Ophth*, Chic, 1948, 40: 181.

The author discusses the lattice type of hereditary corneal degeneration. This type of corneal dystrophy is bilateral, chronic, slowly progressive, and of hereditary dominance. The etiological factor is unknown. It begins in the first decade of life. In youth the condition presents itself as current crossings of the corneal epithelium, photophobia, lacrimation, and mild conjunctivitis. In adult life, attacks recur frequently, and vision progressively declines. In advanced stages the

wheel at the inferior temporal margin of the orbit, with the use of a 22 gauge needle, 3.5 centimeters long. The anatomic arrangement of the muscle cone is such that an anesthetic is retained and affects the nasal ciliary nerve, the long and short ciliary nerves, the ciliary ganglion, the optic nerve, and the third and fourth nerves. Epinephrine injected retrobulbally in the procaine results in a decrease in the intraocular pressure. The injection is indicated prior to all intraocular operations, muscle operations, eviscerations, enucleations, and in cases of acute glaucoma for the immediate relief of pain.

Anesthesia for operations on the lacrimal sac may be obtained by blocking the anterior ethmoidal and infratrochlear nerves at the superior margin of the orbit nasal to the trochlea. The infraorbital nerve may be blocked at either the infraorbital canal or fissure.

Field block of the lids is obtained by injection of procaine close to the periosteum near the orbital margins.

FRANK W. NEWELL, M.D.

## EAR

**Test Findings Before and After Fenestration of the Labyrinth** EDWARD H. CAMPBELL and DOUGLAS MACFARLAN *Arch Otolaryngol*, Chic., 1948, 47: 590

A careful evaluation of hearing is important in considering candidates for the fenestration operation. Most important is the determination of the degree of conduction loss and, if present, the degree of perceptive deafness. Audiometer and tuning fork tests of air and bone conduction are necessary. The fatigue test should be done in one or two frequencies in the speech hearing zone. Fatigue appears in all types of nerve deafness but not catarrhal deafness or early otosclerosis. A carefully performed Gelle test, if negative, is evidence against stapes fixation. Matching of the loudnesses in the two ears (loudness balance test or recruitment) by raising the intensity does not occur in the stage of otosclerosis considered operable.

In cases of nerve or mixed deafness, recruitment may be demonstrated for those frequencies showing nerve degeneration. Speech hearing tests have indicated that patients with conductive deafness showed continuously better hearing as loudness was increased, whereas with nerve deafness a level of loudness was reached at which there was an end of the patient's maximum efficiency in speech discrimination (Walsh and Silverman). Caloric and tuning tests aid in evaluating functional activity of the inner ear mechanism.

In their fenestrated patients, the authors noted that nystagmus following operation was almost always to the opposite side. The active postoperative fistula response was usually associated with the best hearing result, however, this was not always true. A study of the hearing for speech and for pure tones following the fenestration operation did not permit any definite correlation between the two.

JOHN R. LINDSAY, M.D.

## NECK

**The Treatment of Thyrotoxicosis** SIR CARRICK ROBERTSON *Lancet*, Lond., 1948, 2: 675

The author reports 350 cases of thyrotoxicosis in patients who were treated during the period from 1945 to 1947. About one-third of the patients were treated with thiouracil. Of those under 21 years of age, 10 of 16 (62%) were benefited, of those from 21 to 45 years of age, 29 of 73 (40%) were benefited, and of those over 45 years of age (all with nodular goiter) 11 of 22 (50%) were benefited.

In Robertson's opinion the contraindications to thiouracil treatment are (1) signs of pressure on the airway, since enlargement of the goiter is common during the first few weeks of treatment, (2) toxic nodular goiter or a retrolaryngeal upper pole of the thyroid gland, since patients with these conditions continue to complain of discomfort in the neck despite an improved basal metabolic rate, (3) pronounced exophthalmos, (4) predominance of heart symptoms, e.g., tachycardia and fibrillation, as these are the last symptoms to disappear with thiouracil treatment as opposed to their early disappearance following surgery, (5) depression due to thyrotoxicosis, since, like the sulfonamides, the thio compounds are inclined to cause depression in some patients, and (6) absence of facilities for frequent blood counts.

Indications for the use of thiouracil are (1) the youth of the patient, (2) predominance of nervous symptoms other than depression, (3) elderly patients who are grave surgical risks, (4) recurrent thyrotoxicosis after operation, and (5) severe thyrotoxicosis requiring preparation for operation.

Subtotal thyroidectomy was carried out in more than 250 patients including all those who failed to respond sufficiently to thiouracil. Of those aged under 21 years, 14 of 16 responded well, of those between 21 and 45 years of age, all responded well, and of those aged over 45 years, with the exception of 1 who died, all responded satisfactorily.

WAYNE FIELD CAMERON, M.D.

**Cancer of the Larynx** CHEVALIER L. JACKSON, JOHN V. BLADY, CHARLES M. NORRIS, and WALTER H. MALONEY *J Am Med Ass*, 1948, 138: 1080

Six-hundred and twelve patients with cancer of the larynx were treated at the Temple University Hospital, Philadelphia, from 1930 to 1947, inclusive. Two-hundred and nine were treated by laryngofissure, 244 by laryngectomy, and 159 by irradiation. The criteria for the selection of treatment are not stated, but no patient having cervical metastases when first seen had operative treatment.

The primary 5 year cure rate among 206 traced patients with carcinoma of the larynx without metastases when first seen was 68 per cent. An additional 7 per cent revealed 5 year cures following retreatment of recurrence or metastases, which made a total 5 year curability of cancer of the larynx without metastases when first treated of 75 per cent.

	Patients traced	5 year cure rate
Laryngofissure	102	81%
Laryngectomy	35	66%
Irradiation	69	51%
Total	206	68%

The curability of recurrences is as follows

Original treatment	Patients re-treated and traced 5 years	5 year cures	5 year cure rate after retreatment
Laryngofissure	16	7	44%
Laryngectomy	12	1	8.3%
Irradiation	20	7	35%
Total	48	15	7% of 206 cases

Recurrence, metastases, or both developed following treatment by laryngofissure in 19 per cent of the cases, following laryngectomy in 34 per cent, and following irradiation in 33 per cent. When there was recurrence or metastases following laryngofissure, it occurred within the first 3 years in 74 per cent, and after 5 years in 22 per cent (in these patients, 1 case each in the seventh, ninth, twelfth, and fifteenth years, respectively). Thus, following laryngofissure, the 5 year criterion of curability is but 78 per cent accurate. Among these cases, when recurrence or metastasis occurred following laryngectomy or irradiation, it occurred within 5 years.

Fourteen patients had metastases when first seen. All were treated with roentgen irradiation. None survived 5 years.

Thirty-three patients had metastases after receiving treatment for the primary lesion. Of these, 29 received treatment for the metastases. Seven survived 5 years, a 5 year survival rate of 21 per cent. Methods of treatment of the metastases which developed following treatment of the primary lesion, and results of treatment are shown

	survival	5 year
X rays	13	7.8
X rays and radon	3	33
Radon alone	4	0
Surgery x rays radon	9	55
No treatment	4	0
Total	33	21

Of the methods employed, surgery combined with irradiation gives the best 5 year results in cervical metastases—a 5 year curability of 55 per cent.

From these figures it would appear that laryngofissure, with an initial cure rate of 81 per cent and a salvage rate of 44 per cent of recurrences, is the treatment of choice whenever possible. However, it is strongly urged that its use be severely restricted to suitable cases.

Since 1940, the treatment of cervical metastases from cancer of the larynx at the Temple University Hospital has been as follows:

For patients presenting metastases on admission, roentgen treatment is generally employed for treatment of the primary lesion in the larynx, if possible, the metastases are incorporated in the same portal. After the irradiation, either before severe irradiation epithelitis develops or after it has completely healed, the metastases are surgically exposed and radon is implanted in a tissue dosage of from 5,000 to 10,000 gamma roentgens, or a neck dissection with or without the implantation of radon is performed.

More recently, some patients have been treated by radical neck dissection followed by external irradiation to the primary lesion. In a few cases laryngectomy combined with neck dissection has been done. The results in these cases, however, are not suitable for evaluation, because the treatment was given less than 5 years ago.

For metastases occurring after the primary disease has been controlled, a radical neck dissection is performed, and radon is implanted when there is perinodal infiltration.

FRANK B. QUEEN, M.D.

# SURGERY OF THE NERVOUS SYSTEM

## BRAIN AND ITS COVERINGS, CRANIAL NERVES

**Purulent Pachymeningitis** SIR HUGH CAIRNS and F SCHILLER. *Proc R Soc M, Lond*, 1948, 41 805

The authors draw a line of distinction between purulent pachymeningitis and subdural abscess in that the former consists of a film of pus of variable thickness lying in the subdural space and not circumscribed, whereas the subdural abscess is considered as a purely loculated collection of pus in the subdural space (This distinction is probably comparable to our terminology of acute and chronic subdural abscess—abstractor's note)

This series of 33 cases had been collected over a 20 year period so it allowed a correlation of the effects of the antibiotics and sulfonamides in the treatment of this condition. In 23 of the cases the primary infection was in the paranasal sinuses, in 6 cases it was in the petrous bone, and in 4 cases the infection was from a distant focus. A spreading osteomyelitis of the skull was present in 26 of the cases. The use of antibiotics may greatly alter an osteomyelitis of the skull, hence, it is possible that a very mild involvement may have been overlooked in some cases. Thrombosis of the large dural sinuses or cerebral veins was present in 8 cases. Although leptomeningitis was a common sequela before the days of penicillin, this condition is becoming comparatively uncommon.

It is felt that the clinical picture of purulent pachymeningitis is so sharply defined that the diagnosis should not be difficult, however, it is thought to bear some resemblance to uncomplicated cerebral thrombophlebitis. In case of doubt, there should be no hesitation in trephining and in opening the dura. There are usually only a few cells in the cerebrospinal fluid and comparatively little nuchal rigidity unless the condition becomes complicated by leptomeningitis. The symptoms are usually those found in infection of the central nervous system, followed rapidly by hemiplegia, homonymous hemianopia, sensory disturbances, and occasionally convulsions in the early stages.

The most common organisms were anaerobic streptococci, viridans, or other nonhemolytic forms. *Staphylococcus* and *Beta*hemolytic streptococcus were rare. Formerly this infection was almost invariably fatal, however, since the advent of penicillin the prognosis has been greatly improved. Fifteen of the patients in this series were treated to a variable extent with penicillin. Five patients, who were incompletely treated because of an insufficient supply of penicillin, expired. Of the 10 patients who were adequately treated, 7 recovered. The preferred method of treatment is to place rubber catheters through a burr hole into the subdural space and, at frequent intervals, to instill large quantities of dilute

penicillin—approximately 6 c.c. of a solution containing 500 units per cubic centimeter. In addition the patient is usually given intramuscular doses of 100,000 units every 3 hours unless in vitro sensitivity tests reveal that the organism responds readily, after which the dosage may be cut in half. It is believed that the solution injected in the subdural space is absorbed, since very little of it drains back through the catheter. Instillation of penicillin in the subdural space also tends to prevent loculation or typical subdural abscess. However, in 8 of the 10 fully treated patients loculated subdural abscesses developed and in 2, intracerebral abscesses. The possibility of the late onset of a loculated subdural abscess must always be suspected in cases in which there is either a failure of definite recovery, or in which there is a slight retrogression. In such cases it is necessary to perform ventriculography to rule out a loculation on the medial surface of the hemisphere, or an intracerebral abscess. Although gross osteomyelitic involvement of the skull should be removed surgically, the massive removals that were formerly practiced will probably not be necessary when full doses of systemic penicillin is used.

If the primary focus persists after the patient has recovered, this should be dealt with radically, however, it may be deferred for some months. It is suggested that since so many of the cases of purulent pachymeningitis follow operative procedures upon the paranasal sinuses, such operations should be accompanied by prophylactic doses of penicillin both before and after surgery. JACK I. WOOLF, M.D.

**Modern Surgical Treatment of Acute Subdural Abscesses** E. S. GURDJIAN and JOHN E. WEBSTER. *Arch Surg*, 1948, 57 411

The authors report a study of 4 consecutive cases of acute subdural abscess in patients who were successfully treated by operation and penicillin. They attribute the excellent results obtained in these cases to the use of antibiotics and sulfonamides since the surgical management has remained essentially unchanged. This article includes an excellent historical review dating back to the first successful operation of subdural abscess by de la Peyronie, in 1699.

The mode of infection may be by direct extension from the mastoid or paranasal sinuses, or following neglected compound fractures of the skull. An indirect mode from the sinuses may occur by retrograde thrombophlebitis and perivascularitis. The primary source of infections in the 4 cases in this report were a chronic sinusitis in 2 patients and an acute sinusitis in 2. One must always be aware of the possibility of an associated osteomyelitis (1 case) and particularly of an intracerebral abscess (2 cases). Although the exudate is usually over the convex surface of the brain, it may be loculated between the medial surface of the hemisphere and the falx.

A subdural abscess should be considered in any patient with mastoiditis or a paranasal sinus infection who develops severe headaches, drowsiness, convulsive seizures, and increased intracranial pressure. It should be remembered that these symptoms may develop in from 2 to 5 days from the onset of the intracranial spread of infection. All of the 4 patients comprising this report had convulsive seizures—both Jacksonian and generalized in type. Hemiparesis, aphasia, and other focal signs are commonly present. The presence of meningitis should not hinder one in attacking the lesion surgically. Although there may be an associated intracerebral abscess, this usually runs a more protracted course and should be suspected particularly in those patients who either fail to show definite improvement within a few days after treatment or who show a progression of symptoms.

Treatment consists of the insertion of burr holes or simple trephination of the skull and washing out of the subdural space with saline or penicillin, and inserting soft rubber catheter drains into the subdural space. Although no pus was seen to drain from the catheters, they served as a means of introducing penicillin solution into the subdural space. The instillation of penicillin into the subdural space is carried out for a period of 3 days. Systemic penicillin was also given in doses varying from 20,000 to 100,000 units every 3 hours. If improvement is not rapid, further exploration is indicated. The importance of attacking surgically the original focus of infection is emphasized. This should be done at the time of the intracranial procedure, or preceding it.

The most important sequela is the presence of convulsive seizures. Three of the 4 patients in this series continued to have convulsive seizures after recovery, although 2 of them were well controlled with anticonvulsive medication. Although this is probably due to the scarring between the cortex and the arachnoid, it is interesting that in 2 cases requiring operation at a later date for an intracerebral abscess, inspection of the arachnoid failed to reveal any macroscopic evidence of cicatrization.

JACK I. WOOLF, M.D.

#### Late Complications Following Cranioplasty with Alloplastic Plates. JAMES C. WHITE. *Ann Surg*, 1948, 128: 743.

This article is based on answers to a questionnaire, in which case reports were obtained on 151 late complications following the insertion of plates of tantalum, vitallium, and acrylic resin, which came into standard use in our military hospitals during the War.

A brief review is given of the history and development of cranioplasty. From this study of 151 reports of late complications, the author states that definite conclusions regarding the use of plates in the repair of cranial defects can be made. Late complications have occurred most frequently after plating of the frontal bone, especially in reconstructions of the orbital ridge. To construct and secure in place a perfectly fitting plate in this area is a difficult technical

feat. In addition, this region is particularly susceptible to trauma and infection from the frontal sinus and nasal cavity. Complications from these sources are likely to occur as long as the patient lives. It is the author's feeling that the use of autogenous bone for repair of the orbital ridge is probably preferable to the use of metallic plates. However, he suggests the continued use of metallic plates for covering extensive defects in the frontal bone above the level of the sinus.

When swelling and tenderness have developed after an apparently successful plating, treatment by aspiration and penicillin have occasionally been followed by subsidence of the infection when the organism has been sensitive to penicillin and there has been no other predisposing factor such as slipping of the plate, inadequate circulation of the scalp, or communication with the frontal sinus. In the presence of a granulating sinus with exposure of the underlying plate, it is usually best to sacrifice the plate without delay, although in 26 cases of this series chemotherapy and plastic procedures were followed by ultimate healing. The author suggests the immediate removal of any plate which is grossly infected or has loose bone or metallic fragments underlying it, to avoid the risk of infection of the dura with serious risk to the patient and unnecessarily prolonged hospitalization.

Two deaths are reported following the insertion of metallic plates in the stage of active infection, but no other fatal complications have been reported.

In regard to the choice of material in alloplastic plates, the author states that tantalum, vitallium, and acrylic resin give rise to complications of the same order and frequency. Tantalum is by far the easiest to process and fit at the time of operation. The insertion of metallic plates should be postponed for a long period in subjects who are likely to develop epilepsy. This complication, of course, occurs most frequently after deep wounds with dural penetration, indriven bony spicules or metallic fragments, and added sepsis. It would seem wise under these circumstances to wait at least a year and then to use plates of acrylic resin which are visible in roentgenograms, if there has been any history of seizures or evidence of an epileptogenic focus in the electroencephalogram.

It appears advisable not to attempt a primary repair after craniocerebral trauma, but to wait for at least 2 months if the wound heals by first intention. If there has been initial infection, plating should be deferred for at least 6 months, and longer in cases of infection with penicillin-resistant bacteria.

The most common complication after cranioplasty is infection or necrosis of the overlying scalp. The causes of failure after plating and the precautions necessary to prevent it are discussed in this article. The facts disclosed appear to justify the conclusion that a safe, simple, and satisfactory repair of a large cranial defect can be accomplished better and with no greater risk with an alloplastic plate than with grafts of cartilage or bone. When the

cranial defect involves the frontal sinus, however, a return to the use of grafts of living bone is recommended

HOWARD H. LANDER, M D

**Glossopharyngeal Neuralgia** (Sulla nevralgia del glossofaringeo) M CRISTIANI *Minerva med*, Tor, 1948, 39 659

Glossopharyngeal neuralgia is a very rare condition which creates a characteristic clinical picture. Those not familiar with it may mistake the disease for a neuralgia of the trigeminal nerve. The syndrome may create diagnostic difficulties if it is accompanied by earache, pain in the region of the eye, the angle of the mandible, or the neck. Anastomosis of the ninth nerve with the sphenopalatine ganglion, optic ganglion, or the second and third branches of the fifth nerve are responsible for such complications.

The author's patient, a man 56 years of age, suddenly developed severe pain in the region of the right tonsil, radiating toward the base of the tongue and the pharynx. The pain was aggravated by deglutition. Application of a 5 per cent cocaine solution to the trigger zone in the right tonsil provided temporary relief.

No local lesion could be detected. The neurologic examination failed to reveal any involvement of other cranial nerves. Administration of large doses (50 mgm) of vitamin B<sub>1</sub> daily for 7 days, followed by smaller doses for 2 more weeks, produced a complete disappearance of the painful attacks. A check-up 6 months later showed the patient to be in perfect health. A more prolonged observation is required before a statement of a complete cure can be made.

Neuralgia of the glossopharyngeal nerve usually does not yield easily to conservative therapy, consisting of the administration of various drugs, diathermy, etc. Alcohol injections are contraindicated because of the proximity of the vagus, hypoglossus, and sympathetic nerves and large blood vessels. The employment of large doses of vitamin B<sub>1</sub> seems, therefore, to be a valuable addition to our armamentarium.

JOSEPH K. NARAT, M D

## SPINAL CORD AND ITS COVERINGS

**The Effect of Injury to the Spinal Cord and Cauda Equina on the Sexual Potency of Men** DONALD MUNRO, HERBERT W. HORNE, JR., and DAVID P. PAULL *N. England J. M.*, 1948, 239 903

The various aspects of sexual function in patients with spinal cord injuries has received comparatively slight definitive study. Most of the knowledge in this regard has been derived from earlier physiologic studies on animals. At Cushing Veterans Administration Hospital, 84 patients with variable injuries to the spinal cord were investigated in this regard. The cases were divided into two main groups:

1. Transections of the spinal cord, which were subdivided into those verified anatomically and

those in which a continuity of the cord was found at operation, the continuity may have been maintained by scar tissue or, if the cord had not been visualized, the character and length of the clinical course of the patient left no justifiable doubt as to the diagnosis of a transection.

2. Partial cord injuries, in which there was some preservation of cord function as evidenced either by retention of sensation or voluntary motion below the level of the injury.

The three main aspects of sexual function that were examined were in regard to erections, ejaculations, and the ability of the patient to impregnate. The occurrence of priapism was analyzed in a separate group of 320 injuries of the spinal cord and cauda equina. Although it was found that it did occur more frequently in cervical injuries, this could not be considered of diagnostic significance. Erections take place on a purely segmental-reflex basis. The reflex is initiated by tactile stimulation of the glans, the impulses traveling to the second, third, and fourth sacral segments by way of the internal pudic nerves. The efferent impulses leave these same segments by way of the parasympathetic nerves and result in dilatation of the arterioles of the penis and congestion of the corpora cavernosa and spongiosum. Erections were present in 74 per cent of the 84 patients comprising this series. A destruction of the sacral segment of the cord or of the cauda equina and the pelvic parasympathetic nerves will prevent their occurrence. Associated findings will be an autonomous bladder and absent anal reflex. Injuries of any other portion of the spinal cord, regardless of the extent or level of the injury, should not prevent erections.

Ejaculations were found to be present in only 7 per cent of the patients. The authors believe that there are two possible lesions that may affect ejaculations. Since the second phase or actual emission of the semen is effective through impulses traveling over the internal pudic nerve, a lesion involving the sacral segments or cauda equina will prevent ejaculation. It is believed that there is no "center" for ejaculation in the lumbar cord, however, an extensive destructive lesion between the sixth thoracic and third lumbar segments which is sufficiently severe to interrupt the sympathetic components may also prevent ejaculation. Two patients in this series were able to successfully impregnate their wives. In one patient there was a partial lesion at the fifth cervical segment, and in the other a complete lesion at the level of the sixth and seventh thoracic vertebrae. It is not known whether a spinal cord lesion of any type will affect the possibility of viable spermatozoa; nevertheless, it is felt that any neural activity which may take place must occur by way of the sympathetic nervous system. A more detailed study of this problem is to be presented in a later paper.

JACK I. WOOLF, M D



# SURGERY OF THE THORAX

## CHEST WALL AND BREAST

**Carcinoma of the Breast Results from Statistical Research** JOHANNES CLEMMESSEN *Brit J Radiol*, 1948, 21 583

The author concludes from a statistical study that heredity plays some part in the etiology of breast cancer, the disposition to which is inherited together with a disposition to other types of cancer. There is also a tendency for several members of the same family to inherit breast cancer with localization to the same breast.

There can be no doubt that breast cancer is more frequent in the left than in the right breast. Janet Lane-Claypon's figures show a connection between breast cancer and injury, and they suggest also that injury is more frequent on the left than on the right side.

The climacterium should be subjected to further studies with regard to incidence of cancer of the breast, as there is a fall in the incidence curve in the age groups from 45 to 55 years.

EARL O LATIMER, M D

**Carcinoma of the Breast "Precancerous Conditions" of the Breast** E K DAWSON *Brit J Radiol*, 1948, 21 590

The term "hyperplasia" in mammary tissue covers two types of cellular proliferation, adenosis and epitheliosis. Adenosis produces larger and more numerous lobules and is best seen in early pregnancy, it occurs not only as a physiological response during active reproductive life but also during the involutional changes of the climacteric period, when hormonal stimuli are being readjusted because of ovarian decline. It may, at this period, be generalized and possibly unnoticed, or it may be localized. The climacteric patients may give a mildly positive Aschheim-Zondek reaction. This adenosis, described as glandular or lobular mastitis in the older terminology, may be patchy, irregular, and very exaggerated. After nearly 20 years of study, with detailed examination of many hundreds of all types of benign and malignant breasts (many in whole breast sections), the author has found no evidence in human mammary tissue that adenosis leads to the development of carcinoma. That is to say, adenosis, as such, does not become adenocarcinoma and is, therefore, in the author's experience, not a precancerous condition. It gradually fades out, with fibrosis and hyalinization, in very rare cases, it may produce sarcoma, through the intermediate stages of adenoma, fibroadenoma, and fibroma.

The other type of proliferation is epitheliosis, a cellular activity which fills up the ducts and smaller lobular structures. When carcinoma develops, it can be traced, in all cases in the author's experience,

to cell proliferation of the intraductal type, which, at the time of examination, may form a lining, a solid filling, or papillary ingrowths. That is to say, epitheliosis becomes, if malignant, epithelioma, in the French use of this term. However, only a minority of breasts which show epitheliosis microscopically become carcinomatous, in the majority of cases, after a phase of intraductal proliferation which is more or less prolonged, the cells degenerate, with or without cyst formation. The noncystic cases are the more dangerous because, when malignant, they give little or no warning before extensive cancerous development and spread have occurred. In most cases, however, there is some cyst formation. A grossly cystic condition usually means a benign lesion, with extensive degeneration of "pale" or eosinophile cell type, forming the blue-dome cysts of Bloodgood's description.

The author has found no evidence that the blue-dome cyst becomes cancerous and, like adenosis, it may be dismissed as a precancerous lesion. However, another type of cyst is more ominous. We may call it the fatty cyst, as the degenerating cells within it form masses of colostrumlike fatty or foamy cells. This cyst may also become completely atrophic, although the apparently slow removal of the "irritating" fatty contents is associated with periductal fibrosis and later contraction and fixation of the cyst, which produces a very suspicious clinical picture. However, the outcome of this type of cyst is not always atrophy and quiescence. If fatty material remains for a prolonged period within the ducts it may lead to malignant cell formation and growth by its action on surviving, viable epithelial cells still lining the duct or cyst. The author's experience suggests that cancer development in the breast is associated only, if not always demonstrably, with the presence of fatty material in the mammary ducts, at any level, although its source is not necessarily restricted to epithelial cell degeneration.

To summarize, very briefly, the pathologic point adenosis as such does not lead to carcinoma, neither does the blue-dome cyst, the majority of fatty cysts also eventually become quiescent, but with the fatty cyst, and in ducts with fatty contents or fatty degeneration of proliferated epithelium with little dilatation, there is always the possibility of the formation of a progressive epitheliosis which may become definitely malignant.

EARL O LATIMER, M D

**Carcinoma of the Breast Prognosis in Carcinoma of the Breast** R W SCARFF *Brit J Radiol*, 1948, 21 594

It was stressed that although grading was of importance in carcinoma of the breast, it is obvious that the stage of the disease is of much greater significance as far as the ultimate prognosis is concerned. This does not rule out the importance of

histological grading, because the presence of metastases depends to a considerable extent on the histological type of the growth, and it is more likely that growths of high malignancy will show a higher percentage of cases with secondary deposits in glands at the time of operation

In the breast a combination of histological grouping and clinical staging has produced results which, in the main, are satisfactory, although they have been disappointing to some extent

Clinicopathologic grading and staging of carcinoma of the breast give useful information for the prognosis in the cases that are treated by radical mastectomy, especially if the technique advocated by Handley and Thackray is adopted, i.e., simultaneous histological examination of the lymphatic glands from the internal mammary chain

EARL O. LATIMER, M.D.

**Carcinoma of the Breast** Discussion on Carcinoma of the Breast SIR STANFORD CADE *Brit J Radiol*, 1948, 21 596

The author suggests the following grading of malignancies of the breast

Stage I Tumor of the breast only

Stage II Tumor of the breast plus skin changes, or axillary gland changes, or both

Stage III Tumor of the breast plus changes in the supraclavicular or contralateral axillary glands or fixation to the pectoral fascia

Stage IV Skeletal or visceral metastasis

The involvement in stages I and II is anatomically within the area covered by radical mastectomy, in stage III it is beyond surgical excision, and in stage IV it is suitable for palliative measures by radiation or endocrine therapy

The zone of demarcation between a good and bad prognosis, between a fair and poor chance of survival, is the clinical state of the axillary glands. It is, of course, agreed that sometimes clinically nonpalpable glands show histological invasion, and, conversely, palpable enlarged glands show, occasionally, inflammatory stages only, but on the whole the presence or absence of palpable and clinically malignant axillary glands is the best guide to the prognosis for the patient

It is the author's contention that in Stage I of the disease the best method of treatment is radical mastectomy. Postoperative irradiation in this group of cases as an additional measure is of doubtful value

It is important to draw attention to the limitation of usefulness of radical mastectomy. It gives the best results in Stage I. The results in Stage II are much worse, and by itself the operation offers a chance of 5 year survival in only about 20 to 30 per cent of the cases. Stage II should be analyzed. It includes enlarged axillary glands and skin invasion. There are three types of skin invasion

1 Direct spread and fungation, this is the least malignant type

2 Diffuse invasion with edema (the pigskin or *peau d'orange* type), this is of grave significance

3 Invasion of the skin by discrete nodules (so admirably described by Sampson Handley), this type is a death sentence

In such cases radiation is the weapon of choice and preoperative irradiation is, on common sense grounds and from clinical observation of cases and histological studies, the method of choice. Radium or the more flexible and equally suitable method of roentgen irradiation leads to regression of the disease and transforms a percentage of cases into Stage I cases, suitable for surgery, in other cases the progress of the disease is arrested and life is prolonged by many years

In Stage I cases postoperative irradiation gave a 5 year survival of 53 per cent and preoperative irradiation a 5 year survival of 73 per cent. The figures by E. Berven from the Radiumhemmet, Stockholm, are even more striking, with fixed axillary glands the 5 year survival with postoperative radiation was over 97 per cent, whereas with preoperative and postoperative treatment it rose to 32 per cent

The value of local mastectomy is clear-cut—it removes the breast and the primary tumor. It does not touch the axillary contents and if disease is present there—palpable or nonpalpable, operable or inoperable, actual or potential—there the disease remains. The author is not attracted by the idea of removing only part of a cancer, be it in the breast or elsewhere, if he can, with impunity to the patient, remove all of it. Simple mastectomy is suitable in the aged for the removal of a fungating mass, in bad surgical risks with localized disease, and in cases in which radiation is not available or suitable. Simple mastectomy has its value, it has also, like the radical operation, definite limitations. As a routine surgical procedure, regardless of the stage of the disease or the age of the patient, it is a retrograde step and is quite unwarrantable

EARL O. LATIMER, M.D.

**Carcinoma of the Breast** The Value of Simple Mastectomy and Roentgen Therapy in the Treatment of Cancer of the Breast R. McWHIRTER. *Brit J Radiol*, 1948, 21 599

The main method of treatment in the period from 1941 to 1945 was simple mastectomy and roentgen therapy. Full treatment was possible in almost all cases, but, whether fully treated or not, every case classified as operable has been included

At the Royal Infirmary of Edinburgh the 5 year survival rate was 62.1 per cent when simple mastectomy and postoperative radiation was used

During the period from 1935 to 1940 the main method of treatment was radical surgery and postoperative roentgen therapy, and of the 411 operable patients, 50.1 per cent were alive after 5 years

Statistical examination shows that this difference in the survival rates is significant, and the findings, so far as the 5 year survival rate is concerned, suggest that roentgen therapy is a better method of treatment of the axilla. The results obtained in the advanced cases without distant metastases support this observation

With regard to the survival rate of all advanced cases without distant metastases in the period from 1941 to 1945 the author states that treatment by simple mastectomy and roentgen therapy was possible in only a limited number of cases, but all cases, whether fully treated or not, and all untreated cases, are included. The cases in this group are essentially those in which the disease was too advanced to be treated by radical mastectomy, but was still to some extent localized, so far as could be ascertained by clinical and roentgenographic examination. The group, therefore, includes all cases in which the primary tumor was fixed to the pectoral muscle or to the underlying ribs, and all cases in which there were fixed axillary glands or glands in the supraclavicular region, 29 per cent of the patients were alive at the end of 5 years. This remarkably high figure clearly demonstrates that roentgen therapy is an effective method of treatment of the axilla even when the axillary involvement is gross.

The 5 year survival rate in all cases referred during the period from 1941 to 1945 was 43.7 per cent. It is interesting to compare this figure with that obtained during the period from 1935 to 1940, when the main method of treatment was radical mastectomy and postoperative roentgen therapy. There were 790 cases referred during this earlier period and the 5 year survival rate was 32.4 per cent.

The following is a brief summary of the essential points of the technique of simple mastectomy and roentgen therapy.

The method of treatment is a combination of two procedures which must be co-ordinated if the best result is to be obtained.

The following points are of importance in the surgical aspect of treatment.

1 Preoperative preparation with iodine is contra-indicated because it lowers the skin tolerance to roentgen therapy.

2 The skin incision and the undermining of the skin flaps should be as limited as possible so that tissue spaces outside the area to be irradiated will not be contaminated with malignant cells liberated during the operation.

3 Excessive skin should not be removed for tension on the skin flaps may be associated with failure of the wound to heal and delay in the application of roentgen therapy. Tightly stretched skin flaps do not tolerate irradiation well. Skin grafting does not overcome the difficulty, for grafts do not tolerate x-ray treatment well.

4 When the primary tumor is mobile on the pectoral fascia, the fascia should not be removed, as this promotes fibrosis of the pectoral muscle. If the tumor is firmly fixed to the pectoralis major, the muscle should be removed together with the breast.

5 If there are no palpable axillary glands dissection should not be performed, but superficial mobile glands in the subpectoral region and outside of the axillary fascia may be removed. Any further dissection of the axilla will defeat the whole purpose of the treatment method advocated.

6 If the patient is very stout it is better to carry out a radical mastectomy, because in stout patients it is difficult to deliver an adequate dose of x-rays to the axilla.

7 Supraclavicular glands should never be removed, because these glands are easily and effectively dealt with by roentgen therapy.

8 Adhesive should not be applied to the skin after the operation, because this lowers the tolerance of the skin to irradiation.

The following points are of importance in post-operative treatment by roentgen therapy.

1 Only one full course of x-ray treatment should be given. The practice of giving repeated courses at intervals of 3 to 6 months has no place in the treatment of any form of malignant disease when cure is to be attempted, and is just as illogical as partial removal of a tumor at intervals of 3 to 6 months.

2 X-ray treatment should be commenced as soon as possible after the operation, the usual interval is 2 weeks.

3 Four fields are used and every field is treated every day. The axilla is irradiated from two opposed fields and the anterior field extends up to include the supraclavicular region. The chest wall must be treated from tangential or glancing fields so as to avoid lung fibrosis.

4 An adequate dosage must be given, and in Edinburgh the patients receive a minimal tumor dose of 3,750 roentgens in a period of 3 weeks. This is the same dosage as is given when clinically obvious local recurrences are treated, and it is important not to give less.

5 The x-ray apparatus must be sufficiently powerful to deliver an adequate depth dose in the axilla and it is doubtful if effective roentgen therapy can be given with an apparatus of lower voltage than 250 kv. Heavy filtration is employed and the half-value layer of the beam is 3.7 mm. of copper.

EARL O. LATIMER, M.D.

#### Carcinoma of the Breast The Surgical Aspect of Carcinoma of the Breast R. C. B. LEDLIE *Brit J Radiol*, 1948, 21: 610

The author classifies cancer of the breast as follows:

Stage I The growth is confined to the breast, involvement of the skin directly over and in continuity with the tumor is not considered, provided that the area involved is small in relation to the size of the breast.

Stage II The growth is similar to that in Stage I, but there are palpable mobile nodes in the axilla.

Stage III The growth extends beyond the corpus mammae as (1) the skin is invaded or fixed over an area large in relation to the size of the breast, or it is ulcerated, and (2) the tumor is fixed to the underlying muscle or fascia. Axillary nodes may or may not be palpable, but if nodes are present they must be mobile.

Stage IV The growth extends beyond the breast area as shown by (1) fixation or matting of the axil-

lary nodes, (2) complete fixation of the tumor to the chest wall, (3) metastases in the supraclavicular nodes, (4) metastases in the skin wide of the tumor (5) metastases in the opposite breast, and (6) distant metastases, e g, in the bones, liver, and lungs

In practically all Stage I cases, and in a small percentage of Stage II cases (in which one isolated mobile axillary node low down was enlarged and indurated), the author advises radical amputation, unless it is contraindicated by the patient's poor general condition or extreme age, or in cases of pregnancy or lactation, on the assumption that surgery holds out the best hope of eradicating the disease. This has been the author's policy throughout the entire period from 1937 to 1946, and he has found no reason to alter his attitude up to date.

During the first 7 years of the period under review the author advised initial radical amputation in a great majority of Stage II cases and also in a limited number of Stage III cases.

In all cases in which it was available he relied on the pathologist's detailed report on the tissues removed by radical amputation in deciding whether postoperative x-ray therapy was needed. The pathologist's prediction was based on a summary of a number of features, including the size and situation of the primary tumor, its histological type, its relation to or involvement of the overlying dermis, the number of lymphatic channels invaded, and whether the invasion was widespread or limited to a few isolated cells. Perilymphatic infiltration and invasion of blood vessels or nerves were noted, as was the involvement of muscle or fat. Lastly, the number and position of any affected axillary lymph nodes and the extent of their involvement, as well as any perinodal spread, were correlated with the findings in the breast. Postoperative x-ray therapy was given in all cases in which the pathologist predicted that the outlook was indefinite or bad.

Throughout the 10 years under review, x-ray therapy was employed as the initial treatment in (1) the majority of Stage III cases, (2) nearly all Stage IV cases, (3) a small group of cases comprising carcinoma occurring in pregnancy or lactation, mastitis carcinomatosa, and (4) a limited number of Stage I and Stage II cases, occurring in aged and decrepit patients.

Postoperative roentgen therapy following radical amputation has resulted in a marked increase in the symptom-free rate in cases with axillary node involvement. This improvement in results has been seen in both 3 year and 5 year survivals.

X-ray therapy when used (in some Stage II cases, and chiefly Stage III and IV cases) alone produced a regression of the disease in the treated area in a large majority of cases, but distant metastases were responsible for death in most of these (79 per cent) within 3 years. In all of the patients who survived for a longer period (21 per cent) the disease had recurred by the seventh year.

During the period from 1944 to 1946 initial x-ray therapy was employed in an increasing number of

Stage II cases in which more than one axillary node appeared to be invaded. Previous experience with these cases had shown that radical excision and postoperative x-ray therapy usually succeeded in controlling the disease in the treated area, but, in spite of this fact, distant metastases at a later date led to an unfavorable result in an appreciable number. After the initial course of x-ray therapy was completed in a period of about 4 or 5 weeks, the patient was kept under regular observation at intervals of 1 to 2 months. As long as the disease appeared to be regressing in both the breast and the axilla the author refrained from surgery. However, radical amputation has been the treatment of election and has usually been performed at an interval of from 2 to 6 months after x-ray therapy has been completed. The skin sutures are left *in situ* for from 14 to 18 days, as on one occasion when this was not done the flaps separated and secondary suture was necessary.

Amputation of the breast alone or wide local excision of the residual tumor has been reserved for (1) those aged or decrepit patients who were considered unfit for a major procedure and (2) advanced cases in which the initial regression of the primary tumor in the breast was slight, or in which the breast tumor after a period of regression, commenced to enlarge again.

EARL O LATIMER, M.D.

## TRACHEA, LUNGS, AND PLEURA

**Decortication of the Nonexpandable Postpneumothorax Tuberculous Lung.** DANIEL A. MULVHILL and ROBERT KLOPSTOCK. *J Thorac Surg*, 1948, 17: 723.

In about 5 per cent of cases of pulmonary tuberculosis, in which a successful pneumothorax has been maintained for the optimal time, the lung will not re-expand after pneumothorax refills have been abandoned. The inability of the lung to re-expand usually results in highly negative intrapleural pressures, due to absorption of some of the pneumothorax air, and the drawing toward the chest wall of the collapsed lung together with the mediastinum and its structures. The opposite lung may therefore become overdistended, and latent foci may be opened.

The causes of the failure of the collapsed lung to re-expand are (1) extensive destruction and fibrous contraction of a greater part of the lung, (2) a rigid, thick visceral pleura, which is often the result of a pleural effusion or empyema, and (3) a stenosis of the large bronchi, with resultant atelectasis. The first and third causes still call for thoracoplasty as the method of treatment.

The pathology of the rigid visceral pleura—the second cause for failure of re-expansion—is not always inflammatory thickening of the pleura itself. Not uncommonly, it consists of the laying down of a hyalinized fibrous layer on the pleura, to which it is not intimately adherent in large part but is attached by a thin areolar, vascularized layer, which may be easily separated by blunt dissection to leave behind an intact and fairly normal and expandable pleura.

In the light of this described pathology, the feasibility of decortication in some cases in which expansion does not take place is clear, and has been proved in the 5 cases reported

The following list of possible indications has been tentatively set up

1 To increase functional respiratory capacity, when it is required to permit major collapsing procedures, or resection for an open lesion on the contralateral side

2 To avoid extensive thoracoplasty for the obliteration of the pleural dead space (a) when pleural effusion is persistent or recurrent on attempted re-expansion, (b) when a secondary pyogenic non-tuberculous empyema is present, and (c) when attempted re-expansion results in the shifting of the heart and mediastinum toward the chest wall, creating overdilatation dangerous to the opposite side

3 Nonexpandability in the face of the patient's desire to abandon pneumothorax, and avoid indefinite refills

Only long time observation of a long series of cases can determine the percentage expectancy of reactivation of the old tuberculous focus, or reopening of the cavity, after decortication, as compared with the more controlled re-expansion in readily re-expandable lungs on abandonment of pneumothorax

Detailed case histories of 5 patients who have had surgical decortication for postpneumothorax non-expandable lungs are presented. Pulmonary decortication seems to be a useful procedure for dealing with the problem of the postpneumothorax, nonexpandable lung

SAMUEL KAHN, M D

**The Use of Streptomycin in Resection for Pulmonary Tuberculosis** DWIGHT E HARKEN, JOHN J CINCOTTI, and GEORGE G JACKSON *Surg Clin N America*, 1948, 28 1519

The authors believe that extirpative therapy gives better results than collapse therapy in patients with pulmonary tuberculosis. Some previous results have been discouraging, however, technical refinements and antibiotic and chemotherapeutic advances support this method of treatment. Favour and his associates assume that streptomycin is effective only against extracellular organisms, and this assumption is supported clinically by the good results which have been obtained with its use in exudative diseases, fresh military lesions, and hyperemic nonfibrous lesions

Nine cases are presented in which resection was done for pulmonary tuberculosis. Indications for resection were tuberculoma, symptomatic tuberculous bronchiectasis, collapse failure, bronchial stenosis, secondary suppuration, giant cavitation, and a suspected neoplasm. Streptomycin was given 1 week previous to operation and was continued for 2 weeks after operation. The dosage varied from 1 to 2 gm daily, given at intervals of 4 to 12 hours. One gram of streptomycin and 100,000 units of penicillin were instilled into the pleural space at operation, and the

instillation was continued in cases of pleural contamination. Eight of the 9 patients were clinically well and had negative sputum, none had tuberculous spread, empyema, fistula, or wound infection. One fatality occurred in a desperately ill patient whose nonsurgical prognosis was hopeless

The article includes a report of 10 cases, in one of which pneumonectomy was performed for cancer associated with tuberculosis. In this series treatment extended over a period of 14 months, and it is believed that the material and time element are too limited for definite conclusions. In these cases streptomycin was used as a means of prevention of pleural and wound contamination—not as a cure

In the preparation of patients for operation, the use of streptomycin must be judicious because of streptomycin-resistant strains of the tubercle bacillus. Resistance may be from accommodation of the bacillus to streptomycin, or from proliferation of resistant strains. This factor is thought to begin in about 35 days. The effective dose of streptomycin has not been established. In considering the effectiveness of streptomycin as a means of control of wound and pleural infections, one must remember that aseptic technique is the most important factor

The authors state that thoracoplasty is safer after resection than it is as a primary procedure because the disease has been removed. It is pointed out that the use of streptomycin may prove to be of advantage in the conservation of useful parenchyma by segmental resection, and that streptomycin may inhibit the reactivation of quiescent pulmonary tuberculosis in unresected areas during and immediately following operation

ROBERT E FLORER, M D

**The Use of Streptomycin in Pulmonary Resections** JULIAN A MOORE, JAMES D MURPHY, and PARKER D ELROD *Surg Clin N America*, 1948, 28 1543

This article is a study of 63 patients who had undergone either lobectomy or pneumonectomy for pulmonary tuberculosis and had received streptomycin also. At first the dosage was 2 gm daily, given intramuscularly. Later it was changed to 1 gm daily, divided into two doses given at 12 hour intervals. Improvement in technique, equipment, and anesthesia has been of distinct advantage in recent years. The indications for pulmonary resection in this series were a residual cavity after thoracoplasty (45 per cent), destruction of the lung (12 per cent), failure of so-called conservative methods of collapse (15 per cent), tuberculoma (1 case), severe endo-bronchial disease and bronchiectasis (19 per cent), and elective operations in place of thoracoplasty in unilobar cavitation (8 per cent). All operations were done in the Overholt prone position. The intercostal nerves in the operative area were crushed near the midline to diminish postoperative pain. The bronchus was closed with interrupted silk sutures proximal to the point of clamping. Catheter drainage of the pleural space was used. Six weeks after resection a limited thoracoplasty was performed, the first rib being left in place

The over-all sputum conversion rate was 90 per cent. The mortality rate was 5 per cent, all deaths having occurred within 2 weeks after surgery. Two deaths were due to uncontrollable hemorrhage and 1 death was due to cerebral anoxia from cardiac arrest due to the hemorrhage at the operation. The surviving patients were in excellent clinical condition. Empyema developed in 4 cases as the result of bronchopleural fistula. No empyema developed when a tuberculous cavity was torn. Only one spread occurred, and this was not severe. There were 2 deep wound infections, both following thoracoplasties done 6 weeks after resection. Other complications were 1 case of meningitis, 1 of pericarditis, and progression of the disease in 1 patient. The patient with meningitis was treated with streptomycin and was apparently well at the time of writing. The patient with pericarditis survived, and the patient with progression is under treatment. Comparison is made with the cases reported in the literature prior to the use of streptomycin, and this reported series shows a marked improvement in the results.

ROBERT E. FLORES, M.D.

### HEART AND PERICARDIUM

**Decortication of the Heart in Fibrous Pericarditis**  
(La decorticazione del cuore nella pericardite fibrosa) LUIGI TORRACA *Gior ital chir*, 1948, 4 411

The author prefers the term fibrous pericarditis for the chronic malady which causes progressive thickening of the pericardium. He agrees with many students of this condition that most of the cases operated on are tubercular or rheumatic in origin, even though White does not admit rheumatism as one of the causes of this malady. Fibrous pericarditis may follow acute purulent pericarditis due to the *Staphylococcus aureus*. The author mentions 1 of his cases which followed a peritonsillar abscess, and 3 cases which followed a febrile attack with concomitant joint pains, which could have been considered attacks of acute arthritis. In many cases, however, the etiological factor remains obscure.

The rationale of surgical intervention depends on the fact that the symptoms which make up the clinical picture of fibrous pericarditis are due solely to the changes in the pericardium.

The former belief that pericardial changes hinder the cardiac systole has at present been superseded by that of Volhard, namely, that the fibrous tissue hinders the diastole and inhibits the full dilatation of the cardiac chambers. This is more marked in the right side of the heart. The diminished capacity of the right atrium and ventricle causes stasis in the venae cavae which leads to

1 Increased venous pressure (from 300 to 390 mm, the normal being from 50 to 100 mm.)

2 Turgidity of the superficial and deep veins, including the retinal veins

3 Hepatomegaly and ascites.

4 Dyspnea

5 Increased pressure of the spinal fluid (up to 400 mm H<sub>2</sub>O)

6 Edema of the lower extremities

Because of the diminished capacity of the right side of the heart, less blood reaches the left side and consequently there will be less cardiac output, lower arterial pressure, tachycardia, and a weak pulse.

The author, however, does not agree fully with this conception of Volhard because

1 In 1 of his cases the roentgenogram revealed complete dilatation of the auricles and their impression on the esophagus. This dilatation became smaller 1 month after surgical intervention and the auricular impression on the esophagus almost disappeared.

2 Edema of the lower extremities should appear concomitantly with the liver congestion and ascites, but this is not the case.

3 Good results have been obtained with decortication of only part of the anterior surface of the left ventricle.

In this disease the size of the heart is not always small as stated by Volhard because in numerous cases the author found it to be enlarged on the surgical or on the autopsy table. This can be explained by previous enlargement due to some valvular lesion that was present before the fibrous pericarditis supervened. Whenever there is a concomitant valvular lesion, the heart tones are clear, but weak and distant, murmurs are present, and the pulse is weak and more rapid than normal.

Electrocardiography does not give any information of importance.

Roentgenography usually shows enlargement of the cardiac shadow. In 1 of the author's cases there was an increase in the transverse diameter of the heart, while in another case the enlargement was anteroposterior and included the auricles. This proves that the statement that the cardiac shadow is small in fibrous pericarditis, is not always true. Roentgenographic studies reveal also

1 Diminution of the movements of the cardiac borders, especially the right border.

2 No change in the shape of the heart when the patient is in lateral decubitus.

3 Pulmonary stasis (very evident in the author's cases).

4 Straightening of the heart borders which is due, according to Schmieden and Fisher, to increased diaphragmatic traction.

The author agrees with Westerman that in constrictive pericarditis surgical intervention is never too early, and disagrees with Vaguez and Santy, the former stating that surgical intervention must be considered only when cardiokinetics have no more effect on the heart, and the latter stating that there is plenty of time to intervene surgically as the course of the disease is very slow. The author refutes Sellor's statement that in constrictive pericarditis the cardiac muscle is normal, stating that as the pericardium begins to thicken, the connective tissue invades the myocardium and may reach the endo-

cardium (Burwell and Strayton) and the papillary muscles (Schmieden). He also adds the following as indications for early surgical intervention:

1 Increased work (pulsation) imposed on the heart muscle

2 The deleterious action of the progressive ischemia of the disease which will involve the coronary arteries and lead to atrophy of the heart muscle

The type of operation preferred by the author is the pericardiectomy of Rehn or the decortication of the heart of Sauerbruch and Schmieden. By the first term is meant removal of the fibrous pericardial sac and parietal serous lining, and by the latter term, removal of the epicardium in addition to removal as in the first term. Precordial thoracotomy can be done in some cases as a first step, to be followed later by pericardiectomy. The use of digitalis, because of its action to decrease the cardiac output, seems to be contraindicated. In support of this view the author mentions the case reported by Churchill in which, notwithstanding digitalization, the patient developed acute dilatation of the heart. Access to the heart has been through the mediastinum with resection of the third, fourth, and fifth, or third, fourth, fifth, and sixth costal cartilages, a portion of the sternum, and subperiosteal resection of segments of the same ribs. The incision is curved, starts on the sternum and proceeds laterally to the fifth or sixth interspace. It is mandatory that the internal mammary and the intercostal vessels be ligated. In the reflection of the pleura care must be taken not to cause any lacerations. Small lacerations which can be easily sutured may be of no consequence, but those large and difficult to suture will cause a pneumothorax that will render cardiac function difficult. The transpleural route, advocated by Decker, should be used only when the left pleural cavity is free of adhesions. With this approach the possibility of spreading a tuberculous infection must be considered.

The pericardium is removed always, but the epicardium is removed only when it is thickened. When the structures can be separated by digital dissection, the parietal layer is removed first, followed by decortication of the myocardium. If separation of the layer is impossible, the dissection must be done slowly and carefully until the cardiac muscle is reached.

The ideal pericardiectomy consists in removal of all the pericardium, but as this is impossible we must be satisfied with pericardial removal of the anterior, posterior, and apical part of the left ventricle. Care must be taken not to cut the phrenic nerve, even though the consequences are not serious when it is accidentally cut (Sauerbruch, Schmieden). Decortication of the right ventricle and auricles is difficult, and Schmieden and Fisher do not advise it.

Among the complications, the author emphasizes the following:

1 Laceration of the heart, usually the right side or auricles. If the laceration is not sutured well, or if left unsutured, death will occur. Acute dilatation of the heart with arrest in diastole.

2 Disturbances of the cardiac rhythm, irregularity of the pulse, auricular fibrillation, and temporary arrest of the heart. These have been reported by some authors. Except for some irregularities of the pulse, these conditions have not been encountered by the author.

3 Hemorrhage may occur after decortication, consequently hemostasis must be complete. Drainage is required in these cases. The author concludes his article by reporting his 5 cases of pericardiectomy. He obtained good results in 3 cases, in 1 case there was no improvement because the malady was too advanced, and in the last case death followed post-operative collapse.

Patients with a calcified pericardium are difficult to treat and should not be operated upon. Tengwall operated upon 3 patients with very poor results.

JOSEPH M. A. PAPE, M.D.

### ESOPHAGUS AND MEDIASTINUM

Gastric Cyst of the Mediastinum ADRIAN A. EHRLER and SUSANNA ATWELL. *J Thorac Surg*, 1948, 17, 809.

The authors found reports on 27 cases of gastric cyst of the mediastinum in the literature. In only 2 instances were the patients more than 15 years of age. Nineteen patients were infants under 1 year of age and the remainder were infants between 1 and 4 years of age. The presence of gastric mucosa and its resultant secretions which are capable of digestive activity and peptic ulceration, lead to lethal complications relatively early and undoubtedly explain the paucity of such cysts in adult life.

Just how such cysts may be produced is, of course, shrouded in the same veil of obscurity that characterizes congenital abnormalities in general.

The symptoms produced by these cysts may be varied and include dyspnea from pressure and distortion of the air passages or lungs, as well as cough. Dysphagia may occur but a soft infant diet will usually pass even a distorted esophagus, however, an increase in dyspnea or even cyanosis may accompany swallowing. Hemoptysis, hematemesis, or melena may be observed, but usually these conditions signify erosion of the cyst into, or a communication of some other nature with, the air passages or esophagus.

Chief reliance for the diagnosis is placed on the roentgenograms in the posteroanterior and lateral or oblique views. The cyst is usually located in the posterior mediastinum and most often presents toward the right. Laminography may be required for the demonstration of small cysts. The serious consequences of the presence of such cysts in infants demands their removal.

The treatment of choice is complete removal of the cyst if possible. If not, destruction of any remaining mucosa is indicated. Marsupialization and prolonged drainage may occasionally have to be resorted to, and followed by attempts to destroy the mucosa. Simple external drainage is undesirable.





Fig 1 (Ehler, Atwell) Posteroanterior roentgenogram showing fluid level on right side, note hemivertebrae in upper thoracic and cervical spine



Fig 2 Lateral roentgenogram, fluid lies posteriorly  
teinemia, loss of weight, and inanition are marked, due to failure of essential products of nutrition to enter the circulation

A transpleural approach is recommended, since it is adequate and safe in competent hands

A gastric cyst occurring in a boy 15 months old was completely removed through a right transpleural thoracotomy, with an entirely successful outcome, this case is reported in detail and is amply illustrated

A comprehensive review of the literature is given and a bibliography of 32 references is appended

HIRAK T. LANGSTON, M.D.

**Traumatic Chylothorax** R. STARR LAMPSON, J.  
*Thorac Surg*, 1948, 17, 778

Chylothorax is, by definition, the condition which results when chyle accumulates in the free pleural space. This occurs in the presence of serious disease, such as venous obstruction to the superior vena cava, lymphatic block in filariasis, erosion of the duct or its radicals by malignant neoplasm, or tuberculosis. When chylothorax develops after direct laceration which severs the duct—as in bullet wounds, surgical accidents, fracture of adjacent vertebrae, or following indirect injury which tears it by concussion, or traction from external blows, or even coughing—there is always a latent period before symptoms appear. This is usually from 3 to 7 days, but it may be several months. The delay is the time required for the chyle to escape from the extrapleural mediastinum into the pleural space, and fill it to the point at which the volume of fluid embarrasses respiration and causes distress. This alteration of respiratory physiology may precipitate cardiovascular collapse and shock, which respond to thoracentesis. If the condition is of long duration, and frequent thoracenteses have been done, hypopro-



Fig 3 (Ehler, Atwell) Magnification of mucosa of cyst wall to show typical secreting gastric mucosa



The diagnosis of chylous effusion is established by the character of the pleural fluid. Chyle is a milky, thin fluid, with a specific gravity of 1.010 to 1.021, and alkaline in reaction. The values for electrolytes, protein, sugar, and cholesterol approximate those of the serum, but are subject to wider variations, as a result of the diet.

Chyle is a vehicle for the mobilization of proteins, which, in the presence of hemorrhage, are redistributed and made available for essential functions, it is bacteriostatic.

Traumatic chylothorax is an extremely rare disease, only 69 cases having been discovered. The ages ranged from 9 to 62 years, 47 of the 58 acceptable cases were males, 11 females. This is to be expected in traumatic disease.

The most striking feature in the management of these cases is the multitude of ingenious suggestions which have been considered or executed in treatment. Frequent thoracenteses have been used almost universally. Pneumothorax, for the purpose of discouraging the flow of chyle, has been done without great success. Instillation of sterile broth and irrigations with azochloramid and other substances, to stimulate fibrinous reaction, have been of some benefit. The phrenic nerve was crushed twice with doubtful success. The intravenous or intrasternal injection of chyle has occasionally been beneficial. Restricted diets, low in fluids, fat, and protein reduce the production and flow of chyle. Surgical drainage of the mediastinum, through the posterior approach, has been attempted in the hope that a free external flow of chyle would encourage healing of the rupture in the duct. Direct injury to the thoracic duct in the neck has resulted in external chylous fistula or in chylothorax. Both of these conditions have been controlled by ligation of the cervical thoracic duct.

When conservative methods fail, one is justified in risking a direct attack through the chest, at or below the site of rupture, with the intent to ligate the duct low in the mediastinum.

The case presented establishes the fact that low ligation of the thoracic duct is a feasible procedure. After operation, the chylothorax promptly ceased, and the patient has remained free from it for over a year. The operative procedure, which is described in detail, is rather difficult and should be reserved

for the patient who has demonstrated, by the clinical course, that spontaneous closure will in all probability not occur.

SAMUEL KAHN, M.D.

## MISCELLANEOUS

**The Right Thoracoabdominal Approach** JOHN P. HEAVY and GEORGE H. HUMPHREYS *Ann Surg.*, 1948, 128: 948

The need for an approach to the structures of the right upper quadrant of the abdomen which would give a more adequate exposure has long been appreciated. The immobility of the costal margin being the main barrier to good exposure, the authors considered a right thoracoabdominal approach, cutting across the costal margin, in answer to this problem. Following experiments in the anatomy laboratory on cadavers and on living dogs, and finally in the autopsy room, the authors considered that the procedure deserved a clinical trial.

An obese patient with gallstones was selected for the procedure. Through a long curved thoracoabdominal incision, the costal cartilage was divided between the ninth and tenth ribs, entry to the chest was through the ninth interspace, and the abdomen was opened through a curved radial incision in the right diaphragm. The right lobe of the liver was gently rotated into the chest and all the structures in the region of the porta hepatis were well exposed. The gall bladder was easily removed. The only difficulty encountered was in closing the divided diaphragm at the transected costal margin. It is suggested that a rib resection would make the closure less difficult.

This approach is offered as a useful one in secondary and tertiary operations upon the biliary tree, in pancreaticoduodenal operations, in portacaval anastomosis, and in removal of portions of the right lobe of the liver, since the inferior vena cava can be controlled above as well as below. It is also suggested that occasionally it might be easier to perform cholecystectomy through the chest than through the abdomen, as splenectomy and gastrectomy are sometimes carried out. If unexpected technical difficulties are encountered in the right upper quadrant and additional exposure would be advantageous, the approach can be used as an adjunct to the ordinary right upper quadrant incisions.

JESSE F. THOMPSON, M.D.

# SURGERY OF THE ABDOMEN

## GASTROINTESTINAL TRACT

**Peripheral Sensorial Innervation of the Digestive Tract** (Las vías sensoriales periféricas del tubo digestivo) I DE CASTRO, P DE SALA, and J M BLANCO *Rev espan enferm ap digest*, 1948, 7 785

The authors discuss the innervation of the abdominal viscera after observing the effects of distention of the abdominal viscera on the dilatation of the pupils of cats and after cross nerve anastomosis. The distribution of the afferent and efferent vagal and splanchnic nerves is very well illustrated with many interesting figures.

WILLIAM E RICKETTS, M D

**Control of Gastric Secretion** GEORG KAHLSON *Brit M J*, 1948, 2 1091

The author reviews the physiological concepts concerning the control of gastric secretion and attempts to separate the proved facts from unjustified speculation. The results of this analysis are summed up as follows:

"If tentatively we try to link together the pattern of facts as they are seen so far, the contours above the horizon of unjustified speculation are as follows: Gastrin is contained in the pyloric mucosa, and in man and pigs, in the duodenum as well. This agent is liberated by vagus impulses or when chemical substances such as food come into contact with the mucosal regions concerned. The liberated gastrin is carried by the blood to the fundic mucosa, where it causes some change so that histamine is liberated in quantities sufficient to stimulate the parietal cells. In this picture gastrin enters as a common factor in the nervous, gastric, and intestinal phases of acid gastric secretion."

The author admits that a great deal of work remains to be done before this view can be accepted even by those who are suggesting it as a working hypothesis.

HAROLD LAUFMAN, M D

**Histologic Basis for Anacidity in Gastric Disease** LEWIS W GUISS and FRED W STEWART *Arch Surg*, 1948, 57 618

The authors discuss the etiology of gastric anacidity and state that it is variously ascribed by different authors to atrophy of the gastric mucosa, congenital defect, gastritis, avitaminosis (B), idiopathic causes, and gastric carcinoma. However, little correlation has been found between the size of the gastric carcinoma, the site of the neoplasm, and the quality of the secretion.

This report is concerned with an attempt to relate the anatomic findings with the degree of gastritis and achlorhydria in a group of stomachs resected for duodenal ulcer (32), prepyloric ulcers (19), ulcer of the gastric fundus (20), carcinoma of the prepyloric area (92), and carcinoma of the gastric fundus (113).

The size and site of the gastric lesions were also correlated.

Considerable variation in the parietal cells in these stomachs was noted. Frequently the cells were apparently integrate from a histological standpoint, but when figures from gastric analyses were correlated, it became evident that unless the acidophilic granules in the cells could be clearly made out in properly stained sections the parietal cells were probably physiologically inactive.

The number of parietal cells present was correlated with the intensity of the existing gastritis. The coefficient of correlation was  $-0.719 \pm 0.020$ , signifying that as the intensity of chronic atrophic gastritis in the fundus increases, there is a proportionate decrease in the number of parietal cells.

The number of "functional" parietal cells present in the fundus mucosa was correlated with the highest figure for free hydrochloric acid obtained by fractional analysis of gastric material from the same patients. Because of the possibility of inhibition of secretion of hydrochloric acid in the carcinomatous stomachs by a gastric secretion inhibiting substance, the stomachs were divided into two groups, one containing those with peptic ulcers, and the other those with cancer.

In the ulcer group the coefficient of correlation between the number of parietal cells present in the fundus mucosa and the highest figure for free hydrochloric acid obtained by fractional analysis of gastric material from the same patients was  $+0.622 \pm 0.083$ . This high positive correlation signifies that the more parietal cells present, the greater the tendency toward high amounts of free hydrochloric acid.

The correlation coefficient between the number of parietal cells present in the fundus of stomachs with cancers and the production of free hydrochloric acid was even higher, i.e.  $+0.718 \pm 0.0413$ , a highly significant positive correlation. Therefore, the production of hydrochloric acid in the cancerous stomach is directly proportionate to the number of normal-appearing parietal cells present in the fundus of these stomachs. The coefficient of correlation was only slightly higher in cancerous stomachs than in the ulcerous stomachs. No correlation could be obtained between the location of a cancer in the stomach and the production of free hydrochloric acid. The figures also showed that in cases of duodenal and antral ulcers, the fundus is essentially devoid of chronic atrophic gastritis whereas in cases of ulcer of the fundus, moderate gastric changes are found.

Little or no relation was found between the size of the lesion and the free hydrochloric acid except that when the lesion was large enough to destroy or affect the major portion of the fundus mucosa, anacidity naturally resulted. Chronic atrophic gastritis and parietal cell deficiency are the primary causes of anacidity and explain the greater incidence of ana-

cidity with increasing age in the general population

ERNEST D. BLOOMENTHAL, M.D.

**The Management of Massive Gastroduodenal Hemorrhage** FREDERICK H. AMENDOLA *Ann Surg*, 1949, 129, 47

The term "massive gastroduodenal hemorrhage" should apply only to acute rapid loss of blood causing hemorrhagic shock. Unless this type of hemorrhage is considered separately from those of less magnitude, the vital statistics of such cases are hopelessly confusing.

Such hemorrhages produce an immediate rapid diminution in blood volume and hypotension which may produce acute circulatory failure or heart failure. Prolonged severe hypotension from acute hemorrhage may cause irreparable damage to vital organs, particularly in older patients.

Although the figures for conservative management vary greatly, certain facts can be obtained from them. The author reviews reported series of cases by other authors and cases from his own hospital. Expectant treatment resulted in a 19 per cent mortality of patients over 45 years of age and in a mortality of 15 per cent for the entire group of patients with massive hemorrhage. Of those treated surgically, there was but 1 death, or a postoperative mortality of 9 per cent in the group operated upon within 48 hours. Three patients were treated expectantly, to a point where nothing more could be done, and were then operated upon, all 3 of these patients died.

The plan of management is based upon certain deductions from statistical studies, as follows: (1) indiscriminate emergency surgery for ulcer hemorrhage should be strongly condemned, (2) the risk of lethal hemorrhage in younger patients is relatively small, and emergency operative intervention in this group will not often be necessary, (3) all serious bleeders above the age of 45 are potential candidates for emergency operation, (4) severe ulcer pain preceding the hemorrhage or persisting after hemorrhage is a serious symptom, usually indicating deep penetration, or impending or localized perforation, (5) in the presence of pyloric stenosis hemorrhage is more likely to continue or recur, (6) the patient over 50 years of age, who is bleeding from a chronic gastric ulcer, is most likely to die of uncontrollable hemorrhage, (7) surgical intervention, when indicated, carries the least risk during the first 48 hours of active bleeding, (8) in the older group, recurrent severe bleeding in a patient who has just recovered from a previous episode is of the gravest prognostic importance, and (9) the mortality from late surgical intervention is prohibitive.

Based upon these premises, the author has outlined a plan of management of such cases:

1. Active treatment of the patient in shock is begun at once without subjecting the patient to any but the most cursory physical examination.
2. Nothing is permitted by mouth except small sips of water or cracked ice.

3. Blood replacement is begun at once. Plasma may be used, but only to take the place of blood until blood is obtained.

4. Blood is drawn for hematocrit, prothrombin, and blood urea nitrogen determinations, as well as for typing and blood counts.

5. Repeated or continuous transfusion is required as long as the systolic pressure remains below 90 or the pulse over 130, or both.

6. When restorative measures have been initiated, a rapid physical examination is made and a history secured in an attempt to ascertain the most probable source of bleeding.

7. In the absence of a definite history of ulcer in a patient who is bleeding uncontrollably, and in whom surgical intervention appears likely, every reasonable effort is made to establish a diagnosis. This should include examination of the esophagus, stomach, and duodenum by roentgenography, if necessary. Though a patient in shock should not be subjected to this procedure under any circumstances, bleeding of itself does not contraindicate the ingestion of barium and early examination.

8. If the presence of esophageal varices is definitely excluded, a small caliber indwelling tube is passed through the nostril into the stomach, the stomach is lavaged with saline, and continuous suction is applied.

9. Opiates or barbiturates, or both, are given in doses adequate to control restlessness. Morphine occasionally produces nausea and should be given cautiously.

10. Blood pressure and pulse are recorded at half-hour intervals.

11. All fluid, amino acid, vitamin, sugar and salt requirements are met by intravenous infusion and transfusion during the period of profuse bleeding.

12. *Indications for operation.* When causes of bleeding other than chronic ulcer have been excluded with reasonable certainty, (a) patients over 50 years of age who continue to show a rapid pulse, drop in blood pressure, slight air hunger, and other signs of continued bleeding despite repeated transfusions over a period of 24 hours, require surgical intervention, (b) younger patients who continue to bleed profusely and who remain at shock levels despite repeated transfusions over a period of 48 hours require surgical intervention, (c) recurrence of massive bleeding in the older ulcer patient demands immediate operation, (d) massive hemorrhage superimposed upon a known pyloric obstruction requires surgical intervention, (e) simultaneous hemorrhage and perforation obviously call for immediate operation, and (f) patients who are first seen after many days of severe continuous or repeated hemorrhage are extremely poor surgical risks and are best treated expectantly. Simple high jejunostomy under local anesthesia for feeding purposes may be of value.

Because of the many difficulties of operation in such cases, they should only be delegated to the most experienced of abdominal surgeons. No patient should be subjected to operation unless with

massive blood transfusion and modern anesthesia, he can be safely considered for major gastric surgery. If this cannot be accomplished, he is best treated expectantly.

A simple ligation of the bleeder, or ligation of vessels supplying the ulcer, is usually a useless type of surgical procedure in these cases, and a form of resection is almost invariably necessary.

FREDERICK C HOEBEL, M D

**Gastrojejunal Colic Fistula** HENRY H. FAXON and WILLIAM G. SCHOCH, JR. *N. England J. M.*, 1949, 240: 81

The findings in 9 cases of gastrojejunal colic fistula are presented, and the literature on the subject is reviewed.

Usually, the symptoms are attributable to the secondary effects of diarrhea induced by the reflux, into the upper jejunum and stomach, of irritating contents of the large bowel. Passage of gastric material into the colon through the fistula in the reverse direction is delayed, as a rule, by a valve-like action of the jejunal mucosa.

The treatment of gastrojejunal colic fistulas is surgical and consists of removing the fistula, restoring bowel continuity, and correcting the ulcer diathesis.

Preparation of the patient for excision of the fistula should include the institution of an ascending colostomy, as recommended by Pfeiffer, as a preliminary procedure in all patients whose general condition is unsatisfactory.

The tendency in these patients to reactivate an ulcer after an excision of the fistula and restoration of intestinal continuity is so strong that unless corrective surgical measures have been carried out at the earlier operation they should be adopted before the patient is finally discharged from the hospital.

A case is cited for the first time in which, after excision of the fistula, transthoracic vagotomy was used as the definitive treatment of the ulcer diathesis. This patient was asymptomatic a year after the vagus resection.

BENJAMIN GOLDMAN, M D

**New Problems in the Origin of Gastric Ulcer** (Neuere Probleme in Beziehung zur Magengeschwulstentstehung) G. VON BERGMANN. *Deut. med. Wschr.*, 1948, 73: 621

The author refers to his theories which he first expounded in 1913. At that time he stated that he suggested that the ulcers of the stomach had their origin in certain nervous and spastic changes in the gastric blood vessels. Although there have been numerous contributions on the origin of gastric ulceration, he still believes that this condition finds its origin in certain unexplainable alterations in the sympathetic nervous system. This does not presuppose a simple imbalance between the craniosacral and the thoracolumbar outflows, for he states that he has never observed any person who might truly be classed as a parasympathetic individual.

Furthermore, he cites the work of Cushing and others who have observed gastric ulceration follow-

ing manipulation in the midbrain. He also cites the work of his coworker, Kauffman, who was able to produce gastric ulceration by the subcutaneous injection of certain proteins into the back of a dog. The effects which Rosenow was able to produce on the basis of the theory of focal infection, he believes, were due to its effect on the nervous elements of the gastric wall.

He explains that the lesser curvature of the stomach is most frequently affected by ulceration, not because of the course of the "Magenstrasse," but because of the difference between the vascular and nervous distributions in the stomach. The discussion is followed by a citation of various cases in which ulceration has followed certain psychological experiences. One of the patients showed recurrences with definite psychological trauma, and therapeutic results were obtained by the alteration of the situation.

WILLIAM C. BECK, M D

**Surgical Methods in the Treatment of Gastroduodenal Ulcers** (Métodos quirúrgicos para mejorar los resultados en el tratamiento de las úlceras gastroduodenales) RICARDO LOZANO BLES. *Rev. espan. enferm. ap. digest.*, 1948, 7: 704

In 324 cases of nonperforated gastrojejunal ulcer, subtotal gastric resection was done. Of these ulcers, 63 per cent were gastric, 37 per cent were duodenal, and 18 per cent were jejunal. The surgical mortality in the first 100 cases was 12 per cent, while in the last 100 it was 2 per cent. Recurrence of the ulcer took place in only 2 cases.

WILLIAM E. RICKETTS, M D

**Surgical Methods in the Treatment of Gastroduodenal Ulcers** (Métodos quirúrgicos para mejorar los resultados en el tratamiento de las úlceras gastroduodenales) J. SOLER ROIG. *Rev. espan. enferm. ap. digest.*, 1948, 7: 749

The author found that subtotal gastrectomy continues to be the elective treatment for noncomplicated gastroduodenal ulceration. Recurrence of the ulcer was observed in 2 per cent of 315 gastrectomized patients. Forty patients were subjected to vagotomy, and in 19 of these it was done transthoracically. In 1 patient an anastomotic ulcer recurred. The author does not include evidence in this case that the vagotomy was complete.

Vagotomy plus gastrectomy is advised when there is gastric retention due to deformity or stenosis in the duodenum. The postoperative symptoms after vagotomy, such as diarrhea, anorexia, and distention of the stomach, were easily controlled by treatment.

WILLIAM E. RICKETTS, M D

**Surgical Methods in the Treatment of Gastroduodenal Ulcers** (Métodos quirúrgicos para mejorar los resultados en el tratamiento de las úlceras gastroduodenales) R. VARA LÓPEZ. *Rev. espan. enferm. ap. digest.*, 1948, 7: 575

The author reports a series of 531 gastric operations for peptic ulcer. Twenty-eight gastroenterotomies were done with a mortality in 5 cases. The

cause of death in these cases was as follows gastric tetany (1), perforation (1), pneumonia (2), and an unknown cause (1). Subtotal resection of the stomach was carried out in 503 cases with a mortality in 67. The localization of the ulcer was in the stomach in 43.3 per cent of the cases, in the duodenum in 52.1 per cent, and in the jejunum in 2.6 per cent.

The mortality in subtotal gastrectomy varied considerably with the modern surgical improvements in techniques as well as with preoperative and postoperative care. While the mortality in 1934 was above 10 per cent, there were no fatal cases in 1947 and 1948. The most frequent causes of death were peritonitis and upper respiratory infection.

WILLIAM E. RICKETTS, M.D.

**Partial Gastrectomy for Peptic Ulcer.** T. W. MURPHESS and Sr. J. M. C. BIRT. *Brit. M. J.*, 1948, 2, 1095.

This series consists of 248 patients who had undergone partial gastrectomy for peptic ulcer. An attempt was made to assess the merits of four types of anastomosis. Type I was an end-to-side anastomosis with an antecolic proximal loop attached to the greater curvature. Type II was an end-to-side anastomosis with a long antecolic proximal loop attached to the lesser curvature with a valve and a small stoma. Type III was an end-to-side anastomosis with a short postcolic proximal loop attached to the lesser curvature with a small valve and a small stoma. Type IV was an end-to-end anastomosis of the Billroth I type joining the duodenum to the greater curvature of the stomach.

The overall mortality for this series was 2 per cent. In the main, the patients who have had a partial gastrectomy for ulcer are satisfied. Seventy-three per cent are symptom-free and 22 per cent have slight symptoms which are not severe enough to make them dissatisfied. Approximately 5 per cent either have a poor functional result or are dissatisfied. Analysis of the cases whose results are listed as fair or poor led to three conclusions: (1) that pain of the ulcer type is most unusual, and in the patients followed by the authors no anastomotic ulcers have been proved, (2) that the departure from a normal digestion is due to the incidence of what is described as "side effects" or postcibal distress. The symptoms of which the patients complain are nausea and, less often, vomiting, a feeling of distention, lassitude, sweating, and attacks of diarrhea. These come on at varying periods during or after a meal, (3) that fats and fried food are the articles of diet most likely to cause trouble.

The more troublesome and chronic the original ulcer, the more tolerant is the patient of minor functional disturbances in his postgastrectomy result.

Anastomosis of the afferent loop to the greater curvature leads to a high incidence of proximal loop filling. There is nothing to choose between the functional results of the other three anastomoses employed. The long proximal loop needed in the

antecolic operation is more likely to lead to complications than the short proximal loop used in the retrocolic operation. The Billroth I anastomosis is probably the safest of all as it has no afferent loop. Because of the risk of stenosis, this is not a suitable anastomosis after gastrectomy for duodenal ulcer.

In this series there is no evidence to support the view that gastrectomy for duodenal ulcer gives worse results than for gastric ulcer. Eighty per cent of operations for duodenal ulcer were classified as good as opposed to 58 per cent for gastric ulcer.

HAROLD LAUFMAN, M.D.

**Neurogenic Tumors of the Stomach.** R. L. CANNEY. *Brit. J. Surg.*, 1948, 36, 139.

Benign tumors of the stomach are rare. The two types of benign nerve sheath tumors that occur in the stomach are the neurilemmoma and the neurofibroma. The former is usually solitary and is but rarely associated with von Recklinghausen's disease, the latter, however, is frequently multiple and is most often associated with von Recklinghausen's disease. Any of the characteristic stigmata of von Recklinghausen's disease, such as cutaneous nodules, pigmented areas in the skin, mental deficiencies, or skeletal changes, may be present in the individual case.

Apart from the usual association with von Recklinghausen's disease, the distinction between the two types of tumor is entirely a histological one, depending largely on a relative preponderance of fibrous tissue. The distinction, however, is not entirely academic since the neurilemmoma has a much greater tendency toward malignant degeneration than does the neurofibroma.

Sarcomatous changes in the neurilemmomas are not infrequent. The differentiation between benign and malignant tumors may not be easy and depends largely on the cellularity of the tumor and the presence of infiltration of the gastric wall. Generally, the tumors tend to remain locally malignant for long periods and metastasize only in the latest stages so that the prognosis even in the malignant form of the disease is good.

The tumors are usually small (less than 6 cm. in diameter), solid, sometimes lobulated, and attached to the gastric wall by a broad base although they may be pedunculated. The mucous membrane covering the tumor is vascular and often ulcerated. A characteristic feature is the deep punched out ulceration on the surface of the tumor which accounts for the characteristic niche seen on the roentgen film.

There are no characteristic features which distinguish these tumors clinically. The symptoms will depend to a certain extent on the position and situation of the tumors in the gastric wall. Hemorrhage, the most common symptom, is usually considerable and occurs at intervals, the patient being well in the intervening periods but with a steadily progressive anemia. The tumor when situated near the pylorus tends to become pedunculated and to prolapse through the lumen, which gives rise to recurrent

abdominal pain and vomiting. On clinical examination there are few signs of significance that are usually detected except possibly the presence of a palpable abdominal mass. The patients are in good general health and if a benign tumor of the stomach is suspected, they should be examined carefully for the presence of von Recklinghausen's disease.

In the absence of von Recklinghausen's disease, the final diagnosis in these cases will probably not be made until microscopic examination of the tumor has been performed, although its presence may be suspected. If a tumor is suspected from the clinical examination, the patients should certainly be subjected to laparotomy, especially in view of the possibility of malignant changes. Wide surgical excision is advisable although local excision may be preferable for small tumors. Partial gastrectomy will usually be necessary, the extent of the resection depending upon the size and location of the tumor. With such treatment the prognosis is excellent even in patients in whom malignant changes have occurred.

ORVILLE F. GRIMES, M.D.

#### **Argentaffinoma of the Gastrointestinal Tract** DOUGLAS R. K. REID *Brit J Surg*, 1948, 36: 130

Approximately 85 per cent of argentaffinomas occur in the ileocecal region, and of these the great majority are found in the appendix. They are found with decreasing frequency in the ileum, jejunum, duodenum, colon, and stomach.

In the small bowel, a purely submucous tumor may be sessile or polypoid. When it invades the muscle coats, a highly characteristic feature consists in buckling of the bowel wall with resulting invagination of the tumor toward the lumen. This distortion is due to contraction of the fibrous and abundant elastic tissue of the stroma, especially in the subperitoneal coat, and it constitutes the mechanism whereby even very small carcinoids may produce intestinal obstruction. The growth may assume an annular form, although it does not, as a rule, completely encircle the bowel wall. This type produces obstruction partly by stenosis and partly by buckling. Intussusception has resulted from the presence of a polypoid tumor, and in other cases obstruction has been the result of adhesions of coils of bowel in the vicinity of a carcinoid, particularly when this has invaded the mesentery.

All argentaffinomas have the microscopic picture of carcinoma simplex, and in all, whether benign or malignant, the cellular features are constant. Therefore, it is not always possible to distinguish the benign and the malignant forms on the basis of histology alone. It is probably sound to regard all carcinoids as at least potentially malignant and to classify them according to their behavior as localized, invasive, or metastasizing. Malignancy in the form of local invasion of the mesentery or of actual metastases is extremely rare in the appendicular carcinoid. Extra-appendicular tumors, however, which occur at a later period in life, are much more prone to display obvious malignancy.

Metastasis takes place chiefly to the lymph nodes of the mesentery, of which one or many may be involved. Secondary deposits have been found in the liver, and in a few instances in the retroperitoneal tissues, lung, pleura, brain, spinal meninges, pancreas, and inguinal lymph nodes. Both primary and secondary tumors grow very slowly, and cases are on record in which secondary deposits have been observed over periods of years without apparent progression.

Recurrent attacks of colicky pain and vomiting associated with a history of flatulent dyspepsia constitute a common set of symptoms. Bleeding from the bowel is uncommon because of the infrequency of ulceration, but diarrhea is a constant and unexplained symptom.

The treatment of benign argentaffinomas requires no special consideration in that local excision is adequate. In the malignant form, the extremely slow growth of both primary and secondary tumors justifies strenuous efforts at complete extirpation, yet at the same time it condones, in poor risk patients, measures which would be regarded as incomplete and ill-advised in the treatment of adenocarcinoma. Thus, excision of the primary tumor is not necessarily contraindicated by lymph node, peritoneal, or even hepatic metastases.

ORVILLE F. GRIMES, M.D.

#### **Distribution of Gastric Changes Accompanying Gastric Cancers in Various Locations** LEWIS W. GROSS and FRED W. STEWART *Arch Surg*, 1948, 57: 624

This report considers the importance of the variations of location in the distribution of gastritis. Many authors have reported the finding of pangastritis in all specimens of gastric cancer and antral gastritis in the large majority of gastric and duodenal ulcers. Cancers arise most commonly in the pyloric area and are more frequent at this site in younger persons. The degenerative changes of chronic atrophic gastritis are thought to be much more pronounced in the pyloric gland area, especially along the lesser curvature of the body of the stomach, and to be more or less absent along the greater curvature of the body and in the cardiac portion of the stomach. They have already been proved to increase in amount and intensity with advancing age.

The authors attempt to answer the following questions:

1. Is there a differential distribution of chronic atrophic gastritic changes present in the gastric mucosae of persons within the age range for gastric cancer?
2. Does cancer of one portion of the stomach develop earlier than that of any other portion?
3. Is there any difference in the distribution and intensity of the gastritic changes apparent in carcinomas of the various portions of the stomach, or is the "pangastritis" of carcinomatous mucosae a fact?
4. What gastritic changes appear consistently in association with peptic ulcers (a) of the duodenum, (b) of the pyloric area, and (c) of the fundus?

5 Do the changes found in "ulcer stomachs" vary significantly from those found in "cancer stomachs," and in a control series of "normal stomachs" from persons in the same age range?

This study is based upon observations of normal stomachs (48) in the cancer age range, carcinomas arising in the pylorus (92), carcinomas of the fundus (67) excluding the "surgical cardia", carcinomas of the "surgical cardia" (46), duodenal ulcers (32), peptic ulcers of the pyloric area (19), and peptic ulcers of the fundus gland area (20). The pertinent factors studied were mucosal thickness, the type of glands and constituent cells with reference to location within the stomach, the number and size of lymphoid aggregates and follicles, the amount of leucocytic infiltrate, the amount of intestinal metaplasia, and the amount and degree of dedifferentiation of specialized glands (pyloric gland heterotopia).

The mean age and the mean mucosal thickness in millimeters of the various groups are given in Table I.

The mean age of the patients with duodenal ulcer was found to be significantly less than that of all the others. Cancer does not tend to develop at an earlier age in one specific part of the stomach than in the other parts. No significant differences were found in the mean thickness of the pyloric and fundic mucosae in the various conditions.

Examination of the control group of 48 normal stomachs from persons dying in the gastric cancer age range (from 40 to 79 years) showed that there was a low mean incidence of intestinal metaplasia, and dedifferentiation of specialized glands, with no significant difference in the amount found in the pyloric and fundus gland area. There was a slight to moderate amount of leucocytic infiltrate and lymphoid aggregates present in the same group, with a definitely decreased amount present in the fundus as compared to the pyloric area.

The average gastric mucosa of normal persons reaching the gastric cancer age measures around 1.00 mm in thickness. There is a slight amount of intestinal metaplasia and glandular dedifferentiation scattered evenly over the pyloric and fundus areas. The only difference between the fundus and pyloric areas is that the amount of leucocytic infiltrate and lymphoid aggregates, small in the fundus area, is slightly but significantly increased in the pyloric area. This makes necessary the assumption that chronic atrophic gastritis occurs with equal frequency and intensity in the pylorus and fundus of persons in the gastric cancer age range.

The distribution of carcinomas in this study is interesting because it shows 98 carcinomas of the pylorus and 113 carcinomas of the fundus (including the cardia). Formerly pyloric carcinomas were listed as being more frequent, probably because the majority of cardiac carcinomas were considered inoperable. These new figures based on a series of resected stomachs reflect the extension of operability of gastric carcinomas by the addition of total gastrectomy and transthoracic cardiectomy to the older procedures.

TABLE I — MEAN AGES AND MEAN MUCOSAL THICKNESSES

Group	Number of Cases	Mean Age	Mean Mucosal Thickness Mm	
			Pylorus	Fundus
A Control	48	54.2	1.05	1.09
B Cancer of pyloric area	92	58.5	0.94	0.99
C Cancer of fundus	67	56.5	1.00	1.03
D Cancer of cardia	46	58.3	0.95	1.02
E Duodenal ulcer	32	45.0	1.04	1.12
F Pyloric area ulcer	19	57.2	0.91	1.06
G Ulcer of fundus gland area	20	55.7	1.02	0.96

The presence of a carcinoma in the stomach, either pyloric or fundic, was associated with a moderate significant increase in intestinal metaplasia and glandular dedifferentiation. The intensity of the changes present in the pylorus and the fundus was essentially the same although the amount of leucocytic infiltrate and lymphoid aggregates present in the pyloric area was not increased by the presence of cancer in either the pylorus or the fundus, however, the amount of infiltrate in the fundus (low in the control group) was so increased that the amounts were essentially the same in both areas (Table III). The degenerative and inflammatory changes are severe in the mucosa surrounding any gastric lesion.

In the 48 cases of carcinoma of the cardia, the pyloric mucosa showed the same moderate significant increase in intestinal metaplasia and the same lack of increase in the amount of infiltrate and lymphoid aggregates as in cases of carcinoma of the prepyloric and fundus areas. However, the slight increase in metaplasia, glandular dedifferentiation, leucocytic infiltrate and lymphoid aggregates which occurred in the fundus in the presence of carcinoma of the

TABLE II — MEAN AMOUNTS<sup>1</sup> OF METAPLASIA AND DEDIFFERENTIATION, WITH STANDARD DEVIATIONS

Group	Number of Cases	Pylorus		Fundus	
		Mean	Standard Deviation	Mean	Standard Deviation
A Control	48	4.33	2.96	3.68	4.31
B Cancer of pyloric area	92	14.46	6.28	10.98	8.22
C Cancer of fundus	67	11.02	5.92	10.39	6.15
D Cancer of cardia	46	13.01	4.62	6.06	5.98
E Ulcer of duodenum	32	5.74	2.65	1.59	0.53
F Ulcer of pyloric area	19	8.89	3.97	3.08	1.59
G Ulcer of fundus gland area	20	10.22	3.70	9.60	4.95

<sup>1</sup>Graded on an arbitrary scale of 0 denoting complete absence to 24 representing the maximal change possible.



TABLE III — MEAN AMOUNTS<sup>1</sup> OF INFILTRATE AND LYMPHOID AGGREGATES, WITH STANDARD DEVIATIONS

Group	Number of Cases	Pylorus		Fundus	
		Mean	Standard Deviation	Mean	Standard Deviation
A. Control	48	15.39	15.20	9.58	5.73
B. Cancer of pyloric area	92	18.34	3.66	17.52	9.16
C. Cancer of fundus	67	16.16	4.15	17.24	6.09
D. Cancer of cardia	46	15.97	4.46	12.08	7.30
E. Ulcer of duodenum	32	21.52	3.80	4.33	3.29
F. Ulcer of pyloric area	19	25.98	3.81	10.00	5.36
G. Ulcer of fundus gland area	20	21.85	3.22	18.40	7.26

<sup>1</sup>Graded on an arbitrary scale of 0 denoting complete absence to 36 representing the maximal change possible

cardia (the mucosal area nearest the carcinoma) was not significantly increased when compared with the amount found in the control group, and was significantly less than the amount found in the presence of carcinoma of the fundus

One concludes then that there is chronic atrophic gastritis of moderate degree throughout the stomach harboring a cancer in any location except that when the carcinoma is in the cardia the changes are less notable in the fundus

The group of 32 patients with duodenal ulcer showed no increase in intestinal metaplasia or glandular dedifferentiation as compared with the control group, in fact, there was a consistent decrease in metaplastic changes in the fundus although this decrease was not statistically significant because of the small number of specimens studied. There was a definite increase in the amount of leucocytic infiltrate and lymphoid follicles in the pyloric area in this group, but there was, again, a significant decrease in these factors in the fundus. The presence of a duodenal ulcer appears to have little or no association with degenerative changes in the gastric mucosa

In the group of stomachs harboring a peptic ulcer in the prepyloric area there was a significant moderate increase in the amount of intestinal metaplasia, leucocytic infiltrate, and lymphoid aggregates limited to the pyloric mucosa as compared with stomachs from the control group. In a comparison of the prepyloric ulcer group with the duodenal ulcer group, the only real difference found was an increase in the infiltrate in the fundus, which was sufficient to bring it up to the control level. The presence of a prepyloric ulcer, then, is associated with mild atrophic gastritis and gastric changes near the ulcer

The group of 20 stomachs with ulcer in the fundus gland area presented a radically different picture. Here there was a significant moderate increase in intestinal metaplasia, glandular dedifferentiation, leucocytic infiltrate, and lymphoid aggregates in both

parts of the stomach as compared with the control group. These changes were so pronounced that the mucosae of the group could not be distinguished from those of the pyloric and fundic cancer groups. The presence of a peptic ulcer in the fundus gland area of a stomach is therefore associated with a generalized chronic atrophic gastritis of moderate degree, essentially the same as in the cancer groups

ERNEST D. BLOOMENTHAL, M.D.

#### One Thousand Resected Stomachs (1,000 resezierte Mägen) HERMAN ROER *Chirurg*, 1948, 19: 447

Histologic sections from 1,000 resected stomachs were studied. In the majority of cases the macroscopic diagnosis of ulcer was proved by histologic study, in others the macroscopic diagnosis of carcinoma was proved. In a small number of cases the macroscopic diagnoses presented difficulties and in these a diagnosis of carcinoma had to be ruled out. The histologic diagnosis in the 1,000 cases was as follows: ulcer, 871 cases and carcinoma, 129 cases

Of the 871 ulcers, 41.5 per cent were gastric and 56.3 per cent were duodenal ulcers, 2.2 per cent of ulcers were both gastric and duodenal. Eighty-eight per cent of patients were males and 12 per cent were females. Fifty-four per cent of duodenal ulcers occurred in patients from 30 to 45 years of age and 67 per cent of gastric ulcers occurred in patients from 35 to 55 years of age

Of the 129 cases of carcinoma, 7 per cent were found to be ulcer-carcinomas. Seventy-seven per cent of carcinomas occurred in patients between the ages of 51 and 70 years of age, the peak lying between the ages of 51 and 60 years. Seventy-two per cent of patients with carcinoma were males and 28 per cent were females

JOHN L. LINDQUIST, M.D.

#### Appraisal of Oral Streptomycin as an Intestinal Antiseptic, with Observations on Rapid Development of Resistance of *Escherichia coli* to Streptomycin JOHN S. LOCKWOOD, ALFRED D. YOUNG, McLEMORE BOUCHELLE, THOMSON R. BRYANT, JR., and ALFRED J. STOJOWSKI *Ann Surg*, 1949, 129: 14

Twenty-four cases of large bowel lesions of various types were studied. Careful bacteriological examinations were made of stools for the coliform group, the intestinal streptococci, and the clostridia. Various groups were compared, one receiving 0.25 gm of streptomycin every 6 hours, one, 1.0 gm every 6 hours, and one, 1 gm of sulfathalidine plus 0.25 gm of streptomycin every 6 hours

With 1 gm of streptomycin per day, 47.7 per cent of cases showed no response in the *Escherichia coli* colony counts, and 52.3 per cent showed a significant response, in the streptococci group, 87.7 per cent showed no response. In the clostridia group, 38.0 per cent showed no significant response, 22.2 per cent showed a temporary reduction in the colony count, and 38.9 per cent a prolonged reduction

There was no significant difference between the group receiving 1 gm of streptomycin in 24 hours



and in the group receiving 4 gm. Likewise, although the series was small, the addition of sulfathaladine did not improve the results.

It has been reported that lowering the bacterial count with streptomycin may lower the prothrombin time. This was not confirmed, except by a very slight prolongation of prothrombin time in several of the cases.

The maximum effect of the streptomycin varied in the cases which showed response. For *Escherichia coli*, the maximum effect was between the second and fourth days, and for the clostridia group the maximum effect of streptomycin was between the second and seventh days. Following the maximum effect, there was a rapid return to the pre-treatment level in most cases.

None of the toxic effects that occur with parenteral streptomycin were observed with oral streptomycin.

The *Escherichia coli* group were investigated with relation to the development of resistance to streptomycin which begins within 48 hours of beginning treatment. Prior to treatment the isolated *Escherichia coli* group were sensitive to, and completely inhibited (except in one case) by 19 units of streptomycin per cubic centimeter. After treatment they became resistant to at least 156 units per cubic centimeter, except in one case which required 6 days to become resistant.

A prozone phenomenon was noted in which the treated *Escherichia coli* which were not inhibited by less than 156 units per cubic centimeter, and were inhibited by concentrations of 156 to 2,500 units per cubic centimeter would grow well when the streptomycin concentration was elevated further to between 2,500 and 10,000 units per cubic centimeter. This is important in relation to stool assays of streptomycin on patients getting 1 gm. every 4 hours. The levels within 48 hours varied from 4,800 to 9,600 units per gram of wet stool.

FREDERICK C. HOEBEL, M.D.

#### The Occurrence of the Gas Stoppage Sensation in Acute Obstruction of the Ileum. E. LAWRENCE KEYES. *Surgery*, 1949, 25: 47.

In the present article, the author states that the onset of acute obstruction of the ileum is manifested by pain beginning in the middle of the abdomen, accompanied by a downward urge, and persisting for hours, despite defecation. Pain of this type is characterized by a sensation of gas stoppage. After a period of hours, vomiting occurs and certain of these symptoms usually disappear. The author limits his study to the early hours of pain, prior to vomiting.

The characteristics of the pain at onset are presented as they appeared in the case histories of 6 patients with acute obstruction of the ileum. In 4 of the patients the obstruction arose internally, as the result of strangulating intraperitoneal bands or volvulus of the ileum, in 2 of the patients obstruction arose externally, in strangulated inguinal or femoral hernias. The ileum was found to be gangrenous at operation in 4 of the patients and resection of the

ileum was performed, in 2 of the patients the ileum was viable at operation.

All 6 of the patients in this series had acute obstruction of the ileum, evidenced by pain (epigastric, paraumbilical, hypogastric, or generalized) beginning in the midline of the abdomen, accompanied at first by a downward urge following enemas or laxatives, trips to the toilet, or defecation at an unusual time, and persisting despite defecation and enemas for an average period of 10 hours (the shortest, 1½ hours and the longest, 24 hours) before vomiting occurred.

The author believes that acute obstruction of the ileum should be suspected in all patients who have suffered pain of this description for as long as 8 hours when first seen, even though vomiting has not occurred. Obviously, no diagnostic aid such as auscultation, rectal digital examination, leucocyte counts, scout films of the abdomen, etc., should be neglected in making the correct and early diagnosis.

JOHN E. KIRKPATRICK, M.D.

#### The Surgical Aspect of Meckel's Diverticulum. JOHN K. OWEN and GEORGE G. FINNEY. *South M J*, 1949, 42: 98.

One hundred and forty-three cases of Meckel's diverticulum were collected from the records of the Johns Hopkins, the Union Memorial, and the Women's Hospitals in Baltimore. The anomaly was found more often in males in the ratio of 15 to 10. The average distance above the ileocecal valve was 48.8 cm., the average length was 4.4 cm., and the average width at the base was 2.2 cm. Secondary diverticula were present in 9 cases. Usually the diverticula arise at the antimesenteric border, and in most cases a mesodiverticulum is present.

The presence of heterotopic tissue in the diverticulum occurred 39 times, which was a third of the cases in which satisfactory sections were made. In 33 cases the tissue was gastric mucosa, in 3 duodenal mucosa, in 2 pancreatic tissue, and in 1 case colonic mucosa.

Pathologic changes had occurred in the diverticulum of 49 patients, of which about two thirds were males. The most common pathologic change was inflammation, which was present in 44 cases, and in 20 of these there were associated adhesions. Of the cases in which heterotopic gastric tissue was present approximately half showed pathologic changes.

Sixteen patients had ulceration in the diverticulum, and, in 6 of these, hemorrhage occurred. When ulceration occurs it usually is found within the diverticulum, however, in 1 case the site of the ulcer was in the ileum. In 12 of the 16 diverticula in which there was an ulcer, gastric mucosa was present. Ulceration also occurred in 4 diverticula in which there was no gastric mucosa.

Perforation occurred 11 times, the point of perforation usually being within the diverticulum and adjacent to its neck. However, in 1 case the perforation occurred in the ileum.

According to most authors the commonest symptom of a diseased Meckel's diverticulum is the pres-

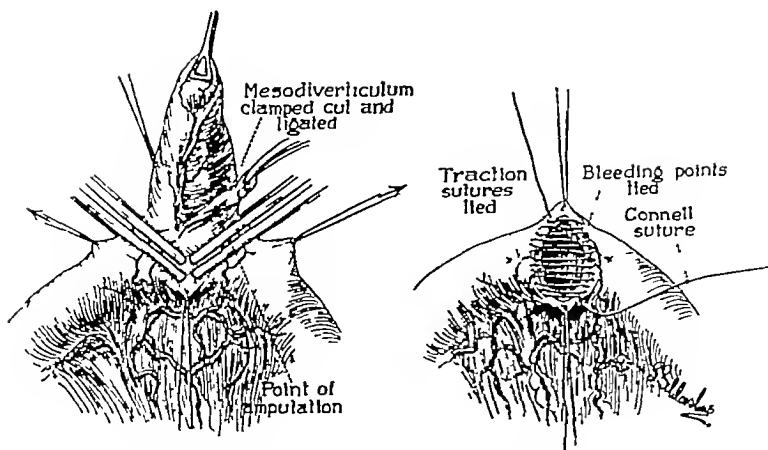


Fig 1 (Owen, Finney) Open technique of Meckel's diverticulectomy

sage of bright red blood in the stool. However, in the author's series of 49 diverticula in which disease was present, only 9 patients had a history of the passage of fresh blood. As a rule, when blood is present it is not mixed with mucus, a sign which differentiates the condition from acute intussusception.

Thirty-three of the authors' patients complained of abdominal pain. Often the pain had its origin in the periumbilical region, as a colic or a gnawing ache similar in character to that of a duodenal ulcer. The pain was usually not relieved by food intake and had no relation to meals.

In cases in which the diverticulum was symptomatic its location was usually from 50 to 60 cm above the ileocecal valve, whereas in the asymptomatic cases its location was usually near the ileocecal valve.

The correct preoperative diagnosis was made only 7 times. X-ray studies offer no help, and in the 15 cases in which studies were made there was no x-ray evidence of a diverticulum.

The surgical procedures used in treating these diverticula were as follows: routine appendectomy technique in 65 cases, clamp technique with Connell closure in 35 cases, open technique in 14 cases, partial resection with end-to-end anastomosis in 8 cases, and inversion of the diverticulum through a purse-string suture in 1 case.

The authors emphasize that the technique of treating a Meckel's diverticulum like an appendix by ligating its base, amputating it, and inverting the stump is applicable only to diverticula that have a narrow neck. Objections to the technique include the leaving behind of an island of gastric mucosa which may perforate or ulcerate, the possibility of intestinal obstruction from encroachment of the mass of ligated tissue beneath the purse-string suture upon the lumen of the small intestine, the possibility of the stump's acting as the leading point for an intussusception, and the danger of postoperative

hemorrhage from inadequate control of the copious blood supply in the wall of the stump.

The authors describe a method of resecting the diverticulum which obviates these objections. It is an open technique applicable particularly to those cases in which the mouth of the diverticulum is large. They have used the method in 14 cases with no complications (see Fig 1).

FREDERICK W. PRESTON, M.D.

#### Procedures Used in the Treatment of Complicated Fistulas

DONALD R. LAIRD *Am J Surg*, 1948, 76:701

A description is given of four procedures useful in the management of complicated fistulas-in-ano, and a discussion of the general principles involved is presented.

Before surgery, careful inquiry into the bowel habits of the patient may account for the difference between a good and a bad result. For example, a patient who passes frequent loose stools and who does not have well developed anal sphincter muscles would be a poor risk for a contemplated incision of the anal sphincter. Conversely, if a patient is inclined to be constipated and passes large well formed stools, incision of a large portion of the anal sphincter fibers may be performed without much risk that control of the gas and feces will be impaired. When extensive incisions of the anal sphincter are necessary the least serious loss of control occurs when the incision is made through the posterior portion of the anal musculature, while the greatest loss of control is produced when the anal sphincters and transverse perineal muscles are incised anteriorly. This is true especially in women.

The four procedures outlined are

1. The mucosal flap operation in which the flap of skin, rectal mucosa, submucosa, and circular fibers of the anorectal wall are dissected upward. The fistulous openings are closed with sutures after

the margins of the openings have been trimmed free from epithelium. This procedure is successful in patients who have relatively thick rectovaginal septa and rectovaginal openings 1 cm in diameter or less.

2 The muscle plug procedure is advocated in patients who have thin-walled, relatively avascular, rectovaginal septa, and rectovaginal openings over 1 cm in diameter. A living muscle flap of rectal wall muscle is drawn from the rectum through the rectovaginal opening and held by sutures placed in the vagina.

3 Mobilization of the rectum for combined rectovaginal and rectourethral fistulas is performed by dissecting an anterior skin flap and continuing it up into the rectum over the anterior three-fourths of the anorectum until it is well above the insertion of the levator ani muscles before the full thickness of the rectal wall is penetrated. In males the margins of the proximal rectum are grasped by forceps and the rectal wall is freed from the prostate and seminal vesicles by sharp dissection. Dissection is then continued laterally as high as possible. After the rectum has been mobilized as completely as possible the bladder and prostatic epithelium which had grown into the defect is trimmed away and the defect is closed by interrupted sutures. This procedure of mobilization of the rectum and the removal of a segment has been used successfully for rectal prolapse accompanied by carcinoma and for extensive adenomatous hyperplasia involving the entire lower rectum.

4 The operation for relaxed sphincters involves the dissection of a rectangular flap of skin past the anal verge. Sutures are then placed in the area of the separated musculature and perineal body. The viable flap of anal mucosa prevents rectal discharges from infecting the deeper parts of the sulcus. The skin is not closed.

HAROLD I. AUFMAN, M.D.

**The Etiology of Chronic Ulcerative Colitis** (El problema etiológico de la colitis ulcerosa grave) M. JOSE SA FLEITAS. *Rev. As. méd. argent.*, 1948, 62: 638.

A very interesting study was made of the fecal bacterial flora in 25 cases of chronic ulcerative colitis. In 13 cases a monomicrobial infection was found, in 6 cases atypical enterococcus (Bargen's type) was found, in 2 cases bacillus coli, and in 1 case each, espirochete type "eurygate," enterococcus, and hemolytic streptococcus. A plurimicrobial infection was found in 12 cases.

The use of vaccines, made from bacteria obtained from feces, was followed by good clinical results in 83 per cent of 13 cases, and an endoscopic "cure" in 58 per cent of the cases. There was an 81 per cent improvement of the roentgenologic signs of the disease.

WILLIAM E. RICKETTS, M.D.

**Surgical Treatment of Nonspecific Ulcerative Colitis** WALTER A. FANSLER and HOWARD M. FRISKMAN. *Am. J. Surg.*, 1948, 76: 713.

Surgery in idiopathic ulcerative colitis may be indicated in either the acute or chronic phase of the disease. At the present time there is no yardstick which will definitely indicate when to abandon con-

servative measures and resort to surgery. This point varies with individual opinion and experience, but it seems obvious that the more recent trend is toward earlier surgical intervention. The operations found most useful are: (1) ileostomy alone, (2) ileostomy with complete colectomy with or without removal of the rectum, (3) partial or complete colectomy with anastomosis of the ileum to the remaining segment of the colon or rectum, and (4) vagotomy.

Of particular interest is the operation of trans-thoracic vagotomy, originally performed by Dennis, of Minnesota. Four patients in the present series were subjected to this operation. These patients had a history of the disease process varying from 8 to 19 years with numerous remissions and exacerbations. In one case there had been a complete remission for almost 10 years. Vagotomy was done in each case during a period of acute exacerbation which did not respond to medical management. All of the patients showed typical x-ray changes with ulceration of the mucosa, shortening of the colon, and loss of haustrations. To date, 3 of these patients have shown marked improvement in their condition after years of prolonged illness. All have had a gain in weight with improvement in their general health. One patient showed a completely healed rectum and distal sigmoid colon 3 months after surgery. Considerable scarring was evident but the colonic mucosa was otherwise pale and normal throughout. Two of these patients still showed patchy granular areas but each examination revealed a more advanced stage of healing. The patient who showed the least improvement had a 17 year history of ulcerative colitis.

Although the observation period is still rather short, it would appear that vagotomy is of definite value in the acute fulminating type of ulcerative colitis, especially since it is in this type that the highest operative mortality had been encountered with the use of emergency ileostomy.

HAROLD I. AUFMAN, M.D.

**Surgical Treatment of Chronic Ulcerative Colitis** (La cirugía en la colitis ulcerosa grave) OSCAR F. NAPP. *Rev. As. méd. argent.*, 1948, 62: 634.

Napp discusses the difficulty of deciding which cases of chronic nonspecific ulcerative colitis should be considered for surgical treatment by ileostomy or colectomy. Several very interesting cases are presented, with reports of the results of surgical management in this disease.

The author concludes (1) that ordinarily chronic ulcerative colitis is not a surgical disease, (2) that operation is indicated only in the presence of complications of the disease and for "intractable" cases under medical treatment, and (3) that the elective operative procedure is a terminal ileostomy.

WILLIAM E. RICKETTS, M.D.

**Malignant Tumors of the Colon and Rectum** I. W. POSTLETHWAIT. *Ann. Surg.*, 1949, 129: 31.

This study comprises 441 patients observed during the 15 year period from 1931 to 1945 at Duke Hospital.

tal, Durham, North Carolina. Many facts worth noting are pointed out or re-emphasized.

Twenty and four-tenths per cent of the group had a family history of malignant tumor. Many of the patients had had previous operations following the onset of their symptoms. Hemorrhoidectomy or injection of hemorrhoids had been performed in 9 per cent of cases with existing rectal or rectosigmoid lesions. The average duration of symptoms was 8 7 months, which agrees closely with other studies.

The lesions were divided into three groups: cecum through hepatic flexure as right colon, transverse colon through sigmoid as left colon, and rectosigmoid and rectum as the third group. Acute obstruction was present in 7 per cent of the right colon and in 5 per cent of the left colon but intestinal obstruction, manifested slowly, was observed more frequently in lesions of the left colon.

Changes in bowel habits and stool were present in all patients, but the most noticeable changes were in the rectum and rectosigmoid; obstructive symptoms in patients in this group were less common than in patients with lesions of the left colon.

Although abdominal pain was the most frequent symptom in both groups of colonic lesions, it was only fifth most common in patients with tumors of the rectum and rectosigmoid.

The average weight loss in all groups was about the same, and the total average loss was 25.6 pounds.

Of 229 cases of rectal cancer, the lesion could be felt digitally in 222. Tenderness was present in approximately a quarter of the cases of colonic cancer. A palpable mass was present in 69 per cent of patients with lesions of the right colon and in 35 per cent of patients with lesions of the left colon. Distention was greatest in the left colon, but was present in only 28 per cent of cases.

Thirty-four per cent of lesions of the right colon had a hemoglobin of less than 90 gm. Stool examinations for occult blood, when made, were nearly always positive.

Roentgenographic examinations were positive by barium enema in 81 per cent of lesions of the right colon and in 88 per cent of lesions of the left colon.

The most important factors in the determination of preoperative procedures were (1) degree of obstruction, (2) alterations of nutrition and chemical balance, and (3) concurrent disease. Attainment and maintenance of an empty bowel, both preoperatively and postoperatively, was considered the most important single factor in the recovery of these patients.

Operative procedures were quite varied but followed the common trends in colon surgery for the period studied. Resectability was slightly higher in white than colored patients and appreciably higher in the female than in the male. It was slightly greater in those under 60 years than in those over this age. With four exceptions, all resected lesions were adenocarcinoma.

The postoperative mortality for all lesions dropped from 32 per cent from 1931 through 1935, to 16 per cent from 1935 through 1940, and to 13 per cent

TABLE I—THE FIVE YEAR SURVIVALS FOR RESECTIONS PERFORMED 1931 THROUGH 1940

	Total resections	Died in hospital	5 Year survivors		
			Living	Dead	%
R	26	3	11	4	57.7
RS	8	3	3	0	37.5
S	10	4	5	0	50.0
DC	7	2	2	0	28.6
SF	4	1	1	0	25.0
TC	2	0	1	0	50.0
HF	5	0	1	1	40.0
AC	6	0	1	0	16.6
C	9	3	3	0	33.3

from 1941 to 1945. The mortality of 43 per cent for palliative procedures on the descending colon is by far the highest figure and far higher than the 25 per cent mortality for resections of rectosigmoid lesions which is 5 per cent higher than that for any of the other resected lesions. The mortality rate of 10.0 per cent for lesions of the right colon is very low as compared to previous series covering earlier years.

Peritonitis was the most common cause of death following operation. Thirty-five per cent of postoperative deaths were due to peritonitis.

Five year survivals for the group operated upon from 1931 through 1940 are shown in the accompanying table.

FREDERICK C. HOEBEL, M.D.

#### The Selection of Patients and Anastomotic Procedures for Carcinoma of the Rectum and Rectosigmoid

R. RUSSELL BEST

*Am J Surg*, 1948, 76: 654

The selection of patients for rectosigmoidectomy and anastomosis is dependent upon several factors: (1) one should be hesitant about attempting anastomosis and favor the abdominoperineal excision in very obese, heavy set individuals, and (2) in all poor risk patients one should favor colostomy and posterior excision or abdominoperineal excision rather than an anastomotic procedure. In some cases simple colostomy combined with a selective procedure such as radium or electrocoagulation may be indicated.

The abdominal dissection with abdominal resection and anastomosis is usually selected for lesions of the rectosigmoid and for upper rectal lesions in which the lower margin is at least 7½ cm (3 inches) or more from the external anal margin. With a lesion in which the margin is below this approximate level, lateral spread over the levator fascia is a possibility and the abdominal approach does not permit adequate removal of the zones of lymphatic spread in the levator muscle and fascia. No surgical procedure should be advocated merely on the grounds that it is technically possible.

Abdominal dissection, posterior resection, and anastomosis is a procedure recommended when the

lower margin of the malignant lesion is below the  $7\frac{1}{2}$  cm level, but above the 3 cm level. Abdominal dissection assures radical removal of the zone of upward spread and the posterior attack permits removal of lateral lymphatic spread in the levator fascia and muscle or direct extension into the levator muscle and fascia. These structures are not adequately removed by an abdominal dissection alone.

Posterior dissection with posterior resection and anastomosis cannot be considered adequate surgery for cancer of the rectum. It is recommended only under special circumstances, as an escape from a higher mortality in the aged and in a few of the poor risk cases.

A small series of 33 consecutive cases is reported by the author. Various procedures were carried out on the patients. The author drained the retrorectal space in the hollow of the sacrum via the posterior approach in every case of low anastomosis. Following the removal of this drain a draining sinus was present for some days or weeks and at times feces appeared. These sinuses may prove stubborn and annoying for several months. Incontinence has not been a troublesome factor in some cases, but it cannot be denied that the sphincter many times seems to lack its original energetic tone. This is true particularly when the resection and anastomosis have been done posteriorly in the more feeble individuals in their late seventies or eighties. In 2 cases the feces collected between the sphincter area and the line of anastomosis and the patient was unable to expel the feces without an enema. This difficulty lasted for several weeks.

HAROLD LAUFMAN, M D

#### LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

##### The Serum Bilirubin during the Course of Icterus

H DEENSTRA *Acta med scand*, 1948, 132 223

The author studied a number of patients with icterus and attempted to determine the rate of the diazo reactions in the serum by the Deenstra method (*Acta med Scand*, 1948, 132 109) as well as the absorption of bilirubin on the albumin precipitate by the van den Bergh method for indirect bilirubin.

He found that in the first stage of a rapidly changing icterus the rate of the diazo reaction increases predominantly, but it also decreases with the upward or downward fluctuations of the icterus. In the second stage, the diazo reaction increases temporarily when the icterus decreases. During the first stage a rapid diazo reaction is frequently not attended by a stronger adsorption of bilirubin on the albumin precipitate, while during the second stage this phenomenon takes place.

It is also to be noted that the rates of the diazo reaction and of the adsorption of bilirubin on the albumin precipitate may change independently of each other. It is believed that many factors influence the adsorption of bilirubin on the albumin precipitate. The author is unable to explain why the diazo reaction increases temporarily during the

so-called second stage when the icterus decreases. A number of other questions are raised and are left unexplained for the present.

ROBERT TURELL, M D

##### Injuries to the Bile Ducts P H T THORLAKSON *Canad M Ass J*, 1949, 60 119

Several important concepts may help the surgeon to prevent injury to the bile ducts. Patients with gallstone disease should undergo cholecystectomy early in the course of their disease before extensive pericholecystitis makes the operation technically difficult. Adequate exposure, aided by satisfactory anesthesia and an incision of adequate length is essential. The author prefers a right paramedian muscle-splitting incision, except in large people with a very wide costal angle, in whom a transverse subcostal incision is preferable. Sharp dissection, especially when one encounters adhesions, is recommended.

Indications for exploring the common bile duct are jaundice, or a history of jaundice, palpable stones within the duct, a thickened or dilated duct, a thickened and contracted gall bladder, or doubt concerning the patency of the lumen of the duct. As an additional safeguard against injury one may explore the duct before removing the gall bladder, the presence of the tube in the common duct then facilitates accurate identification of the cystic and hepatic ducts. Probes should be passed up the right and left hepatic ducts and the ampulla should be dilated to 5 mm, never more than 7 to 8 mm.

The author prefers to remove the gall bladder from the cystic duct outward, because when the cystic artery is clamped most of the bleeding is controlled. Anatomical dissection of the cystic duct and artery is important and each should be tied separately.

In some cases when technical difficulties are present a cholecystostomy may be done, especially in a poor risk patient. Rarely, in exceptionally difficult cases, a partial cholecystectomy may be justified.

In the event that free bleeding from the cystic artery occurs, it is a simple matter to compress the hepatic artery in the foramen of Winslow until the bleeding can be accurately controlled.

Anomalous arrangement of the ducts and vessels may confuse the surgeon. The angle which the cystic duct forms with the hepatic duct and the length of the cystic duct are two anatomic details which vary greatly. An accessory bile duct is found in 18 per cent of cases. The right hepatic artery may be double, it may arise from the superior mesenteric artery, or it may lie adjacent to the cystic duct. The cystic artery may arise from the gastroduodenal artery, or from some other branch of the hepatic trunk.

The best time to repair an injury to the common duct is immediately after it is incurred. Therefore the duct should be inspected carefully after the gall bladder is removed and before the cystic duct is ligated. Reconstruction of a severed duct should be

## SURGERY OF THE ABDOMEN

effected by end-to-end anastomosis over a tube. The T tube or catheter should never be brought out through the site of injury. It is best not to use too snug a tube since damage to the endothelium of the duct may occur. Structures sutured should not be under tension, and sutures should not penetrate to the lumen of the duct.

The ideal method for the late repair of injuries to the common duct is an end-to-end anastomosis of the cut ends, or, if a stricture is present, resection of the stricture and end-to-end anastomosis. Usually, this is done over a tube which maintains the patency of the duct during the early phases of healing. In the past, rubber tubes have been used for this, but polythene tubes, recently introduced, seem to be better. It is important that the tube be readily removable or easily able to be passed.

When the transpancreatic portion of the duct is not available for the anastomosis, an indirect method must be used. The author prefers choledochoduodenostomy since this is a relatively easy method. If the duodenum cannot be approximated to the duct remnant, a loop of jejunum or a single bowel segment of jejunum must be used. If a loop is used, an enteroanastomosis between the proximal and distal loops at a distance of approximately 18 to 24 inches from the hepatojejunostomy should be performed in order to divert the bowel contents from the site of anastomosis and thus reduce the danger of cholangitis.

In cases in which no extrahepatic remnant of the duct can be identified, a dissection within the liver hilus for the intrahepatic portion of the duct should be made. This may then be anastomosed to a cut end of the jejunum and the continuity of bowel restored according to the Roux en-Y principle. The enteroanastomosis in this case should be made 24 inches from the liver.

Because of the possibility of bile peritonitis, external drainage should be provided following all types of repair of the bile duct.

FREDERICK W. PRESTON, M.D.

**Anastomosis of an External Biliary Fistula into the Gastrointestinal Tract. Report of 6 Cases (A propos de 6 cas de fistule-anastomose pour fistule biliaire d'origine cholédocienne).** TINGAUD. *Rev. chir.*, Par., 1948, 67, 353.

Patients with external biliary fistulas usually are debilitated because of a long standing illness and the loss of biliary secretions to the outside. Usually at least some degree of liver damage is present. Although an operation designed to re-establish the biliary tract is the ideal treatment for these patients, this often involves a difficult dissection which may prove more than the patient can stand. For such a patient the transplantation of the external biliary fistula into the gastrointestinal tract is a simple and adequate procedure which has received insufficient recognition in the literature.

The authors report 6 cases in which this operation was done. In 3 cases anastomoses of the

fistulas were done after initial exploration revealed that reconstruction of the common duct would be too difficult. In 2 patients a primary anastomosis was done because the patients were in poor condition, and it was necessary to avoid a long operation. In 1 patient a previous operation for reconstruction of the common duct had failed.

The ages of the patients varied from 39 to 70 years. All of the external fistulas were partial, producing intermittent jaundice, and all had followed cholecystectomies. Implantation of the fistula into the stomach was done in 5 patients, and in 1 patient the fistula was anastomosed to the duodenum. In most of the cases the Witzel technique was used, the anastomosis being made over a rubber tube in 2 instances. The results were successful in all except the one in which the patient had the fistuloduodenostomy; this patient died.

The authors believe that the best site for the implantation of the fistula is usually the stomach because of its mobility. In certain cases, in which the duodenum presents readily, it also may be used. The use of the jejunum or ileum for this type of anastomosis is not recommended.

Follow-ups of these patients were made for only a few months. However, the authors cite the experiences of other surgeons, which show that recurring fistulas, recurring strictures, and ascending cholangitis follow this operation no more frequently than they follow anastomosis of the common bile duct to the small intestine over a rubber tube. The chief advantage of anastomosis of the fistula over other reconstructive procedures on the bile ducts is its great simplicity.

FREDERICK W. PRESTON, M.D.

**Technical Conditions of Manometric and Radiologic Control in the Course of Interventions on the Biliary Passages (Conditions techniques du contrôle manométrique et radiologique au cours des interventions sur les voies biliaires).** PIERRE MALLET-GUY. *J. internal chir.*, Brux., 1948, 8, 989.

Technically, three essential conditions must be fulfilled in the course of interventions on the biliary passages: the asepsis of the surgical intervention should not be endangered by the maneuvers used; the duration of the operation should not be prolonged more than 10 or at most 15 minutes, and this presupposes a perfectly regulated technique without the possibility of false maneuvers, and the data obtained should be easy to read and simple to interpret so that the surgeon may waste as little time as possible in making sure of the diagnosis and drawing the necessary therapeutic conclusions.

The manometric control consists of the registration of a hyperpressure test realized by injecting into the gall bladder or the choledochus a certain amount of tepid water. Sometimes a very small amount suffices to obtain a peak, other times the injection must be repeated to obtain gradually a sufficient increase in the pressure. The roentgenographic control consists in taking two films after the injection of



## UTERUS

**Newer Methods in the Management of the Abnormal Cervix** GEORGE A. HAHN *Surg Clin N America*, 1948, 28 1401

The author describes the anatomy and physiology of the cervix, and considers the various cervical lesions, erosion, ectropion, leucoplakia, lacerations, and hypertrophy of the cervix.

The symptoms, etiology and clinical picture of chronic cervicitis are discussed and it is believed that the most important step in the treatment of chronic cervicitis is that of determining whether or not beginning cancer is present. If cancer is present, the diagnosis must be made at the earliest possible time so that proper treatment may be carried out. If cancer is not present, elimination of the cervicitis should prove to be an important factor in preventing the first malignant change. Minor lesions are treated by cauterization and coagulation, more extensive lesions are treated by means of the circular biopsy and endocervical resection.

Carcinoma *in situ* is treated by extensive circular cervical biopsy, not by hysterectomy or irradiation.

Cervical polyps, cervical myomas, cervical tuberculosis, and cervical syphilis are briefly discussed.

T. FLOYD BELL, M.D.

**Vaginal Cytology in Uterine Cancer** (Citologia vaginal no cancro do útero) C. STRECHT RIBEIRO and GIL DA COSTA, JR. *Acta endocr gyn*, 1948, 1 414

This study is based on 12 cases admitted to the radium therapy service of Santo Antonio Hospital of Porto, 1 for observation and 11 with the clinical diagnosis of uterine cancer. Vaginal material for cytologic examination was collected with an Ayre spatula from the entire suspected surface in each patient, spread on slides, fixed immediately in a solution of equal parts of alcohol and ether, and stained with hematin-eosin, Giemsa's stain, and Shorr's stain.

Twelve slides of material collected on 6 alternate days from the patient under observation were negative for cancer cells, but malignant cells were found in the smears from all the other patients and corresponded to forms of grade 4 in 3, grade 3 in 5, grade 2 in 1, and grade 1 in 2 of the patients, while the histologic diagnosis was spinocellular epithelioma in 3, intermediate cell epithelioma in 3, and basocellular epithelioma in 5 of them. Not only were neoplastic cells present on all slides in all the cases of cancer of the uterus but the percentage of altered cells ran from 70 to 90, including the neoplastic cells and the small and varying modifications of the cells normally found in a vaginal smear.

Recognition of cancer cells is relatively easy in menopausal patients and becomes even easier as the ovarian insufficiency increases, since the number of

desquamated epithelial cells becomes proportionately smaller and that of the leucocytes larger. In women with sexual activity the large number of unaltered cells makes the search for neoplastic cells difficult.

The changes observed in nondifferentiated cells vary from those seen in differentiated cells. In the first, the nucleus is predominantly involved and changes occur in its volume, which appears greatly increased in relation to the cytoplasm and varies from cell to cell, or in its configuration (multilobulated or with irregular contour), or in the amount of its chromatin (increase), or in its staining capacity. The differentiated cells show irregular delimitation of the cytoplasm, unequal size, mitotic or amitotic activity, nuclear hyperchromatosis, multilobulation, and monstrous nuclei.

The method is valuable to confirm clinically suspected cancer and should be used to establish a positive diagnosis in cases of incipient malignancy. It constitutes a great aid to biopsy which, however, should always be used to confirm the diagnosis.

RICHARD KEMEL, M.D.

**Adenocarcinoma of the Uterus** J. MASON HUNDLEY, JR., EVERETT S. DIGGS, and THEODORE KARDASH *Am J Obst*, 1949, 57 52

The procedure of choice in adenocarcinoma of the cervix consists of the investigation of all abnormal vaginal bleeding by thorough curettage to insure an early diagnosis, followed by the intracavity application of radium and, of greatest importance, panhysterectomy and bilateral salpingo oophorectomy.

The five year survival rate of 32 patients who were treated with intracavity radium and panhysterectomy was 84.4 per cent. The five year survival rate of 34 patients who were treated with intracavity radium and roentgen therapy was 20.6 per cent. Twenty-one (64 per cent) of the patients received postoperative roentgen therapy. Postoperative roentgen therapy is believed to be obligatory only when extrauterine metastasis is observed.

No planned treatment by surgery alone was performed. There was no operative mortality and no untoward sequelae during convalescence.

The uteri and adnexa of 67 patients were available for study of the effects of this preoperative intracavity radiation. Nineteen (28.5 per cent) patients showed no residual malignancy, but residual carcinoma was found in 48, or 71.7 per cent. Extension to the myometrium occurred in 64.5 per cent of patients, and cancer was confined to the endometrium in 35.5 per cent. Tubal involvement was noted in 4 patients and the ovary was affected in 3 patients.

Forty and three tenths per cent of the total number of patients had associated uterine myomas.

The importance of panhysterectomy is stressed.

JOHN R. WOLFF, M.D.



an opaque solution. If the gall bladder route is chosen for the exploration, 20 c.c. of tenebryl are injected and the first film is taken immediately, the second, 3 minutes later. If the cystic or choledochal route is chosen, the two films are again taken with an interval of 3 minutes, but each is preceded by an injection of 10 c.c. of lipiodol. The conclusion is drawn from a comparison of the three standard documents obtained in this manner.

If there is no indication for cholecystectomy under manometric control, the surgeon punctures the gall bladder and, keeping his eyes on the tracing, slowly injects the contents of the syringe (usually, 20 c.c. are needed to form a peak). He observes the return line of the pressure and, when the stylet reaches the vertical line of the peak, he injects a new amount of water and forms systematically four or five curves under the same conditions.

Three results are then possible: (1) in each tracing the stabilization level rises, widely exceeding the level of the normal pressures which are around 18 cm. of water; these are block curves, indicating an obstacle; (2) the pressure does not rise materially and may be stabilized at 0 or below it; hypotony of the biliary passages is probable; and (3) the pressure tends to become stabilized around 18 cm. of water; this is the reaction of a normal gall bladder.

If cholecystectomy is indicated, the cystic duct is dissected and incised transversely over half of its circumference. A probe is used to verify its permeability and, if necessary, the duct is dilated enough to allow the introduction of a special double-jointed cannula, of which the extremity is pushed into the choledochus, the second segment remains in the cystic duct, and the third segment goes under the liver. After removal of some choledochal bile, the manometric system is connected with the cannula. If there is little dilatation, a few cubic centimeters of water suffice to give a peak and the level of

stabilization may be established by superimposition of three or four curves. No spastic reactions of the sphincter of Oddi have been observed.

If choledochotomy is indicated, the calculi are removed and a Pezzer sound of sufficient caliber is introduced into the duct and tied in place. Manometric control is then performed, but it is subject to error because of the possibility of relative blocking of the sound.

The author's experience, based on 850 surgical interventions carried out under these controls, allows him to insist on the efficacy of the method.

RICHARD KEMEL, M.D.

**Primary Splenic Neutropenia: A Specific Indication for Splenectomy** LOUIS T. PALUMBO *Ann Surg.*, 1949, 129: 131

A case of primary splenic neutropenia is presented as clinically cured by splenectomy and removal of an accessory spleen. The case conforms to the description given by Wiseman and Doan in 1939 and in 1942. The condition in the author's patient resembled Banti's syndrome, Felty's syndrome, subleukemic myeloid leukemia, hyperplastic anemia, malignant neutropenia, or certain types of chronic infection.

The disease occurs as the result of splenic dysfunction caused by selective destructive action of the reticuloendothelial cells of the spleen, and is closely related to congenital hemolytic icterus and essential thrombocytopenic purpura, in which cases the erythrocytes and platelets, respectively, are destroyed.

A definite and accurate diagnosis is dependent upon a complete clinical survey of the patient and a detailed study of the sternal marrow, the circulating blood, and on biopsy of a lymph node.

This disease should be included in the long list of diseases in which splenectomy is definitely indicated.

JOHN J. MALONEY, M.D.

# GYNECOLOGY

## UTERUS

**Newer Methods in the Management of the Abnormal Cervix** GEORGE A. HAHN *Surg Clin N America*, 1948, 28 1401

The author describes the anatomy and physiology of the cervix, and considers the various cervical lesions, erosion, ectropion, leucoplakia, lacerations, and hypertrophy of the cervix.

The symptoms, etiology and clinical picture of chronic cervicitis are discussed and it is believed that the most important step in the treatment of chronic cervicitis is that of determining whether or not beginning cancer is present. If cancer is present, the diagnosis must be made at the earliest possible time so that proper treatment may be carried out. If cancer is not present, elimination of the cervicitis should prove to be an important factor in preventing the first malignant change. Minor lesions are treated by cauterization and coagulation, more extensive lesions are treated by means of the circular biopsy and endocervical resection.

Carcinoma *in situ* is treated by extensive circular cervical biopsy, not by hysterectomy or irradiation.

Cervical polyps, cervical myomas, cervical tuberculosis, and cervical syphilis are briefly discussed.

T. FLOYD BELL, M.D.

**Vaginal Cytology in Uterine Cancer** (Citologia vaginal no cancro do útero) C. STRECHT RIBEIRO and GIL DA COSTA, JR. *Acta endocr. gyn.*, 1948, 1 414.

This study is based on 12 cases admitted to the radium therapy service of Santo Antonio Hospital of Porto, 1 for observation and 11 with the clinical diagnosis of uterine cancer. Vaginal material for cytologic examination was collected with an Ayre spatula from the entire suspected surface in each patient, spread on slides, fixed immediately in a solution of equal parts of alcohol and ether, and stained with hematin-eosin, Giemsa's stain, and Shorr's stain.

Twelve slides of material collected on 6 alternate days from the patient under observation were negative for cancer cells, but malignant cells were found in the smears from all the other patients and corresponded to forms of grade 4 in 3, grade 3 in 5, grade 2 in 1, and grade 1 in 2 of the patients, while the histologic diagnosis was spinocellular epithelioma in 3, intermediate cell epithelioma in 3, and basocellular epithelioma in 5 of them. Not only were neoplastic cells present on all slides in all the cases of cancer of the uterus but the percentage of altered cells ran from 70 to 90, including the neoplastic cells and the small and varying modifications of the cells normally found in a vaginal smear.

Recognition of cancer cells is relatively easy in menopausal patients and becomes even easier as the ovarian insufficiency increases, since the number of

desquamated epithelial cells becomes proportionately smaller and that of the leucocytes larger. In women with sexual activity the large number of unaltered cells makes the search for neoplastic cells difficult.

The changes observed in nondifferentiated cells vary from those seen in differentiated cells. In the first, the nucleus is predominantly involved and changes occur in its volume, which appears greatly increased in relation to the cytoplasm and varies from cell to cell, or in its configuration (multilobulated or with irregular contour), or in the amount of its chromatin (increase), or in its staining capacity. The differentiated cells show irregular delimitation of the cytoplasm, unequal size, mitotic or amitotic activity, nuclear hyperchromatosis, multilobulation, and monstrous nuclei.

The method is valuable to confirm clinically suspected cancer and should be used to establish a positive diagnosis in cases of incipient malignancy. It constitutes a great aid to biopsy which, however, should always be used to confirm the diagnosis.

RICHARD KEMEL, M.D.

**Adenocarcinoma of the Uterus** J. MASON HUNDLEY, JR., EVERETT S. DIGGS, and THEODORE KARDASH *Am J Obst.*, 1949, 57 52.

The procedure of choice in adenocarcinoma of the cervix consists of the investigation of all abnormal vaginal bleeding by thorough curettage to insure an early diagnosis, followed by the intracavity application of radium and, of greatest importance, panhysterectomy and bilateral salpingo oophorectomy.

The five year survival rate of 32 patients who were treated with intracavity radium and panhysterectomy was 84.4 per cent. The five year survival rate of 34 patients who were treated with intracavity radium and roentgen therapy was 20.6 per cent. Twenty-one (64 per cent) of the patients received postoperative roentgen therapy. Postoperative roentgen therapy is believed to be obligatory only when extrauterine metastasis is observed.

No planned treatment by surgery alone was performed. There was no operative mortality and no untoward sequelae during convalescence.

The uteri and adnexa of 67 patients were available for study of the effects of this preoperative intracavitary radiation. Nineteen (28.5 per cent) patients showed no residual malignancy, but residual carcinoma was found in 48, or 71.7 per cent. Extension to the myometrium occurred in 64.5 per cent of patients, and cancer was confined to the endometrium in 35.5 per cent. Tubal involvement was noted in 4 patients and the ovary was affected in 3 patients.

Forty and three tenths per cent of the total number of patients had associated uterine myomas.

The importance of panhysterectomy is stressed.

JOHN R. WOLFF, M.D.

**Adenocarcinoma of the Cervix and of the Cervical Stump** BAYARD CARTER, WALTER L. THOMAS, and ROY T. PARKER *Am J Obst*, 1949, 57: 37

During the period from 1938 to 1947, a total of 50 cases of adenocarcinoma of the cervix were observed at the Duke University Hospital, Durham, North Carolina. This number represents 3.4 per cent of all cervical carcinomas seen at this clinic. Adenocarcinoma of the cervical stump was found in 11 cases (22%).

In 42 of the 50 cases the carcinomas were in stages 2, 3, or 4 when first observed. The symptoms had been present for an average period of 9 months before the patients were seen so that a delay of 10 months occurred before the diagnosis was made and treatment could be started.

Thirteen (26%) of these patients are living and without evidence of disease, and 6 (12%) have reached the 5 year limit. No deaths occurred as the result of irradiation or surgical treatment.

Eighteen patients received x-ray and radium therapy and of these, 2 are living.

Five patients underwent radical hysterectomy, or radical removal of the cervical stump plus radical lymphadenectomy. In 4 patients, cancer was found in the lymph nodes, in 4 patients, in the cervix, and in 1 patient, in the uterus and vagina. All of these patients have died of cancer.

Similar radical surgical treatment was carried out in 7 cases. In 6 of these the lymph nodes were free of cancer, and in 1 patient the left iliac nodes showed cancer. All 7 patients are alive and without cancer.

In conclusion the author states that the occurrence of 11 cases of adenocarcinoma of the cervical stump, plus the high incidence of squamous cell cancer in cervical stumps strengthens the conviction that panhysterectomy is preferable to supravaginal hysterectomy.

JOHN R. WOLFF, M.D.

**Carcinoma of the Cervix** JULIETTE BAUD *J Am M Ass*, 1948, 138: 1138

The author reports the results of her study of 105 patients with carcinoma of the cervix (stage I) who were treated from 1929 to 1941 with radium alone, at the Curie Foundation in Paris.

The technique of treatment, and the dosage are given.

Although 2 patients died of sepsis early in this period, sepsis has not developed since 1936, as a result of improvement in hospital conditions. There were few rectal reactions. In one patient, a proved necrotic ulcer developed on the anterior wall of the rectum, which eventually healed.

Of the 105 patients treated, 74 (70.4%) were alive without evidence of disease after an observation period of 5 years. The cases with recurrence are described in detail.

The failures in this series cannot be explained on the basis of dosage delivered, and cannot be attributed to any special anatomicoclinical type of lesion.

The author believes that cure of epithelioma of the cervix uteri, stage I, can be obtained by treatment

with radium alone, as well as with radium plus roentgen rays, and that perhaps the roentgen rays are not necessary. However, rather than undertake such a program too soon they have started to treat a series of patients by performing a Wertheim operation 6 weeks after the intracavitary therapy, thus removing the danger of local recurrence. It also permits study of the effects of radium therapy, and verification of the condition of the pelvic glands.

T. FLOYD BELL, M.D.

**The Present-Day Status of Noninvasive Cervical Carcinoma** GERALD A. GALVIN and RICHARD W. TELINDE *Am J Obst*, 1949, 57: 15

Since 1940, cervical biopsy has revealed the presence of intraepithelial cancer (carcinoma *in situ*) in 75 cases. In all cases the changes in the surface epithelium were typical. Once this diagnosis was established, a modified Wertheim operation was performed in 67 cases, and conization of the cervix and the application of radium in 7 cases. In the remaining case the lesion was discovered in a cervix amputated during the course of a Manchester procedure. In all cases the entire cervix was available for sectioning. In 55 of these cases microscopic invasive cancer was found, in 10 cases carcinoma *in situ* only was noted, and in the remaining 10, no further abnormality was present.

When a biopsy reveals carcinoma *in situ*, three clinical possibilities may be present. The biopsy may have been taken from the periphery of an advanced cervical cancer, microscopic invasive cancer may be present elsewhere in the cervix, or only carcinoma *in situ* may be present.

A survey of 17 cases of carcinoma *in situ*, followed by spread of the cervical cancer, and 1 case of the authors', led to the conclusion that this type of lesion is a true cancer demanding appropriate treatment. That cervical amputation is not enough has been proved, in 3 cases, by the finding of plugs of carcinomatous tissue well up in the cervical canal.

The authors recommend a modified Wertheim procedure which consists of a total hysterectomy, with removal of 2 cm. of the parametrium on each side of the cervix, plus a fairly wide cuff of vagina. Gland dissection is omitted. An ovary may be saved in younger women. All 67 patients operated upon are living, and without recurrence. One death from cervical carcinoma occurred among the 7 patients who had been treated by irradiation.

All of these lesions were discovered during the routine investigation of patients for gynecologic complaints. None showed any suggestion of gross cervical cancer, although the majority presented some abnormal appearance of the cervix, diagnosed clinically as cervicitis, erosion, eversion, laceration, and leucoplakia. Although most of the patients were asymptomatic, it was learned, on close questioning, that 58 per cent had some type of irregular vaginal bleeding, especially postcoital spotting. Comments on cytologic studies are omitted since the author does not have sufficient data at this time.

The occurrence of basal-cell hyperactivity and its relationship to true carcinoma *in situ* is discussed  
JOHN R. WOLFF, M D

**Controversial Factors in the Management of Carcinoma of the Cervix** ROBERT A. KIMBROUGH, JR., and CRAIG W. MUCKLE. *Surg Clin N America*, 1948, 28 1415

A brief historical survey of the treatment of cervical carcinoma is presented

Although the first radical abdominal hysterectomies were performed by John G. Clark, and independently by Rumpf in 1896, it was Wertheim, in 1898, who popularized the procedure. Victor Bonney became the outstanding successor of Wertheim in continuing the radical surgical approach. The operative mortality and complications were extremely high.

Kelly and Burnham, in 1912, initiated the elective treatment of carcinoma of the cervix with radium. From 1920 until comparatively recently, radiation in various forms was universally accepted as the treatment of choice for all cases of carcinoma of the cervix. The negligible primary mortality, fewer complications, and the high incidence of apparent cures following irradiation made its adoption the treatment of choice.

The technique of radiation therapy with x-rays and radium is outlined.

The results of radium therapy as estimated from present day reports is about 25 per cent, for growths apparently limited to the cervix, it is 75 per cent, for those questionably limited to the cervix, 50 per cent, for those which have invaded the broad ligaments, 20 per cent, and for the advanced cases the 5 year salvage is practically nil. These results are quite comparable to the results obtained by Bonney and Wertheim with the radical operation.

The radical surgical approach has been practiced during the past few years by a few surgeons. Meigs has recently reported in detail his reasons for this radical procedure. He has performed this operation 100 times without an operative death. More than 40 consecutive operations were performed without the development of a single urinary fistula. In 1946 he reported that a 3 year cure rate of 77.7 per cent had been obtained.

At the present time the results of surgical treatment are not significantly better than those following radiation in lesions of similar extent.

T. FLOYD BELL, M D

**The Desirable Management of Fundal Carcinoma** LEWIS C. SCHEFFEY and WARREN R. LANG. *Surg Clin N America*, 1948, 28 1425

In considering the etiology of the development of fundal carcinoma, the authors review the literature as to the possible influence of unrestrained estrogenic activity. They conclude that there is no indisputable proof that endometrial hyperplasia, per se, is the precursor of adenocarcinoma of the fundus. On the other hand, every worker in the field has probably

seen instances in which clinical observation has given the factual impression that hyperplasia has preceded adenocarcinoma, or has observed an area of hyperplasia accompanying frank cancer of the corpus. These controversial etiological factors should be given due weight when the means of controlling fundal carcinoma are discussed.

Certain physical peculiarities found in patients with fundal carcinoma are enumerated, such as obesity, high incidence of hypertensives, the more than occasional diabetic, and an absence of anemia in the vast majority. Postmenopausal bleeding has, in a goodly proportion of patients, been due to endometrial carcinoma. Four out of 5 patients with fundal cancer are over 50 years of age. Roughly, a third of the patients have never been pregnant and of these, one-half have never married. Women with fundal cancer are more likely to have had menorrhagia in the premenopausal and menopausal epochs.

All patients suspected of having fundal cancer should have curettage, as vaginal smears are only suggestive.

In the premenopausal patients, that comprise 20 per cent of the cases of fundal cancer, the age limit is roughly 40 to 50. In this group, diagnosis is often delayed and mistakes in therapy can happen. Fibroids may be thought to cause the abnormal bleeding. Roentgen therapy may be employed to control the bleeding and the cancer may be overlooked.

There is considerable variation in the histologic picture presented by fundal carcinoma. Although gradation is not always a simple matter, the Jefferson group has tried to simplify it by confining their classification to low, intermediate, and high grades of malignancy.

The clinical grouping of fundal cancer is by no means standardized. The authors follow the grouping of the American College of Surgeons. A better classification may come from the World Health Organization of the United Nations.

The surgical eradication of fundal cancer should consist of total hysterectomy and adnexal removal. In case the disease has invaded the uterus deeply, recurrence may be prompt. With cancer of low malignancy and extension, survival for a long period may occur.

With the advent of radium and x-rays, irradiation came to be utilized almost exclusively in aged or debilitated individuals, and in those handicapped by obesity, diabetes, cardiovascular and renal disease, with striking results in many cases, but before long it became apparent that only arrest of the disease occurred.

The next step was a logical one in combining irradiation and surgery to complement each other. This has resulted in a rational procedure in most gynecologic clinics today. Differences of opinion exist with respect to whether radium or x-ray therapy is superior in the part that irradiation plays. The statistics reported show much better results with preliminary irradiation followed by surgery than by surgery alone.

The methods that are favored in the Jefferson Clinic are presented concisely, in the patient of good operative risk and in the poor risk patient. The best results in their hands has been with irradiation therapy followed by resection, with an encouraging survival rate of 91.2 per cent. T. FLOYD BELL, M.D.

**The Role of Surgery in the Treatment of Carcinoma of the Cervix** CHARLES D. READ *Am J Obst*, 1948, 56: 1021

Since 1907, when Bonney performed his first radical abdominal hysterectomy for cancer of the cervix, at the Chelsea Hospital for Women in London, England, that group has continued the "all out" surgical attack against this disease. It must be remembered that at the time this approach was started, there was no adequate alternative treatment.

In the late 1920's this operation was largely supplanted by radiotherapy. However, surgery has continued to be used in selected cases.

Although Bonney reported a primary surgical mortality of 14 per cent among the first 500 patients operated upon from 1907 to 1936, this high mortality rate has been remarkably lowered in recent years as the result of a careful selection of patients, improved anesthesia, the use of blood and plasma, the use of penicillin and the sulfonamides, and (not least of all) good nursing. Read and Cook have performed 207 Wertheim operations, with 6 operative deaths (under 3 per cent). About 1 case in every 7 cases are now treated surgically by this group.

The selection of cases for radical operation is confined to radioresistant growths proved either clinically or cytologically, columnar celled (adenocarcinoma) carcinoma of the cervix, stenosis of the vaginal vault prohibiting the accurate placement of radium, the presence of large fibroids or ovarian cysts complicating cervical cancer, salpingitis complicating cervical cancer, refusal of radiation by the patient, and pregnancy complicating cervical cancer.

From 1936 to 1941, radical operations were performed on 54 patients deemed unsuitable for radiation, or who were found to be radioresistant. Thirty-four patients had first stage growths and 20 patients had second stage growths. There were 24 (44.4 per cent) 5 year cures. Three operative deaths (5.5 per cent) occurred in this group.

Studies of the regional glands obtained from the Wertheim operation, lymphadenectomy alone, and autopsy material demonstrated that the degree of lymph gland involvement in patients with stage 1 growths was 20.25 per cent, with stage 2 growths, 30.35 per cent, with stage 3 growths, 40.50 per cent, and with stage 4 growths, 60 per cent. The author believes that the adequate application of radium will definitely cure the majority of local cervical growths, but the effectiveness of deep therapy as a cure of regional gland metastases has not yet been proved.

The technical modifications of the Wertheim operation as it is employed today are described.

With the present state of our knowledge, the routine treatment of election for the average case of

cervical cancer is by radiotherapeutic means, but in certain cases surgical treatment offers the best prospect for the patient. The more extensive use of lymphadenectomy, especially in stage 3 lesions, might improve the results. It is believed that the absolute cure rate in carcinoma of the cervix can be increased by a surgical approach in those cases which prove to be radioresistant, or in which irradiation is not possible. JOHN R. WOLFF, M.D.

**Leiomyosarcoma of the Uterus** G. HAMILTON DAVIS, JOHN S. HOWE, and WILLARD G. FRENCH *Am J Obst*, 1948, 56: 1048

A recent unusual incidence of four case specimens of leiomyosarcoma of the uterus observed at the pathologic laboratory of the Methodist Hospital, Brooklyn, New York, within a period of 6½ months led to the present study. Sixteen cases were reported in the period from 1917 to 1948 and during that time 2,318 benign leiomyomas were observed, the incidence of sarcoma to benign fibromyoma being 0.69 per cent.

Leiomyosarcomas are classified as "unequivocal" when the gross and microscopic features are definitely malignant, and "low grade" when the histologic pattern is not decisive yet contains malignant characteristics.

All leiomyomas which are unusually soft, friable, or of unusual color should be viewed with suspicion and incised, after removal at the operating table. Immediate consultation with a pathologist should follow and a frozen section should be examined.

The gynecologist should carry out radical procedures in all women over 40 years of age when he encounters grossly typical leiomyomas or those with a history of rapid growth. When the omentum is adherent to leiomyomas, it should be widely excised.

Although recurrence in the retained cervical stump is rare, total hysterectomy with bilateral salpingo-oophorectomy is the procedure of choice.

Of the 16 cases, 11 were adequately followed up. Six patients (54.5 per cent) died of metastases within 2 years and 9 months, 3 patients are living and well, without recurrence, 2 patients have had further operative procedures for recurrences, but to date are living and well, without demonstrable recurrence.

JOHN R. WOLFF, M.D.

**ADNEXAL AND PERIUTERINE CONDITIONS**

**Concerning 2 Cases of Krukenberg Tumor (Tumor de Krukenberg a propósito de dois casos)** ALVARO DE AQUINO SALLES and HILDEFARDO STOLTZ *In Brasil gin*, 1948, 13: 259

Among 4,345 patients admitted to the Gynecologic Clinic of the University of Brazil from 1936 to 1948, there were 14 malignant ovarian tumors (0.32 per cent). Four of these (26.67 per cent) were metastatic secondary to carcinoma of the digestive tract, and 2 of the 4 presented the typical macroscopic aspect of Krukenberg tumors. These 2 cases are described.

## MISCELLANEOUS

**Torsion of the Organs and of Tumors of the Female Genitalia** Clinical Contribution (La torsione degli organi e dei tumori dell'apparato genitale femminile Contributo clinico) EMILIO RUGGERI  
*Ginecologia*, Tor, 1948, 14 493

Seventy cases of torsion are reported. This number represents about 1 per cent of a total of 4,360 patients operated upon at the gynecological clinic at Parma, Italy, in the period from January, 1939 to March, 1946. The material comprised 58 cases of torsion of ovarian and parovarian tumors, 4 of subserous, pedunculated fibroids of the uterus, 5 of the tube, and 3 of the uterus itself. Nearly all these patients with torsion were engaged in work requiring physical activity and most of them were in the child-bearing age, however, there was no evident relationship to the number of children they had borne. Among the ovarian and parovarian tumors torsion was about twice as frequent on the left side, which gave some support to the role played by the sigmoid colon in the etiology of this condition, there was a disproportionate number of torsions among the dermoid cysts (heavier tumors), but there was no marked effect from the size of these growths. The more irregularly shaped masses seemed more prone to twist. There was no evidence to the effect that the length of the pedicle was of significance.

The diagnosis is apt to be difficult and in some cases is practically impossible. The leucocyte count is apt to be low in these cases of torsion, especially when they come to operation early, however, when the condition is accompanied by appendicitis the former may not be distinguishable. This may be true also in torsion of a tumor of the pelvis combined with extrauterine pregnancy. The author's clinic is starting to resort to peritoneoscopy in some of the acute abdominal cases and this may solve some of the diagnostic problems which are involved.

The treatment is always urgent surgery. The suprapubic route is preferable, both because of the visual control of the procedures to be chosen and because of the opportunity to use intraperitoneal chemotherapy (sulfonamides). Chemotherapy, thus applied, is regarded in this clinic not only as widening surgical indications but also as improving the prognosis.

In this entire material there was only 1 death and this could not have had more than a casual connection (pachymeningitis) with the original condition.

In 1 of the 4 pregnant patients the uterus was removed because of multiple fibroids and toxicity, in the other 3 patients the tumor was removed with continuance of the pregnancy to term.

JOHN W. BRENNAN, M.D.

The first is remarkable because of the extraordinary survival of the patient, who had had a gastroenteroanastomosis for probable anterior gastric tumor  $8\frac{1}{2}$  years previously, and a right oophorectomy for a solid tumor 4 years and 3 months previously. This history and the presence of another large genital tumor, with ascites, metrorrhagia, rapid weight loss, and asthenia, led to the diagnosis of Krukenberg tumor. As a preliminary step before operation, a celioscopy was performed which, as a diagnostic aid, may be of great value since it allows direct visualization and endoscopic color photography of the tumor, biopsy, and the aseptic collection of peritoneal fluid for bacteriologic, chemical, and cytologic examination. In this case about 8 liters of ascitic fluid were removed, it was slightly bloody and contained a large amount of mucin and neoplastic cells having the typical signet ring aspect of Krukenberg tumor cells. A pneumoperitoneum was produced and revealed the presence of a large friable tumor with irregular surface, which occupied most of the small pelvis and whose point of attachment could not be determined. Total hysterectomy with left salpingo-oophorectomy was performed. The patient died 3 weeks after the operation.

The second patient had been operated upon for malignant tumor of the jejunum 2 years previously and presented a large, rapidly growing tumor in the pelvis, apparently of ovarian origin. She was in satisfactory general condition. At laparotomy the tumor was found to be inoperable and the abdomen was closed after material for examination had been taken. The diagnosis was bilateral ovarian Krukenberg tumor with infiltration of the small intestine, ileopelvic colon, and epiploon. Deep roentgen therapy was instituted, but death in cachexia occurred 11 months later.

About 20 cases of Krukenberg tumor have been reported in Brazil, most of them among multiparas from 25 to 54 years old. All of the tumors were bilateral and secondary, and only 1 patient survived more than 1 year. Although at present the consensus is that this tumor is always metastatic and secondary to a primary gastroenterogenous, mammary, vesicular, pancreatic, hepatic, or suprarenal carcinoma, the possibility of its being primary in the ovary cannot be excluded. Many theories have been advanced to explain the special predisposition of the ovary to develop metastases. Changes in the surface tension and in the pH may be contributing factors.

With regard to the surgical treatment, the question has been raised as to the convenience of preserving the uterus in order to allow the use of radium tubes as a complementary method to deep roentgen therapy in the postoperative period. The prognosis is always unfavorable because of the metastases which appear by the lymphatic route or by implantation after the primary tumor has been removed.

RICHARD K. FUELL, M.D.

# OBSTETRICS

## PREGNANCY AND ITS COMPLICATIONS

**Volvulus of the Sigmoid Colon in the Course of a Pregnancy of 7 Months** (Volvolo del colon sigmoideo nel corso de una gravidanza al settimo mese)  
GIUSEPPE BRACCO *Ginecologia*, Tor., 1948, 14 544

The patient, a housewife 44 years of age, had had one natural labor 3 years previously and was now 7 months' pregnant. She had suffered in youth from dyspepsia and enterocolitis. For several weeks now she had been suffering from attacks of abdominal pain, especially pronounced in the left iliac fossa, and of obstinate obstipation. These attacks would clear up, but finally, however, paroxysmal pains, progressive meteorism, dilatation of the stomach, and complete retention of the feces and gas developed at night. Roentgenologic examination with an opaque enema disclosed, in addition, the exact location and character of the twisted sigmoid.

At laparotomy the sigmoid at the indicated point was found to be twisted about itself for 360 degrees and exhibited the usual signs of tissue necrosis. Since the patient's general condition was still not grave it was decided to resect the involved loop of intestine (about 60 cm of gut) with end-to-end anastomosis. The pregnancy was left undisturbed. At first the convalescence was undisturbed and gas and feces began to pass, however, on the fourth day after operation there was a sudden change for the worse, with intense meteorism, hiccoughs, dry tongue, a temperature of 37.2°C, pulse from 90 to 100, and retention of gas and feces. After 2 days of this the patient went into labor and gave birth to a premature infant (1,870 gm) which died 2 days later. After this childbirth the patient's condition improved rapidly and she was discharged 10 days later (18 days after operation) in good condition.

At the operation the mesosigmoid was found thickened and retracted and this is believed to explain the tendency of the long sigmoid loop to twist on itself. The sudden obstipation coincident with the start of labor is well known and is the reason that so many authors have advocated artificial interruption of the pregnancy preceding, or following, any operative approach to the volvulus itself. However, the patient in the author's report here given was in excellent general condition and there was no evidence of impending labor at the time of operation, the case is therefore thought to help establish an indication for noninterference with the labor in such cases.

JOHN W BRENNAN, M D

**Purpura Hemorrhagica as a Complication of Pregnancy** J A CHALMERS *Brit M J*, 1948, 2 1020

Purpura hemorrhagica is a rare complication of pregnancy. The author reviews 63 cases recorded in the literature, and a further case is now added. In the present case the purpura was acute and transient,

and labor was unattended by any complication. Treatment should be directed to restoring the blood picture to normal before the onset of labor. If this is impossible, special measures for the control of postpartum hemorrhage may be necessary. The prognosis in the acute cases is good, but there is grave danger of maternal death in the chronic cases. The fetus is commonly involved, and may die of hemorrhage or of prematurity associated with the early onset of labor in a considerable proportion of these cases.

CHARLES BARON, M D

**Corpus Luteum Excision During Pregnancy and Its Effect on the Production of Progesterone** (Lu tectomia en el embarazo y su efecto sobre la producción de progesterona) JOSÉ BOTELLA LLUSIÀ and MANUEL LADRÓN DE CEGAMA *Acta endocr gyn*, 1948, 1 408

In 1946 the authors published 3 cases in which the gravidic corpus luteum was removed without producing abortion, one of the patients had been pregnant for 45 days and one was operated upon 8 days after the fecundating coitus. In this article 2 additional cases are described.

The first woman was pregnant for 2 months and had a left ovarian cyst, the size of a mandarin, with the corpus luteum on its proximal pole. The second was also pregnant for 2 months and had a bilobular twisted right ovarian cyst, the size of an orange, with the corpus luteum in some normal ovarian tissue which persisted between the two lobules of the cyst. No signs of luteinization were found in the other ovary of either patient. The involved ovaries were removed and the pregnancies continued to run their normal course.

The urinary pregnandiol was determined for several days following the operation in both patients and was found to remain constant and within the limits normal for pregnancy, despite the absolutely certain removal of the gravidic corpus luteum which has been accepted as the only source of progesterone, and therefore of pregnandiol, or at least as its principal source during pregnancy. It must consequently be admitted that progesterone can be produced outside of the ovary in quantities sufficient to maintain pregnancy and that this vicarious production takes place from the beginning of the pregnancy. The conclusion to be drawn is that the corpus luteum is not needed as a source of lutein hormone during pregnancy.

This progesterone may come from two sources: one is the placenta which, according to experiments of Seegar and his coworkers with cultures of young chorionic tissue, acquires very early the property of producing lutein hormone, the other is the suprarenal cortex, of which the progesterone content has been determined by Engelhart and Beall, and its relations with the corpus luteum as well as its hypertrophy during pregnancy have been amply described.



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RICHARD KEMEL, M D

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The author bases his opinions on a study of 281 posterior cephalic presentations over a period of 20 years.

He believes there are three important diagnostic procedures useful in posterior occiput, vertex, and brow presentations: determination of the sagittal suture (often by rectal examination alone), the palpation of the chin, and the palpation of the ears (by vaginal examination).

By feeling the sagittal suture one can detect the time of internal rotation. Location of the chin immediately identifies the whereabouts of the anterior and thence the posterior fontanel. The posterior border of the ear necessarily directs itself toward the occiput.

Although these observations are elementary, they are sufficiently important for re-emphasis.

WARREN R. LANG, M D

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The chief dangers of cesarean section are hemorrhage and infection, specifically peritonitis. These dangers have been controlled by improved surgical techniques, modern anesthesiology, blood transfusion, sulfonamides, antibiotics and oxytocics, so that the risk of cesarean section has been reduced to that of vaginal delivery of a few decades ago. Now that cesarean section may be used with greater impunity, the indications have been broadened to include many conditions that formerly were forbidden because of the great risk. This means the saving from death or damage of more mothers and babies. However, a new risk has been added. Due to a false sense of security on the part of the obstetrician, cesarean section is sometimes performed as a substitute for a less risky delivery through the birth canal. It must not be forgotten that the risk in cesarean section is five to ten times greater than that in vaginal deliveries. Dystocia, hemorrhage, and similar major complications offer the chief indications for cesarean section, which should be decided on the following evaluation of risks.

1 If the danger to mother or child by vaginal delivery is less, cesarean section is contraindicated.

2 If the danger to mother or child by vaginal delivery is equal to that by cesarean section, then the type of delivery selected will depend on the skill of the obstetrician. Some of the problems which arise in this group are now included in the modern

indications for cesarean section where formerly vaginal delivery was indicated.

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Fetal-pelvic disproportion at the inlet may be recognized before the onset of labor by the physical signs of abnormal presentation, high presenting part, premature rupture of the membranes, and pelvic mensuration. The following criteria should be used in evaluation of contracted pelvis with disproportion at the inlet: shape of the inlet, anteroposterior diameter (true conjugate), transverse diameter, and size of the fetus, particularly of the head.

The best method of individualizing fetus and pelvis by physical examination was first described by Muller, and later improved by Hillis, and consists of placing a finger in the rectum or vagina while the other hand (or an assistant) presses on the fundus. In this way the head is brought down to engagement, or below, if there is no disproportion. If disproportion is present it cannot be engaged. (Engagement is defined as being present when the head covers three-fourths of the symphysis pubis, two-thirds of the sacrum, and the most dependent portion of the skull, not scalp, reaches an imaginary line drawn between the ischial spines. This is known as "station 0"). In flat pelvis the head must descend 1 cm lower before it is engaged. When disproportion at the inlet has been discovered during pregnancy, by physical signs and pelvimetry, then complete roentgen studies should be made and the case evaluated. If disproportion is extreme, elective cesarean section should be selected; if moderate, the patient should be given a test of labor. A satisfactory method of evaluating the degree of disproportion is found again in the Muller-Hillis maneuver and the author uses the following standards:

1 Severe disproportion exists if, in the presence of a well developed lower uterine segment, the head cannot be brought lower than 3 cm short of engagement (station -3). An elective cesarean section is indicated and other common signs of disproportion usually are present.

2 Moderate disproportion exists if the head can be brought lower than 3 cm short of engagement but still does not engage (between station -3 and station 0). A test of labor is then indicated. It is in this group that disproportion is often missed, particularly if the head can be brought down to station -1. Too often it is interpreted as reaching station 0, or even +1 where a little more care and skill in making the examination would show the true condition.

At present there is no clearly defined test of labor other than the well known anatomicophysiology test and this is usually too prolonged to be considered safe, a proper decision can be made long before such a severe test is completed. The most important factors involved in a test of labor are (1) the shape and size of the pelvis, (2) the size of the baby and degree of molding, and (3) the strength and frequency of uterine contractions. These factors involve so many variables that there are no stan-



# OBSTETRICS

## PREGNANCY AND ITS COMPLICATIONS

**Volvulus of the Sigmoid Colon in the Course of a Pregnancy of 7 Months** (Volvolo del colon sigmoideo nel corso de una gravidanza al settimo mese)  
GIUSEPPE BRACCO *Ginecologia*, Tor, 1948, 14 544

The patient, a housewife 44 years of age, had had one natural labor 3 years previously and was now 7 months' pregnant. She had suffered in youth from dyspepsia and enterocolitis. For several weeks now she had been suffering from attacks of abdominal pain, especially pronounced in the left iliac fossa, and of obstinate obstipation. These attacks would clear up, but finally, however, paroxysmal pains, progressive meteorism, dilatation of the stomach, and complete retention of the feces and gas developed at night. Roentgenologic examination with an opaque enema disclosed, in addition, the exact location and character of the twisted sigmoid.

At laparotomy the sigmoid at the indicated point was found to be twisted about itself for 360 degrees and exhibited the usual signs of tissue necrosis. Since the patient's general condition was still not grave it was decided to resect the involved loop of intestine (about 60 cm of gut) with end-to-end anastomosis. The pregnancy was left undisturbed. At first the convalescence was undisturbed and gas and feces began to pass, however, on the fourth day after operation there was a sudden change for the worse, with intense meteorism, hiccoughs, dry tongue, a temperature of 37.2°C, pulse from 90 to 100, and retention of gas and feces. After 2 days of this the patient went into labor and gave birth to a premature infant (1,870 gm) which died 2 days later. After this childbirth the patient's condition improved rapidly and she was discharged 10 days later (18 days after operation) in good condition.

At the operation the mesosigmoid was found thickened and retracted and this is believed to explain the tendency of the long sigmoid loop to twist on itself. The sudden obstipation coincident with the start of labor is well known and is the reason that so many authors have advocated artificial interruption of the pregnancy preceding, or following, any operative approach to the volvulus itself. However, the patient in the author's report here given was in excellent general condition and there was no evidence of impending labor at the time of operation, the case is therefore thought to help establish an indication for noninterference with the labor in such cases.

JOHN W. BRENNAN, M.D.

**Purpura Hemorrhagica as a Complication of Pregnancy** J. A. CHALMERS *Brit M J*, 1948, 2 1020

Purpura hemorrhagica is a rare complication of pregnancy. The author reviews 63 cases recorded in the literature, and a further case is now added. In the present case the purpura was acute and transient,

and labor was unattended by any complication. Treatment should be directed to restoring the blood picture to normal before the onset of labor. If this is impossible, special measures for the control of post partum hemorrhage may be necessary. The prognosis in the acute cases is good, but there is grave danger of maternal death in the chronic cases. The fetus is commonly involved, and may die of hemorrhage or of prematurity associated with the early onset of labor in a considerable proportion of these cases.

CHARLES BARON, M.D.

**Corpus Luteum Excision During Pregnancy and Its Effect on the Production of Progesterone** (Lu tectomia en el embarazo y su efecto sobre la producción de progesterona) JOSÉ BOTELLA LLUSIÀ and MANUEL LADRÓN DE CEGAMA *Acta endocr gyn*, 1948, 1 408

In 1946 the authors published 3 cases in which the gravidic corpus luteum was removed without producing abortion, one of the patients had been pregnant for 45 days and one was operated upon 8 days after the fecundating coitus. In this article 2 additional cases are described.

The first woman was pregnant for 2 months and had a left ovarian cyst, the size of a mandarin, with the corpus luteum on its proximal pole. The second was also pregnant for 2 months and had a bilobular twisted right ovarian cyst, the size of an orange, with the corpus luteum in some normal ovarian tissue which persisted between the two lobules of the cyst. No signs of luteinization were found in the other ovary of either patient. The involved ovaries were removed and the pregnancies continued to run their normal course.

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dards used other than an arbitrary number of hours selected by each individual obstetrician. The impatient and the surgically minded prefer a short time, the more patient and conservative ones prefer a longer time. The author attempts to solve this problem by use of the following standards:

After labor is established, with a good uterine contraction lasting longer than 30 seconds, at 5 minute intervals or oftener, and showing some shortening and effacement of the cervix, a Muller-Hillis maneuver is done every 3 or 4 hours. The shorter interval is used when the labor is more active and the longer, if less active. If the test is going to succeed it will be found that with each maneuver the head can be brought to a slightly lower level, and the test may be continued. However, if at the second of two successive maneuvers progress is stationary and the head cannot be brought to a lower level than at the previous examination, the test should be considered a failure and the baby delivered by cesarean section without further delay. Thus, a decision can be reached before the complete dilatation and the 2 hours of labor required by the anatomicophysiology test. In fact, the success of the test is dependent on the fact that in normal labor the head will descend through the pelvic inlet before the cervix is fully dilated.

Contraction of the midpelvis is occasionally seen, usually in android and anthropoid pelvises, and is first recognized during the physical examination by the prominence of the ischial spines. As soon as this is discovered the sacrospinous notch should be palpated and its width in fingerbreadths noted. A test of labor may be permitted in midplane contraction since the head is not too low at this level to be reached by abdominal section. Such tests should not last a long time but if progress is definitely arrested at the ischial spines cesarean section should follow promptly.

A contracted outlet, severe enough to require cesarean section, is quite rare but must be recognized early. Once the descending head has reached the narrow outlet and obstruction develops, a destructive operation is the proper treatment, for, with the narrow intertuberous transverse diameter and the short posterior segment due to the shallow sacrum, the baby will be badly damaged or killed if forceps are attempted.

Stenosis of the cervix is commonly acquired rather than congenital, and usually requires cesarean section. It follows one of the varieties of surgical treatment to the cervix, since any procedure that leads to extensive scar tissue will cause rigidity.

If the patient has reached term and a tumor takes up enough space in the pelvic inlet to cause dystocia, she should be delivered by cesarean section.

Patients with congenital anomalies require cesarean section whenever they cause stenosis and obstruction, otherwise they do not interfere with labor. One condition that should be watched is the double uterus. If the nonpregnant uterus becomes incarcerated in front of the fetus, it will act the same as a blocking tumor, and cesarean section is indicated.

Since spastic contraction rings can be diagnosed positively only by a hand in the uterus, they are not often recognized. Most of such manifestations of local tetany respond to antispasmodics such as demerol and scopolamine in combination, but if a permanent constriction ring is present only cesarean section will deliver the baby.

Placenta previa and premature separation of the placenta have much in common as far as indications for cesarean section are concerned. The two chief points for consideration are the amount of bleeding and the degree of cervical dilatation. Active bleeding requires prompt treatment and the quickest way to control such hemorrhage is to deliver the baby and placenta. If the cervix is incompletely dilated, preliminary operations to complete dilatation only add further trauma and hemorrhage, making a bad case worse. Cesarean section solves the problem quickly and efficiently. If the bleeding is only slight, more conservative measures may be used, or if the cervix is fully dilated, forceps or even version are indicated. The big danger in cases of hemorrhage is active bleeding in the presence of an incompletely dilated cervix, and in such a situation cesarean section should be the first treatment considered. While in placenta previa, cesarean section is usually indicated in the centralis and partialis varieties, the marginal type may be treated by more conservative methods such as puncture of membranes, Braxton Hicks version, Willett's traction forceps, and others. In premature separation, particularly abruptio placentae, with a long cervix, cesarean section is to be chosen. In the milder types the accepted conservative methods may be used, especially if the baby is dead, but if there is a chance to obtain a living child cesarean section offers the best hope and the burden of proof of correct judgment lies on him who decides otherwise.

Cesarean section is indicated in heart disease only when there is a prospect of obstruction due to disproportion or to dystocia from other causes.

Labor in thyrotoxicosis and pulmonary tuberculosis should be treated on the same principles as heart disease. Diabetes may require cesarean section in those cases in which the chorionic gonadotropin levels persist above normal, in spite of adequate estrogen and progestin therapy, with the consequent danger of an oversize, over-term, dead fetus. Here an elective cesarean section is indicated about 2 weeks before the calculated date, provided palpation and abdominal mensuration show the fetus is large enough to be viable. Sterilization per se is not an indication for cesarean section.

There are a number of fetal indications for cesarean section. Abnormal presentation and position is one of the signs of pelvic inlet contraction before the onset of labor, as stated earlier, but this does not mean that disproportion is the only cause. In general, abnormal presentation in a contracted pelvis is an indication for cesarean section, but when the contraction is only slight and the fetus small, vaginal delivery is the better choice. Transverse presenta-

tions are particularly dangerous and a primigravida with dry labor should be sectioned even if the pelvis is normal

Breech presentations in a primigravida should be studied carefully, if the pelvis is contracted more than a slight degree, elective cesarean section is indicated. Elderly primigravidas approaching 40 years of age should be treated in the same way even if the pelvis is normal since the baby has a high priority, and it is impossible to predict how the after-coming head will descend through the pelvis. Of course, greater pelvic contractions require cesarean section unless it has been proved that a large sized baby can be delivered safely through the birth canal by previous successful labors, for there is no way of conducting a test of labor in either breech or transverse presentations. The correct decision must be made, at the latest, before the first stage is completed.

Fetal monsters commonly present abnormally and can be recognized in most instances by roentgen studies. The most treacherous cases are hydrocephalus with breech presentation and soft tissue tumors that do not cause a shadow on x ray film. In general, monsters are not an indication for cesarean section but should be treated by destructive operation after the cervix is fully dilated. Rarely cesarean section must be done when a vaginal delivery is impossible.

Marked variation of the fetal heart rate during labor is one of the newer indications for cesarean section and this indication should be used with caution. It is usually a sign of cord complications, such as forelying cord, occult prolapse of the cord, tight loops and coils of a long cord, or an unduly short cord. This is not an indication for cesarean section before the onset of labor unless the fetal heart rate shows very marked change of rate. The best example of such indication is seen in a primigravida with very little cervical dilatation and marked variations of the fetal heart rate between pains.

The elderly primigravida of 40 years or over usually should be delivered by elective cesarean section because of the high priority value of the baby. In most cases this is the woman's only chance to have a baby, and with the difficulties of labor likely to be encountered it is best to offer the fetus every opportunity for safe delivery. Again this is a generalization and there are occasional exceptions, for each case should be decided on its own merits. Last of all, cesarean section in a dying mother or immediately postmortem is a fetal indication that should not be forgotten.

The dictum of "once a cesarean section always a cesarean section" is not necessarily true, for with careful study, observation and skill, certain patients who previously have undergone cesarean section may be delivered successfully through the birth canal. Elective cesarean section is required in all cases in which the previous indication was contracted pelvis, likewise if wound healing at the former section was complicated by endometritis and uterine infection, since there is danger of rupture of the uterine

scar during the next labor. In other words, cesarean section is indicated in a succeeding labor if there is danger of obstruction, dystocia, or rupture of the uterine scar due to poor wound healing. Delivery through the vagina may be considered and attempted if the previous section was for hemorrhage, toxemia, or some similar indication in which the problem of dystocia was not involved and convalescence was uncomplicated by infection.

There is no substitute for thorough study, careful observation, and skill. CHARLES BARON, M D

## LABOR AND ITS COMPLICATIONS

**Fetal Mortality in Breech Deliveries** WARD F SEELEY *Am J Obst*, 1949, 57 113

A survey of 1240 breech deliveries in the two 5-year periods from 1932 to 1936 and from 1942 to 1946 at the Harper Hospital and at the Herman Kiefer Hospital, Detroit, Michigan, shows that even in expert hands the fetal risk in breech presentation is greater than in vertex presentation.

The very high gross fetal death rate often attributed to the breech position is, to a great extent, due to the inclusion of very premature infants who would have little chance of survival with any position, of those severely malformed, and of those already dead on admission.

There is no increased risk for viable prematures when presenting by breech, yet birth weight is an important factor in fetal death. Babies of medium weight have the best chance of survival.

The frank breech position does not seem to increase the fetal risk. The length of labor is not an important factor.

Babies of elderly primiparas with breech presentation have a higher mortality if they are delivered vaginally.

Prolapsed cord is a definite added hazard as it occurs six times more frequently in breech than in vertex presentations.

The maternal risk is not increased, and mortality is due to associated conditions not due to the breech presentation. A slight increase in morbidity follows perineal injury, which can be prevented by episiotomy.

Prophylactic version deserves more universal consideration. Elderly primiparas, patients with pelvic contraction, even though of mild degree, primiparas with large babies, and cases with various combinations of these conditions deserve careful consideration of delivery by cesarean section. Better care should aid in reducing the mortality among fetuses developed sufficiently for extrauterine life.

The importance of the skill of the attendant is well exemplified by the survey. From 1932 to 1936, when the deliveries were conducted by internes and residents, the stillbirth and neonatal mortality for full term infants was 6.5 per cent. From 1942 to 1946, when 95 per cent of the deliveries were by skilled attending men, this mortality was 3.5 per cent.

JOHN R. WOLFF, M D

## PUERPERIUM AND ITS COMPLICATIONS

**Several Indications for Infiltration of the Renal Pedicle During Pregnancy and the Puerperium** (De quelques indications de l'infiltration du pédicule rénal pendant l'état gravidopuerpéral) RIVIERE, MAHON, CHASTRUSSE, and SOUMREU *Gyn obsl*, Par, 1948, 47 646

It has been determined experimentally that section of the renal pedicle brings about vasodilatation of the renal arteries and diuresis. This same effect can be induced by infiltration of the renal pedicle with novocain. It has been noted clinically that novocain infiltration of the renal pedicle employed in the treatment of nephritic colic also abolished the spasm of the ureter and pelvis, bringing about a vasodilatation and a polyuria, and a secondary fall in the blood pressure. This effect was proportional to the extent to which nervous reflex mechanisms were involved in the anuria.

During the pregnant and puerperal states anuria or oliguria is not rare, it is often seen in eclampsia, pre-eclampsia, retroplacental hemorrhage, pyelonephritis, and in all of these cases vascular spasm is of great importance. The authors believe that this is a functional spasm which can be relieved by novocain infiltration of the renal pedicles (the technique is not described). These effects cannot be so dramatically shown in the woman who has underlying renal disease.

Infiltration of the pedicles can also induce diuresis in cases of postabortion nephritis. Cases of the latter are described in which the abortion had been attempted by the use of certain poisons and by the intrauterine instillation of soapy water. Typically, an acute nephritis with anuria was produced, the treatment for which consisted of penicillin and novocain infiltration of the renal pedicles, if the latter procedure was not successful, immediate decapsulation of the kidneys was done. One per cent novocain was employed, 25 c.c. in each pedicle, in a few cases decapsulation was carried out.

Fourteen cases were reported: 5 cases of eclampsia with anuria, all responding favorably to infiltration by diuresis, 2 cases of severe toxemia, both ending fatally in spite of therapy which included infiltration, 5 cases of postabortive nephritis following the use of soapy water in the uterine cavity as an abortifacient—diuresis followed infiltration in 3 of these cases, 2 cases of toxic nephritis with anuria following the ingestion of poisonous abortifacients—diuresis followed infiltration in 1 case, while the other ended fatally.

Infiltration of the renal pedicles deserves merit in all cases of anuria and oliguria observed during the pregnant and puerperal state. Failure of this procedure to induce diuresis is an indication for renal decapsulation for it signifies that the functional state is passed and that the obstruction has become mechanical. In the cases of postabortive nephritis this is indicated especially in the prevention of this renal complication of abortion, caused by the

methods described, early infiltration can be life saving.  
PHILIP B. CHASE, M.D.

**Indications for Renal Decapsulation During the Pregnant and Puerperal State** (Les indications de la décapsulation rénale au cours de l'état gravidopuerpéral) R. MAHON and H. DAVY *Gyn obsl*, Par, 1948, 47 653

In the pregnant and puerperal state, when anuria and azotemia appear and are resistant both to medical treatment and to the infiltration of the renal pedicles with novocain, early decapsulation of the kidneys affords the best chance of initiating diuresis. Renal decapsulation in the pregnant woman is not a new operation, having been performed first in the United States in 1903 and in France in 1905. The old indication was a persistent anuria 24 hours after delivery of the fetus, but in recent years this procedure has only been attempted in the anuria following criminal abortion. Decapsulation does not have an excellent reputation, and was formerly used only as a last resort. However, it has its merits as a procedure to be employed in a definite anuria which does not respond to other therapeutic measures and which is complicated by a progressive azotemia. This train of events usually arises in the following situations:

1. In criminal abortions, following either the ingestion of poisons or the intrauterine injection of soapy water, accompanied in the latter case by gas bacillus (*Clostridium welchii*) infection.

2. In certain forms of gravidotoxic pyelonephritis.

3. After certain eclamptic states.

The anuria following attempted criminal abortion by the taking of poisonous abortifacients is the most serious of the various symptoms which must be treated. Extreme congestion and ectolysis of the kidney parenchyma and tubules are noted pathologically, the result of a slowly developing process which can be checked by decapsulation.

"Soap nephritis," a form of toxic nephritis, can follow the intrauterine injection of soapy water. Its most serious complication is anuria and secondary azotemia which is treated most successfully by renal decapsulation. This should be accompanied by penicillin therapy and other such measures as the intravenous injection of fluids and novocain infiltration of the renal pedicles. There should not be more than a 24 hour delay; then decapsulation should be done, first on one kidney and then on the other 2 or 3 days later.

*Clostridium welchii* bacillus can produce a severe generalized toxemia of which nephritis with anuria and secondary azotemia is the most serious manifestation. Although penicillin may check the initial infection, the anuria and azotemia may persist, and only decapsulation can initiate diuresis. Even when hysterectomy is indicated because of gangrene, decapsulation should be carried out.

In the anuria of gravidotoxic pyelonephritis, renal decapsulation has its place in treatment along with the intravenous injection of fluids and novocain infil-

tration of the renal pedicles. Two cases of gravidotoxic pyelonephritis, one a chronic nephritis aggravated by pregnancy, the other an acute nephritis appearing in the course of a pregnancy, are reported. All of the symptoms of eclampsia disappeared following delivery except the anuria and azotemia which responded only to decapsulation of both kidneys. At operation renal biopsies were taken and disclosed a nephritis with extensive tubular epithelial destruction and cytoplasmic vacuolization, which left no doubt as to the severe derangement of the renal physiology. It is concluded that in all cases of post-eclamptic anuria, decapsulation of the kidneys should be done when medical management fails.

In anuria occurring late in pregnancy it is advisable to empty the uterus before term, delivery of the fetus frequently bringing about renal decongestion. However, if it occurs early in pregnancy before the fetus is viable, renal decapsulation should be carried out and the integrity of the pregnancy maintained if possible.

PHILIP B. CHASE, M.D.

### NEWBORN

**Umbilical Healing and Infection** (Ueber Nabelheilung und Nabelinfektion) WILHELM H. THIELE. *Germanisch & Frauenh.*, 1948, 8: 774.

The author calls attention to the dangers which appear after the dried remnant of the umbilical cord has sloughed off. In view of the relatively long time it takes for complete epithelization to occur and the presence of pathogenic bacteria, the equilibrium between bacterial virulence and body defense can easily break down.

The resulting infection may take various forms. There may ensue an acute peritonitis or fulminating

sepsis. What seems to be merely a nutritional disturbance may also develop.

With signs of poor nutrition, especially in the breast-fed infants, one must consider umbilical infection. The diagnosis is made by inspection. Probing for pus may be dangerous. The recommended treatment of the sloughing cord is the so-called "dry method" of management.

WARREN R. LANG, M.D.

### MISCELLANEOUS

**Kidney Function in the Fetus** SAMUEL T. THIERSTEIN, FRED D. COLEMAN, and FRANK H. TANNER. *Am. J. Obst.*, 1948, 56: 1178.

In the present article the authors state that since the kidneys are functioning at birth, one frequently observes urination a very short time after birth. Knowing that the infant is born with a full bladder, one can speculate on how frequently the fetus urinates during the last months of fetal life and in what quantities urine is secreted.

A case report is presented of an infant delivered with an enormously distended bladder containing 4,200 cc of urine. The extreme abdominal enlargement prevented delivery of the baby until the bladder was incised and the fluid evacuated. The kidneys were normal except for secondary changes due to secreting against pressure. The urethra was patent, and the cause of the obstruction, or lack of elimination of the urine from the bladder, can only be surmised.

The volume of urine found in the bladder of this infant may be a clue to the approximate amount secreted by all fetuses during the last months of intrauterine life.

JOHN R. WOLFF, M.D.

# GENITOURINARY SURGERY

## ADRENAL, KIDNEY, AND URETER

**Adrenalectomy in the Treatment of Arteritis** (La place de la surrénalectomie dans le traitement des artérites) LUCIEN LEGER, A MATHIVAT, and S TCHÉKOFF *Presse méd*, 1948, 56 898

Arteritis occurring in young and middle-aged patients can sometimes best be treated by unilateral adrenalectomy. This is true particularly in patients in whom medical treatment and lumbar sympathectomy have failed.

Experimental evidence that hyperadrenalism produces peripheral arterial lesions has been obtained by Leriche and others who transplanted adrenal glands subcutaneously in rabbits every 4 or 5 days. These animals developed peripheral arterial thromboses. Leriche observed gangrene develop in the paw of one animal after the fourth transplant.

The operation of adrenalectomy in the treatment of arteritis was introduced by Oppel in 1917, and later revived by Leriche and his school. Many modern surgeons have abandoned it because they thought that the results obtained were not sufficiently good to warrant such an extensive operation. Many failures in the past are attributable to lack of understanding of the indications for the operation.

The authors have used this operation in the treatment of 25 patients since 1943 without an operative death. These patients suffered from an occlusive type of peripheral arteritis of the lower extremities. The disease is of unknown etiology, it affects younger patients, and it was particularly frequent after the recent World War. Among the 25 patients, none had diabetes, syphilis, or Buerger's disease.

A total removal of one adrenal gland is done through a lumbar approach with removal of the twelfth rib. Usually the left adrenal is resected, sometimes the right. The lumbar sympathetic chain is not disturbed.

Among the 13 cases which have been followed postoperatively for 2 years or more, the results in 8 were classified as good, in 2 as fair, and in 3 as failures. However, even in patients who did not present a satisfactory result, there was no further progression of the pathologic process, and no patients required amputations of the major extremities.

Of the 25 adrenal glands removed none was normal morphologically. The most common gross lesion was hyperplasia of the adrenal cortex, resembling that sometimes seen in patients with hypertension. Microscopic changes included thickening of the capsule, hyalin changes and sclerosis of the capsular vessels, sclerosis of the zona glomerulosa, hyperplasia of the zona fasciculata, hyperplasia of the zona reticulosa in 7 cases and atrophy in 5 cases, and islands of lymphocytes in the zona fasciculata.

Although the authors have obtained good results in 2 patients over 60 years of age, they emphasize

that it is in those below 50 in whom the operation is indicated. The arteries must still show ability to constrict, and gangrenous lesions, if present, must not be too far advanced.

FREDERICK W PRESTON, M D

**Megaloureter: A Report of 2 Cases** J H CARVER *Brit J Surg*, 1948, 36 168

Two patients with unilateral hydronephrosis and hydroureter are reported. Nephroureterectomy was performed in both cases. The specimens presented marked hypertrophy of the muscularis, normal ureteral orifices, and little or no infection. The etiology of megaloureter is discussed. The author prefers to attribute his 2 cases to neuromuscular imbalance at the ureterovesical junction and offers them in support of Hurst's theory of achalasia.

ORMOND S CULP, M D

**Diverticulum of the Ureter** (Divertículo del uréter) PEDRO MOREYRA BERMAN and ALBERTO HALAC *Bol Soc cir Cordoba*, 1948, 9 123

Diverticulum of the ureter is very rare. Diagnosis is made only from urographic studies. The case reported by the authors was that of an otherwise healthy man of 35 years who complained of left lumbar pain. Cystoscopy was of no value but ureteral catheterization revealed deficient elimination of the left kidney and x-ray films of the lower third of the left ureter demonstrated a large saccular diverticulum. The condition is considered embryologic in origin, the abnormality probably arising from the wolffian canal.

Treatment depends upon the location of the diverticulum. The indwelling catheter should be used when surgery is done and should remain *in situ* until healing is completed, regardless of whether the diverticular sac is excised, ligated, or transplanted into the bladder. When the kidney is diseased ureteronephrectomy may be indicated. The authors' case was treated by simple ureteral catheterization and dilatation of the orifice of the diverticulum until all subjective symptoms disappeared. The prognosis depends on the circumstances complicating the findings.

STEPHEN A ZIEMAN, M D

**Implantation of Secondaries from a Renal Carcinoma (Hypernephroma) within the Ureteral Lumen** JAS B MACALPINE *Brit J Surg*, 1948, 36 164

Five years after a left nephrectomy was performed for "hypernephroma," a 44 year old female had recurrence of hematuria which came from the ureteral stump. Ureterectomy revealed two tumors within the lumen, both of which were histologically similar to the cortical neoplasm.

Thirteen years after the nephrectomy a metastasis was removed from the left temporal lobe of the



brain of this patient, but she died 1 year later with liver metastases

The literature is reviewed to ascertain if the spread of nonpapillary renal carcinoma was similar to the metastasis in this case. Very few authentic examples could be found.

ORMOND S. CULP, M.D.

## A New Method of Implantation of the Ureter into the Urinary Bladder (Nový způsob implantace močového do měchyře) LUDVÍK HAVLÁSEK *Lék listy*, 1948, 3 545

At the Obstetrical and Gynecological Clinic in Brunn, Czechoslovakia, during the period from 1925 to 1947, 21 operations for fistula of the ureter were done. Twenty patients presented vesicovaginal fistulas, while 1 patient presented a combined vesicovaginal fistula with suprapubic extension through the operative scar. In 3 patients both ureters were involved. Seventeen of the cases resulted from the Wertheim panhysterectomy, 2 from the Schauta and 1 from a simple hysterectomy for cancer of the cervix, 2 from a simple hysterectomy for uterine fibromyoma, and 1 from injury during criminal abortion. Three of the patients were treated by nephrectomy and the remainder underwent vesicoureteral implantation.

From 1936 on, 6 of the patients were subjected to a modified Sampson implantation. In 1 woman the injury was bilateral, and it is these 7 implantations which form the basis of this report. The lower end of the proximal stump of the severed ureter is shaped into 2 flaps, as in the original technique of Sampson, and these are introduced through the incision in the bladder wall and then spread out and fastened to the inner surface of the bladder wall by mattress sutures passed back by separate nontraumatic needles through the bladder wall from the inside. The incision in the bladder wall is a simple cut made over the tips of a curved forceps introduced through the urethra into the bladder. The tips of the forceps then grasp another suture, and traction on this extra suture is what pulls the ureteral stump through the bladder incision into the vesical cavity. After the flaps are sutured, this extra suture, which is led out through the urethra, is then used for traction to pull the entire funnel shaped implantation area into the vesical lumen. The walls of this invaginated bladder wall are then stitched with finest catgut around the ureter above the area of implantation, and the latter area is left protruding in valvelike fashion into the cavity of the bladder. The incision is placed as close as practicable to the original ureterovesical opening, and the distal stump of the ureter is closed and stitched in such a manner to the structures of the pelvis as to bring the mobilized bladder high up under the urethra (Latzko). The ureteral stump is implanted in an oblique direction through the muscular wall of the bladder and the folds are raised and stitched above the ureter as in the method of Witzel.

A retention catheter is left in place for 10 days or longer, the bladder is washed out daily with a weak

silver chloride solution and plenty of fluids, and urinary antiseptics are administered.

Two of the patients had received an injury during the Wertheim operation, the wound in each case was recent, clean, and especially favorable for cure. Both the immediate and late results were excellent. In the remaining 4 patients (in 1 of whom the injury was bilateral) a fistula had been present. Here again the immediate and later results were good, in the fourth woman the fistula recurred and cure was obtained by nephrectomy.

The patients of this group who were operated upon successfully were later subjected to cystoscopy, descending pyelography, and ureteral catheterization for periods ranging from 1 to 4 years. In every case the new aperture was wide, the urine was discharged rhythmically, yet in only 1 case could a reflux be detected. In 2 instances following the operation, a cystopyelitis lasted for a year or so, in the bilateral case the implantation was made into the vertex of the bladder and this was followed by much suffering (cystopyelonephritis) in the 4½ year period until the patient's death from carcinomatous metastases.

On the whole, however, the trifling disturbances, such as moderate dilatation of the ureter and kidney, pelvis, swelling and edema of the implantation flaps, and delay in the appearance of the dye in the kidney tests, tended to disappear in time. The author regards the operation, as here described, especially well adapted anatomically, biologically, and functionally, for the operative treatment of injuries and fistulas of the ureter.

JOHN W. BRENNAN, M.D.  
SCHNITTMAN J. *Urol*, Balt., 1948, 60 421

**Results in Ureterointestinal Anastomosis** MORRIS  
A slightly modified form of the Coffey I operation for ureterointestinal anastomosis is described. In a series of 12 cases in which this technique was employed the normal pyelograms were increased from 25 to 80 per cent as compared to results following the original Coffey I operation.

It is the author's belief that the close observation of the following principles was largely responsible for the improvement.

- 1 The rectosigmoid should be freely movable, if it is not, mobilization is indicated.
- 2 A minimum portion of the ureter should be freed, to prevent angulation and injury to the blood supply.
- 3 An adequate trough should be made. Lateral flaps at least 1.5 cm in width are formed. With the bowel held with moist saline gauze, a longitudinal incision is made in the taenia through most of the circular muscular fibers. However, a very thin layer of circular fibers is left intact with the mucous membrane "pouting out" in a few places. With the bowel grasped gently by the gauze covered hand and with the aid of a fixation forceps, the flap is started in the incised portion of the bowel where there are still a few intact circular fibers. The seromuscular layer is then peeled back in a plane between the severed and



intact circular fibers, at right angles to the line of the incision

The ureter is inserted into the bowel through a transverse incision in the mucosa

FREDERICK A LLOYD, M D

### BLADDER, URETHRA, AND PENIS

**Cystitis Emphysematosa** MARIE ORTMAYER *J Urol*, Balt., 1948, 60 757

About 50 cases of human cystitis emphysematosa have been reported in the literature, four-fifths of these are autopsy reports. The condition is distinctive in that vesicles are formed in the mucosa of the urinary bladder. These are filled with gas. Investigation has shown that the infecting organisms can be made to grow with gas formation in vitro if the pH is favorable. The organisms cultured have nearly always been of the *Bacillus coli communis* group.

The disease is generally accompanied by bloody and frequent urination, rarely with pneumaturia, crepitation over the bladder area is sometimes felt. The plain x-ray film may show a ring of air outlining the bladder. The cystoscopic view is quite striking, with the shining, silvery vesicles standing out from the mucosal surface, these resemble air bubbles in their reflectability, and have purplish edges.

The author's patient was a 69 year old diabetic female who presented bloody urine with frequency. She was found to have a low grade fever, a high fasting blood sugar, and glycosuria. The bladder presented the appearance of being covered with air bubbles everywhere, many were hemorrhagic at their circumferences. The cysts were from 4 to 10 mm in diameter and, in places, were arranged in clusters. Some of these burst under vision, and released gas. The cultures of urine from the bladder and both kidneys yielded *Bacillus coli*. Cultures for tubercle bacilli were negative. A repeat cystoscopy 4 days later showed marked regression of the disease, only a few blebs remaining. The patient had a huge hydronephrosis and hydroureter which were removed surgically. She recovered completely.

This represents the twelfth case of this disease which has been reported after being discovered at cystoscopy.

JOSEPH E MAURER, M D

**Condition of the Bladder and Ureters After Nephrectomy for Renal Tuberculosis** (Sur l'état de la vessie et des uretères après la néphrectomie pour tuberculose rénale) PIERRE MURET *Bordeaux chir*, 1948, No 1 5

The author reports some representative cases following nephrectomy for renal tuberculosis on which he bases the following conclusions.

The nontuberculous ureteral stump undergoes very little change after nephrectomy, its tonicity and motility persist long after the operation without presenting any noticeable change. However, the lesions of the tuberculous ureteral stump, like those of the bladder, regress and disappear gradually, a process of fibrous cicatrization eliminates the speci-

fic lesions and fills the lumen of the ureter. Two years after operation permeability of the ureter is still the rule and obliteration the exception, but 3 years after operation the reverse is true.

The tuberculous ureter may be the source of complications, such as persistence of pyuria, urinary or purulent fistula, and ureteral abscess. These complications usually heal under simple therapeutic measures.

Ureteral reflux is induced by the changes in the bladder and bladder neck as much as by the ureteral lesions, it is a serious complication which menaces the function and favors tuberculous infection of the remaining kidney. Bladder denervation by pelvic neurotomy or anesthetic infiltration, or endoscopic resection must be tried in such cases, if these measures fail or if the bladder has lost all functional value through cicatricial contraction, ureterosigmoid anastomosis will give good results, but if the anatomic condition of the ureter does not allow this anastomosis, the last possible recourse will be cutaneous ureterostomy.

The author has noted a peculiar modality of certain residual urines when the bladder is filled with opaque solution, the kidney and ureter also become filled by reflux, if the catheter is then removed and the patient is made to void, the film taken immediately thereafter shows the bladder to be still filled (residue), but the kidney and ureter are empty. It would seem that in this case of passive reflux the residue does not designate difficulty in the evacuation of the bladder but a filling of the organ by the previous renoureteral contents. This would explain the usefulness of bladder drainage by an indwelling catheter.

As the ureteral stump may cause complications, it is more logical to prevent them by some simple precautions which do not aggravate the surgical intervention. Thus, exonephrectomy has given favorable results. In this procedure, section of the renal pedicle allows exteriorization of the kidney, which remains attached only by its ureter, the incision is closed completely, after which the ureter is cut between two clamps and the stump is kept exteriorized in the lower angle of the wound by a special clamp or a small collar of gauze. In cases in which the ureteral or perireteral changes make this procedure impossible, the sheathing method of Dor can be used. In this method, the ureteral stump, which has been cut by thermocautery between two clamps, is introduced into a tightly fitting drain by pulling on the stump ligatures that have been left long for the purpose. The wound is closed around the drain, which may be used to inject antiseptic substances.

RICHARD KEMEL, M D

**Tumors of Diverticula of the Urinary Bladder** (Les tumeurs des diverticules vésicaux) JACQUES MICHAON *J urol méd*, Par, 1948, 54 438

Coexistence of diverticula and tumors of the bladder is not very rare, but the development of a neoplasm within a diverticulum is very unusual. Re-

ports of approximately 100 such cases, all in males, have been published. This is not surprising, inasmuch as diverticula as such occur nearly exclusively in the male sex, and the frequency of cancer of the bladder in men is three times as great as in women. Tumors in diverticula are found mostly in the sixth decade of life. In the majority of the cases reported, the involved diverticula were found on the posterolateral aspect of the bladder. Acquired formations are more frequently affected than congenital diverticula. The location of the tumors varies but most of them are at the base of the diverticulum. Malignant lesions are found seven times as often as benign.

Stagnation of the urine within the diverticulum and inflammation of its mucosa are predisposing factors.

Hematuria, slight or intensive, single or repeated, should arouse a suspicion of malignancy. In many instances, rectal examination may confirm the diagnosis. Cystoscopic and roentgenologic examinations are essential for the establishment of the diagnosis. Filling defects can be visualized better after a direct introduction of the opaque medium into the diverticulum than after cystography or intravenous urography.

Electrocoagulation may be employed for the treatment of benign papillomas but diverticulectomy is indicated in the presence of malignant tumors. The intraperitoneal route is the most popular either by the endovesical or extravescical method or a combination of both. As a rule, the endovesical method alone does not allow a radical extirpation of the diverticulum. The submucous endovesical method is recommended by some authors because it facilitates the preservation of ureters, but urograms and ureteral catheterization make the other methods equally safe. If the ureter is sectioned inadvertently, or if a part of it must be removed because it traverses the tumor, a reimplantation is not advisable. A nephrectomy, nephrostomy, or cutaneous ureterostomy is preferable.

Although not very efficient, x-ray therapy may be employed in advanced stages.

The prognosis of diverticular tumors is the same as that of other neoplasms of the bladder. In 1 case reported by the author a papilloma of the diverticulum was found concurrently with papilloma in another region of the bladder. In the 2 other cases a cancer of the diverticulum was present.

JOSEPH K. NARAT, M.D.

**Extravesical Radium Therapy in Cancer of the Bladder.** R. OGIER WARD. *Brit J Urol*, 1948, 20, 191.

A new technique is described for radium treatment of malignant bladder growths. To date, the author has used it in 6 cases, 5 of which are reported. By this method, radium needles are brought into apposition with the neoplasm by implantation into the outer layers of the bladder wall without necessarily opening the bladder.

A complete preliminary study of the urinary tract, including cystoscopy and biopsy, is made routinely. The size, shape, and position of the growth are recorded to facilitate the extravescical placement of the radium needles at operation. The operating team includes a physicist to determine the dosage. At operation the bladder is mobilized and as the needles are placed in position from without, through a site determined to correspond to the intravesical site of the tumor, a continuous cystoscopic check is made to prevent penetration of the cavity by the needle. If penetration does occur, the needle must be withdrawn to an area within the bladder wall to prevent the formation of a fistula.

In this technique the bladder surface can be studied cystoscopically beforehand, the base of the tumor palpated, and the presence or absence of extravescical extensions can be seen at operation. Irradiation is given in maximum intensity to the base of the tumor, the part from which the most dangerous spread usually occurs. In the standard transvesical technique it is obvious that although the vesical surface of the tumor is in view, no estimate either of its thickness or of its extensions is possible.

No excessive claims are made for this method of treatment. In 2 instances dramatic palliative results were achieved which obviated the need for a mutilating operation. It is noted that in both of these cases there were no extravescical extensions.

ALLAN K. SWERSIE, M.D.

## GENITAL ORGANS

**Cancer of the Prostate and Its Hormonal Management** (Das Prostatakarzinom und seine hormonale Behandlung) EGON WILDBOLZ. *Deut med Wschr*, 1948, 73, 305.

The author is of the opinion that the understanding of the hormonal effect upon the cancers of the prostate gland has completely changed the general attitude toward this disease. He quotes a personal communication from Deming, to the effect that tissue transplants of carcinoma of the prostate will grow in the anterior chamber of the eye of male mice, but not in female mice unless they receive massive doses of testosterone. The chemical similarities between vitamin D and the estrogenic substance has led him to try this vitamin. He has observed a definite beneficial therapeutic effect.

Studies were carried out to observe the morphological changes in estrogen therapy. It was noted that there is a vacuolization of the cancer cells, shrinking of the nuclei, and a definite reduction in the mitotic figures.

In discussing the clinical aspects the author praises the value of the phosphatase determinations. These have helped both in the diagnosis and in the evaluation of the therapeutic effects.

The results of therapy are based upon a study of 77 cases. In 47 of these there was histologic proof of the diagnosis. Of the 77 patients, 60 were treated

with hormone therapy. The usual dosage was 5 mgm of stilbestrol per day. This was reduced to from 1 to 3 mgm as soon as the symptoms disappeared. Castration also was employed in a good many cases. The author believes that this is not sufficient as there is a return of androgen in the blood after a period of time. This may have its origin from vicarious manufacture of the hormone in some of the other glands of internal secretion, probably the adrenal. The author thinks that all of this therapy should be held in abeyance until symptoms other than those of urinary obstruction make their appearance. The obstruction can usually be managed by transurethral resection. One of the patients has survived 10 years with nothing other than several transurethral resections.

As the hormonal therapy is proving its worth it is creating a new approach to both the therapy and the knowledge of prostatic cancer. Yet it does not appear to be curative, so that selected cases should still be treated by radical perineal prostatectomy.

WILLIAM C. BECK, M.D.

### MISCELLANEOUS

**Incontinence of Urine Caused by Dysplasia of the Vesical Neck, with Paradoxical Vesicoureteral Reflux. Nephroureterectomy and Young's Operation. Classification of Urinary Incontinence.** (Incontinência urinária por displasia do colo da bexiga com refluxo paradoxal vesico-ureteral. Nefroureterectomia e operação de Young. Classificação da incontinência urinária.) GUERREIRO DE FÁRIA *Hospital*, Rio, 1948, 34: 795.

Complete incontinence of the urine caused by dysplasia of the neck of the bladder, a vesicoureteral reflux, and megaloureter were observed by the author in a man, aged 22 years, who was born with a meningoencephalocele, lumbosacral spina bifida, deformities of the spine and the pelvis, paralysis and atrophy of the right lower extremity, and incontinence of the urine and feces.

Intravenous and retrograde urography established the diagnosis of vesicoureteral reflux on the left side, congenital left hydroureter, and voluminous uronephrosis. The affected ureter and kidney were removed through a double incision, lumbar and pelvic. After the operation the pyuria disappeared and the incontinence became less pronounced. One and one-half years later the internal sphincter was repaired according to Young's technique. A follow-up study showed complete recovery of the bladder function.

JOSEPH K. NARAT, M.D.

**The Treatment of Urinary and Genital Tuberculosis with Streptomycin.** FREDERICK LLOYD, GEORGE BAUMRUCKER, and OLIVER STONINGTON. *Surg Clin N America* 1948, 28: 1639.

In an attempt to evaluate the effectiveness of streptomycin therapy in urinary and genital tuberculosis, the authors reviewed the cases of 23 patients who were treated with 1 gm. (in two divided doses of 0.5 gm. each) of this drug for a period of 120 days.

Sixteen patients completed the full course of streptomycin and were observed for periods of from 1 to 8 months following completion of the therapy.

The authors concluded from this series of patients that streptomycin is of very limited value when employed by itself in the treatment of urinary and genital tuberculosis in the male.

The symptomatic improvement that often accompanies its use is due to the temporary healing of the bladder lesions.

Renal tuberculosis with positive pyelographic findings does not respond well to streptomycin therapy, in fact, the destruction of the kidney may occasionally be accelerated by its use.

In the very early renal lesions with a low leucocyte count in the urine and with pyelographic findings, the response to streptomycin therapy may be excellent. A prolonged follow up (5 to 10 years) will be necessary to determine if actual healing has taken place.

Streptomycin has little effect upon lesions in the male genitalia, but it does cause prompt healing of scrotal fistulas.

When used in conjunction with surgical treatment, the drug will undoubtedly prove to be of tremendous value, for the partial healing effect will probably be enhanced by the results of operative treatment.

The healing of tuberculous lesions in the bladder that respond slowly after nephrectomy are occasionally accelerated by streptomycin therapy.

When the bladder lesions do not improve because the ureteral stump fails to heal following nephrectomy, the use of streptomycin should render a second ureterectomy a far safer procedure.

Loin fistulas and postoperative tuberculous wound disruption heal promptly when using streptomycin therapy.

CONRAD A. KULINY, M.D.

**Report of the Clinical Cancer Research Committee of the British Empire Cancer Campaign.** *Brit Empire Cancer Campaign*, 1947.

The Clinical Cancer Research Committee has submitted an exhaustive clinical compendium of 50 pages comprising a detailed statistical analysis of 156 cases of cancer of the kidney, 451 cases of cancer of the bladder, and 399 cases of cancer of the prostate.

Tumors of the kidney comprised 144 primary lesions and 12 recurrent lesions. Except for the teratomas, which were equally distributed among males and females, the majority of these tumors occurred in males (2 or 3 males to 1 female). The mean ages were from 57.0 to 58.6 with no statistically significant differences between the groups, except in the case of teratomas in which group the mean age was 32 years. No relevant causative factors were found on investigation of the patient's occupation, heredity, or past history. Hematuria was the commonest initial symptom, except in patients with teratomas, in whom the discovery of a tumor often preceded the onset of any symptoms.

In 10.5 per cent of patients with carcinoma, the primary lesion was silent and the first symptoms no

ticed were those due to metastases. While three-fourths of the patients had consulted a doctor within the first 3 months, and as many were immediately referred to the hospital, one-fourth were found to have recognizable metastases on admission. Nephrectomy was performed in 42.1 per cent of the patients with carcinoma, in 75.0 per cent of patients with teratomas, and in 71.0 per cent of those with growths in the pelvis of the kidney. Seventy-six patients were operated on with a mortality of 13.2 per cent. In cases in which the treatment consisted of complete nephrectomy with removal of fat and fascia and with or without x-ray therapy, the 5 year survival was 34.5 per cent. In cases in which the kidney alone was removed with or without adjunctive radiation therapy, the 5 year survival was 26.9 per cent. There were no 5 year survivals among those cases in which radiation therapy alone was employed. No statistical difference was found to exist among the cases of hypernephroma and carcinoma. The number of cases in which metastases developed before discovery of the primary tumor, and operability and survival rates were similar.

Tumors of the bladder comprised 423 primary lesions and 28 recurrent lesions. The ratio of males to females was 3 to 1. The mean age of the males was 63.5 years, and of the females 65.9. A statistical difference was found to exist in the occupational levels, a higher preponderance was observed in the skilled worker class. The past histories were irrelevant, however, 16.1 per cent of the patients had had treatment for previous attacks of hematuria which had been diagnosed as papilloma of the bladder. Painless hematuria was the first symptom observed in 69 per cent of patients, and other urinary symptoms were observed in 26 per cent. The initial symptoms were those caused by metastases in 1 to 2 per cent of cases, and discovery by cystoscopic examination of a symptomless primary tumor occurred only 3 times (0.7 per cent). In spite of the incidence of hematuria, only 54.4 per cent of the patients consulted a doctor within the first 3 months, 15 per cent of patients had had symptoms for 6 months or more before consulting a physician. Cystoscopy was performed in 82.3 per cent of all patients, in 82.5 per cent of cases the tumor was considered to be malignant, in 82.0 per cent of the patients normal kidney function was present, 170 of the tumors were of the papillary type, 2 were myxosarcomas, and the remainder were infiltrating carcinomas, 79 lesions ex-

tended beyond the bladder, there were 14 cases of distant metastases. One hundred and eleven patients with papillary carcinoma underwent radical therapy, with an operative mortality of 13.5 per cent and a 5 year survival rate of 29.7 per cent. Of the infiltrating carcinomas, radical procedures were possible in 69 cases, with an operative mortality of 18.8 per cent and a survival rate of 14.5 per cent. Radiotherapy alone, which was used in 24 cases of papillary carcinoma and 36 cases of infiltrating carcinoma, gave survival rates of 8.3 per cent and 2.8 per cent, respectively.

Prostatic tumors comprised 399 cases in the survey, of which 383 were primary, and 16 were recurrent. The mean age was 67.4 years and the maximum incidence was in the age period from 65 to 70. There was no statistical difference in the occupational study, or in the past history of patients. The first symptom of the disease was difficulty or frequency of micturition in 60 per cent of patients, however, in 21 per cent of patients the first symptom noticed was referred pain or other symptoms pointing to the possible presence of a metastasis. In 53.5 per cent of the cases the patient consulted a doctor within the first 3 months, but in about 20 per cent of cases the disease had existed for more than 6 months when the patient was first seen, 58.3 per cent of the patients were referred to the hospital at once, but 17.3 per cent were kept under symptomatic treatment for more than 3 months. On admission, 27 per cent of the patients had clinically recognizable metastases of which 81 per cent were bony metastases. So called radical operations were performed on 38 patients, in 24 of whom the diagnosis of malignancy was made by means of the microscope, after an enucleation operation for a supposedly benign condition had been performed. The operative mortality for the so called radical operations was 7.9 per cent. Transurethral resection was performed on 44 patients, with an operative mortality of 15.9 per cent. In the advanced cases, suprapubic cystostomy alone carried an operative mortality of 22.6 per cent, but the expectation of life was raised thereby, from 31 per cent (which was the level among the untreated patients) to 49.3 per cent, according to the stage of the disease. Radiotherapy achieved about the same results. Estrogenic therapy had not been introduced at the time these cases were registered.

PETER L. SCARDINO, M.D.

# SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

## CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC

### Giant Cell Tumor of the Sacrum A Case Report RALPH F. BOYERS *Ann Surg*, 1948, 128: 1164

The author presents the case report of a giant cell tumor of the sacrum in a 29 year old white male who had fallen from a truck about 7 months before admission to the hospital. One week after falling he noticed pain in the lower back in the sacral region, and 3 weeks later he noticed slight swelling in that region. Pain was accentuated by prolonged sitting. For 3 or 4 months prior to admission to the hospital he noticed numbness in the posterior aspect of the left leg. There was approximately 40 pounds of weight loss with illness.

Physical examination revealed a well developed, undernourished, white male with findings limited to the lower back and rectum. There was a large, ovoid, pulsating swelling located centrally in the region of the sacrum. Over the mass were many dilated blood vessels and there was slight tenderness to palpation. Rectal examination revealed a protrusion of the sacral mass against the rectal wall, displacing the rectum anteriorly. Pulsation could be felt by the examining finger.

Röntgenograms showed the entire sacrum, with the exception of the proximal end, to be destroyed, replaced, and expanded in all diameters with a thin shell of subperiosteal new bone remaining irregularly distributed over the surface of the tumor and a few strands of bone remaining with it. The coccyx was partially destroyed.

Several roentgenologists were consulted but each was hesitant, due to the pulsating nature of the neoplasm and fear that too much radiation would be necessary. Surgery was therefore decided upon although it meant the sacrifice of sacral segments II, III, IV, V, and the coccyx, and all the sacral nerves below the first.

The first operation was done with the patient in the prone position. The vascularity was so great that after 5 hours of operating time the procedure was abandoned and the skin closed. The patient recovered rapidly and in approximately 3 weeks a left rectus incision was made near the midline. After the common iliac vessels were exposed and occluded, cessation of the pulsations in the tumor was observed. Occlusion of the hypogastric vessels also completely stopped the pulsation. These vessels were doubly ligated and transected, and both common iliac arteries were occluded with umbilical tapes. The laparotomy wound was closed with through-and-through silver wire sutures and the patient was placed in the prone position. The old posterior wound was reopened and the cleavage plane at the coccygeal end was re-established. The tumor was then freed and removed with little bleeding. The

skin was closed loosely with drainage of the huge dead space. The first sacral nerves were intact but the remainder were necessarily sacrificed. The patient was again placed in position for laparotomy, the wire removed, exposure regained, and the tapes removed from both common iliac vessels. The abdominal wall was closed and the patient was returned to the ward in good condition.

Microscopic section showed this to be an extremely vascular but typical benign giant cell tumor with areas of bony tissue scattered throughout its substance.

The laparotomy wound healed per primam, but the sacral wound was finally healed by Thiersch grafting.

Upon discharge from the hospital, about 1 year after operation, rectal and urinary sphincters were not functioning, there was anesthesia over a small area perianally, and hypesthesia extending down the posterior aspects of both legs and in the heels. About 2 years and 3 months after removal of the tumor a questionnaire elicited the information that the patient performed light work around a small shop and his house, and claims that his legs "play out" after vigorous exercise. There is no control of urinary or rectal sphincters. A Cunningham clamp is worn and a constipating diet is followed. His weight is normal and his appetite good. Permanent cure of this benign tumor may now be expected.

RUDOLPH S. REICH, M.D.

### Developmental Coxa Vara A. B. LE MESURIER, J. *Bone Surg*, 1948, 30-B: 595

The present article is based on 15 cases of developmental coxa vara admitted to the Children's Hospital, Toronto, and 1 other case which was first seen at the age of 43 years.

Despite a fairly extensive literature, and probably because the condition is not common, its real nature and severity have seldom been recognized as soon as they should be, and treatment has not usually been started until there was marked deformity. The condition is characterized by the development, at the age of about 3 or 4 years, of a limp or waddle which is usually painless, and is progressive. A varying degree of coxa vara deformity is present on one or both sides, but the most striking feature is the roentgenographic appearance of a gap in the neck of the femur just distal to the epiphyseal line, together with a bend in the femoral neck at this level. This x-ray appearance is, in itself, almost sufficient to establish the diagnosis of coxa vara deformity as soon as the patient is first seen.

In the treatment of late cases, unless the deformity is very severe, limitation of abduction can be overcome and shortening can be reduced by osteotomy between the trochanters, or below them, the lower fragment being abducted widely.

This operation was performed on 12 hips. The osteotomy united rapidly and the limp either disappeared or was much improved. Besides overcoming deformity, the gap in the bone healed completely within a year and in a much shorter time than would have been possible without operation, with a single exception. In the one case in which the gap failed to heal, the fragments probably were not abducted widely enough. At the end of 2 years the gap was still open and the deformity of the neck had increased. Recently another osteotomy was performed on this patient with more abduction of the fragments.

In the early cases, the most important thing is to close the gap before deformity becomes disabling and it would seem better, if possible, to do this without osteotomy, which may distort the mechanics of the hip. Since healing of the gap after osteotomy seemed to be due to elimination of the shearing forces, it was thought that the same result might be obtained by insertion of a Smith-Petersen nail. This was done in one hip of a patient. After a period of 11 months, the gap was still widely open. In the other hip of the same patient, a few days after nailing the first hip, a large drill was passed up the neck of the femur into the head, into this drill hole two tibial bone grafts, placed cortex to cortex, were inserted tightly. Eleven months after operation, the gap in the bone was pretty well healed, repair was much more advanced than on the side which had been treated with a Smith-Petersen nail.

Since then 2 other cases have been treated by grafting, in both the gap is healing well, one after 3 months and the other after 4 months. It would seem that this is much the best way to secure closure of the gap. The most striking thing about these 3 grafted cases (one with a nail in the other hip) is that all are walking and running normally and all have lost the limp they had before operation, although there has been no change in the degree of coxa vara deformity. It would appear that weakness or instability at the site of the gap in the bone is an important element of the limp, and that if the gap can be closed before the coxa vara becomes sufficiently severe to cause disability, the symptom should disappear.

RUDOLPH S. REICH, M.D.

**Patella Cubiti. A New Method of Treatment for Its Avulsion.** JOSEPH SACHS and GEORGE DEGENSHEIN  
*Arch. Surg.*, 1948, 57: 675

Patella cubiti is a condition of the elbow wherein a patella-like bone lies proximal to the olecranon process within the investments of the triceps tendon. A review of the literature reveals that less than 25 cases have been reported to date. The cause of the condition is a subject of much debate. There are two schools of thought—one, that the condition is a congenital anomaly, the other, that it is of traumatic origin.

The patient with patella cubiti is always asymptomatic except for mild limitation of extension which may go unnoticed. Discovery of this anomaly is

usually coincidental when other conditions require that roentgenograms be taken. Avulsion of a patella cubiti presents a definite clinical picture. The patient usually gives a history of extension force on the elbow, followed by pain and inability to extend it, on palpation, a moderate sized bony fragment may be felt posterior to the lower end of the humerus. The fragment is usually mobile and cannot be brought down to the elbow joint unless the elbow is extended.

Roentgenograms reveal a sesamoid bone which, when avulsed, lies perhaps 1 to 2 cm proximal to the olecranon, when not avulsed it lies immediately proximal to the olecranon and articulates with it. All edges of this bone are smooth. The most important (roentgenologic) diagnostic feature is the fact that the combined measurement of the ulna and the sesamoid is greater than that of the opposite normal ulna, or, in the case of a bilateral patella cubiti, longer than would be expected from the length of the related radius. This diagnostic feature will help differentiate patella cubiti from traumatic fractures or from avulsion of the olecranon process, with which it is sometimes confused.

In the report of a case submitted by the authors, a 21 year old white male was admitted to the hospital with a complaint of pain in the left elbow. On examination, the patient could flex but not extend the elbow. A clinical diagnosis of fracture with avulsion of the olecranon was made. A roentgenogram revealed the presence of a patella cubiti in the left elbow, measuring  $3\frac{1}{2}$  by 1 cm, and separated from the olecranon by at least 2 cm. Roentgenograms of the right elbow revealed a patella cubiti separated only 1 to 2 mm from the olecranon.

Open operation was performed. The distal end of the triceps tendon, after it enveloped the sesamoid, was torn from its olecranon attachment and markedly thinned out so as to prevent adequate suture. The articulating surfaces of the sesamoid and the olecranon were smooth, glistening, geographic, and were covered with a serous membrane, and they contained a sparse amount of hyaline cartilage.

A No. 32 self-tapping Sherman vanadium steel screw was introduced which firmly fixed the sesamoid to the head of the olecranon. The elbow was immobilized in plaster at a 90 degree flexion for 4 weeks. The wound healed per primam. The patient improved progressively and on follow-up visits to the clinic there was evidence of rapid return of extensor function, but a mild weakness of the extremity was observed.

The patient was then inducted into the Navy and he was hospitalized for complaint of weakness in the left arm. With rest and physical therapy, he gained progressively until approximately 1 year after operation when he was able to perform all functions with the elbow.

After a period of 3 years the arm with the avulsed patella cubiti has as much extension as, or even a little more than, the one on the opposite side, and there is no residual weakness.

RUDOLPH S. REICH, M.D.

**Knee Pain of Muscular Origin** (Muskulaer bedingte Knie-schmerzen) HERMANN RICHTER *Chirurg*, 1948, 19 451

It is well known that pain in the knee joint may be a result of abnormality elsewhere than in the knee joint itself. Familiar examples are the pain caused by hip joint disease, flat foot, bowlegs, absence of the metatarsal arch of the foot, and by other deformities of the leg and foot. In addition, there are numerous patients who complain of knee pain without demonstrable abnormality in the joint itself and without evidence of any of the conditions mentioned. In most of these cases there is some muscular insufficiency of the lower extremity resulting from muscular degeneration. The gastrocnemius muscle, particularly its medial belly in the middle and upper portions, is most frequently and most severely involved. Often there is muscular degeneration in the adductors, in the hip musculature, or in other muscles of the leg. These patients do not complain of muscular pain, but the indurated muscle segment may be palpable and may be sensitive to pressure, although deep lying muscular degeneration may not be palpable. Muscular degeneration may be a result of overstretching or of a rheumatic type of abnormality or both. In another group of patients with knee pain, localized tenderness may be found over the origin of the gastrocnemius muscle from the femur. The medial head is most frequently affected. This syndrome resembles epicondylitis.

Benefit may be obtained from treatment with adhesive strapping or other means of support and immobilization. Compression bandages applied to the affected muscles may help. Various modalities of physical therapy are beneficial. In severe cases bed rest or immobilization in a plaster cast may be necessary. If the condition appears to be related to occupational strain, it may be advisable to change the occupation. JOHN L. LINDBLUM, M.D.

### SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC

**Arthroplasty in Cases of Congenital Dislocation and Subluxation of the Hip in Children** (De l'arthroplastie dans les luxations et sub-luxations congenitales de la hanche chez le jeune enfant) HENRI LAFFITE and PIERRE SUIRE *J. Internat. chir.*, Bruxelles, 1948, 8 968

This report is based on 23 operations on 16 children with 10 subluxations and 13 dislocations. All of these children had control of urination and defecation. The youngest child was 5 years old. Preceding the operation, motion of the affected hip was encouraged.

Ollier's incision was used and carried down to the joint. The femoral head was reshaped and the acetabulum was made deeper to fit the femoral head. The capsule was sutured tightly. The bone graft was usually taken from the base of the trochanter, measuring 4 by 2½ cm., and it was between 4 and 5 mm. thick. The graft was removed downward

from the top and was fixed to the supra acetabular region with catgut. Penicillin was given routinely and immobilization was secured with plaster. The hip and knees were flexed about 20 degrees with the leg in 30 degree abduction.

GEORGE I. REISS, M.D.

### FRACTURES AND DISLOCATIONS

**A Study of Results Obtained in the Treatment of Fractures of the Lower End of the Radius in Insured Persons in Finland** OLLI VALTONEN *Ann. chir. gyn. fenn.*, 1948, 37 287

It is estimated that from 2,500 to 3,000 fractures of the lower end of the radius occur annually, in Finland. The author's study is based upon 425 cases which occurred in 1936, all of them in insured persons. Two-thirds of the patients were treated by general practitioners, and one-third were treated in outpatient departments or by specialists in surgery. The average duration of treatment was 46.2 days. The results of treatment were good in 72.5 per cent, fair in 10.6 per cent, unsatisfactory in 10.1 per cent, and poor in 6.8 per cent of the cases. Permanent disability did not exceed 10 per cent in any case. The normal anatomy was restored in 86.4 per cent of cases. Better results were obtained by specialists in surgery than by surgeons in outpatient departments or general practitioners. Good results were obtained by specialists in 81 per cent of cases and by outpatient department surgeons in 74.2 per cent, while general practitioners obtained good results in 69.7 per cent.

Good results were impaired by advanced age, failure of reduction, and prolonged immobilization. Three cases were complicated by rupture of the extensor pollicis longus.

DANIEL H. LEVINTHAL, M.D.

**Fractures of the Neck of the Femur** T. G. HUEZ *Hogg Med. J. Australia*, 1948, 2 593

The present article on fractures of the femoral neck has been divided historically into phases.

The negative phase was classified as that in which nothing constructive was done to reduce the fracture or maintain the reduction, with the result that non-union of fractures was the rule, and the mortality was high.

The abduction phase dates from about 1800, when Whitman reduced the fracture of the femoral neck, placed the limb in wide abduction and internal rotation, and then fixed the lower extremities in a plaster cast. From 40 to 50 per cent of the fractures united, although a stiffness developed in the knee joint. The blood supply to the head of the femur was impaired and it was difficult, with the plaster spica, to prevent rotation movements of the fractured area. The American Orthopaedic Association appointed a committee to study this method. The end results in 201 cases showed a primary mortality of 28 per cent and bony union in 30 per cent of the patients 12 months after injury.



The operative (nailing) phase had its new start in 1931 by Smith-Petersen. The results reported were as follows: mortality in 10 per cent of cases, bony union in 75 per cent, and nonunion in 15 per cent. In the second part of the third, or operative, phase subtrochanteric osteotomy was used (1941). The final results in 75 cases reported by the Royal British Infirmary showed bony union in 58.7 per cent, bony union and arthritis in 1.3 per cent, nonunion in 8 per cent, fibrous union in 13.3 per cent, and doubtful results in 10.7 per cent. Results in 50 consecutive fracture cases reported by King showed bony union in 37, nonunion in 3, death in 7, results unknown in 3.

At Launceston General Hospital 27 selected patients were operated upon for fracture of the neck of the femur. Three patients died, 7 were not traced, and 17 were examined 2 years after operation. Among the remaining 14 cases, there were 2 cases of nonunion, 6 cases of bony union with good results, and 6 cases of bony union with osteoarthritis.

RICHARD J. BENNETT, JR., M.D.

#### Partial Patellectomy in Fractures of the Knee

(Patelectomia parcial en las fracturas de la rótula)

ARNOLDO E. DIDIER. *Bol. Soc. cir. Rosario*, 1948, 15: 196

Preservation of knee function is the single standard required of any therapeutic measure for the treatment of patella fracture. The choice of suture material and other elements of repair are secondary. Prolonged immobilization of the knee joint often results in ankylosis or at least the development of adhesions requiring considerable physical therapy for their correction.

Total patellectomy obviates these difficulties, but the author believes partial patellectomy has further advantages and produces superior results. Partial patellectomy according to the Thompson technique permits re-establishment of the continuity of the tendon and ligament without the inconvenience of total patellectomy.

Twenty cases are reported. In the last 4 the Prince and Stein modification was employed. This consists in attaching the separated muscle and tendon ends to the under surface of the patella by a suture through the body of the patella.

STEPHEN A. ZIEMAN, M.D.

#### Refractures in Children (Ueber Refrakturen im Kindesalter)

ADALBERT BUETTNER. *Chirurg*, 1948, 19: 347

The author observed 37 cases of refracture through the original fracture line over a period of 20 years. These were usually refractures of the forearm bones. He found that the bones were most vulnerable between the third and fifth weeks.

Fracture through the epiphyses healed the fastest. Refractures healed somewhat slower, but those occurring in the metaphyseal region healed faster.

The degree of angulation of the fracture fragments was directly proportional to the delay in callus formation. Angulation in the lateral direction delayed

union especially. Usually lack of bridging callus on one side preceded the refracture. In adults, pain at the fracture site was an important sign. In children, however, pain was usually absent. The refractures were usually more severe than the original fractures. If a fracture occurred after firm union of the original fracture had been established it usually occurred at a different location. This type of fracture should be classified as a new fracture.

GEORGE I. REISS, M.D.

#### ORTHOPEDICS IN GENERAL

##### End Results of Excision of the Carpal Bones

JAMES K. STACK. *Arch. Surg.*, 1948, 57: 245

Inflammation of the wrist results in (1) capsular and ligamentous fibrosis, which is not confined to a single articulation because of the intercommunication of the various component joints of the wrist, (2) a cystic change in the carpal bones, especially those which bear the greatest functional burden, due to the hyperemia induced by the primary lesion, and (3) an arthritic change due to either a necrotic change in the articular cartilage or friction from the necrotic bones acting as a foreign body in the joint mechanism.

These changes may result also following removal of all or a part of one of the two portions of the scapholunate system which forms the intermediary joint between the capitate bone and the distal radius. In the readjustment which takes place following the excision the capitate tends to approximate the radial articular surface and displaces the remaining member of the scapholunate system, and the ligamentous strain causes inflammation. There will be, in addition, the scraping effect of cartilages working out of alignment.

Removal of a single bone or a large portion of one of them is not a good procedure, however removal of the lunate bone together with the navicular will result in no significant deviation, functional or cosmetic. Such a removal is really a very favorable type of arthroplasty, all of the remaining surfaces being covered with articular cartilage. If fibrosis has already become established the operation will probably not overcome it, but pain will be relieved and a stable, useful range of motion may be expected.

The author presents 9 wrists which have been treated by excision of the scaphoid and lunate bones, and these are the basis for this article.

NEWTON C. MEAD, M.D.

##### Congenital Discoid Meniscus

I. S. SMILLIE. *J. Bone Surg.*, 1948, 30-B: 671

Twenty-nine congenital discoid menisci were encountered by the author among 1,300 meniscectomies performed between 1941 and 1948.

These menisci are classified as follows: (1) primitive—the very large, complete discs, (2) infantile—approaching the normal meniscus, and (3) intermediate—the type of abnormality found between (1) and (2).



The relative thickness of the periphery and central margins of discoid menisci does not, on the whole, differ greatly from that of cartilages unrelated to the classification

Injuries or sequelae sustained by the primitive discoid cartilage may be summarized as (1) a plane of cleavage or splitting ensues in the structure of the fibrocartilage between the undamaged superior and inferior aspects (2 in the 29 cases), (2) longitudinal tears are superimposed, usually on the inferior surface (4 cases), (3) the inferior surface is worn away and a shallow crater is produced, (4) both inferior and superior aspects are worn away, thus producing a defect (hole) in the center of the disc (2 cases)

The author, as well as other writers, has alluded to the "snapping knee." No one has precisely commented on the mode of origin. It is the author's opinion that one or more ridges develop on the superior aspect of discoid fibrocartilage and that somewhere between slight and full flexion of the femoral condyle, the acoustic phenomenon is elicited by virtue of a sudden forward excursion of the disc. Other causes of snapping are osteochondritis dissecans, impingement of the same on the tibial spine, and unstable knee joint

The intermediate disc differs categorically from the primitive in that it is less massive, less complete, and is thin at the central zone to the point of transparency. In addition to these principal differences, the intermediate disc is characterized by two notches in the central (thin) zone. Injuries of the intermediate disc are peripheral or extraperipheral longitudinal tears, which do not differ from those found in the lateral menisci, of noncongenital variety

The infantile disc varies from the normal lateral meniscus in increased breadth of its middle segment. It is comparable to one found in a full-term fetus. Six such cases were encountered in the series. Injuries sustained in this group of congenital menisci were those of incomplete transverse or oblique tear involving the lateral cartilage

Nine cases of cystic degeneration of the menisci were encountered in the series. Five were associated with primitive discs and 4 with infantile specimens. Trauma is said to be a factor

Although primitive medial menisci are said to be rare, the author describes one case reported in the literature and adds one of his own. These are the only cases of medial menisci described to date

SAMUEL L. GOVERNALE, M D

**Knee Joint Changes After Meniscectomy** T J FAIRBANK *J Bone Surg*, 1948, 30-B 664.

Radiological studies among 80 medial meniscectomies showed ridge formation involving the femoral condyle in 43 per cent of patients, narrowing of the interarticular space in 32 per cent, flattening of the femoral condyle in 18 per cent, and no change in 33 per cent of the cases. Lateral meniscectomy was performed in 27 cases. Little or no change was observed in 50 per cent, ridge formation of the homolateral femoral condyle was found in 7 per cent, while

narrowing was found in 40 per cent, and flattening in 17 per cent of the cases

The present investigation demonstrates that sustained weight-bearing in a meniscectomized patient results in circumferential compression and/or spread of a condyle devoid of a meniscus. The adverse cartilaginous change may ensue from increased friction, and from nutritional and mechanical factors due to interarticular overload

In conclusion, the author maintains that the formation of a ridge, narrowing of the joint space, and flattening of the femoral condyle are attributable to loss of weight-bearing function of the meniscus. Furthermore, meniscectomy is not wholly innocuous and may predispose to early degenerative changes in the joints

SAMUEL L. GOVERNALE, M D

**The Etiology of Peroneal Spastic Flat Foot** R I HARRIS and T BEATH *J Bone Surg*, 1948, 30-B 624.

There has been wide acceptance of the thesis that spastic flat foot is caused by peroneal muscle spasm induced by painful stimuli arising from the tarsal joints. This is brought about by the abnormal stresses thrown upon these joints during the flexible phase of these weak, flat feet

This theory does not explain why in many cases electromyographic studies indicate that no spasm of the peroneal muscles exists. Instead, these muscles have become shortened by adaptation to long-continued deformity, and the condition is not corrected by novocain block of the peroneal nerve, section of the nerve, or by anesthesia and cure in many cases. The author thinks that the spastic flat foot is probably congenital in origin and rigid from the onset. He believes that most so called "peroneal spastic flat feet" are due to tarsal anomalies, usually a talocalcaneal bridge of bone or a calcaneonavicular bar

A series of 17 cases of peroneal spastic flat foot, which have been studied in the last 2 years, have presented a talocalcaneal bridge in 12 instances, a calcaneonavicular bar in 3 instances, and rheumatoid arthritis in 2 instances

The talocalcaneal bridge can be well demonstrated with roentgenograms but only by means of a special positioning technique (Figs 1 and 2) which will show the joint between the sustentaculum tali and the neck of the talus in a normal foot but not in a foot with a talocalcaneal bridge. Lateral x-ray projections will show marginalipping of the talonavicular joint on its dorsal surface due to abnormal motion and strain at this point secondary to the limitation of movement in the subtalar joint

Anatomists have attributed the talocalcaneal bridge to the fusion of the "os sustentaculi" to both the calcaneus and the talus, and it may be of either bone or "gristle." How this forces the calcaneus into the valgus position is obscure. This condition is probably often diagnosed as a congenital equinovagis deformity. There may be surprisingly few symptoms despite severe deformity. The calcaneonavicular bar may be present and associated



Fig 1 (Harns, Beath) Radiographic projection necessary to reveal talocalcaneal bridge. The central x-ray beam is projected downward and forward at an angle of 45 degrees, through the heels which have been freed of the leg shadow by flexing the knees



Fig 2 Roentgenogram obtained by the technique depicted in Figure 1, in a patient who had a talocalcaneal bridge on the left side (A). On the right side (B), which is normal, the joint between the sustentaculum tali and the neck of the talus can be seen

with neither deformity nor symptoms. When symptoms are present they usually consist of severe deformity, pain, and weakness. At other times symptoms follow a wrenching injury of the foot which avulses the calcaneus from the navicular. These symptoms subside with rest but reappear if early exercise is permitted.

Rheumatoid arthritis with peroneal spastic flat foot is entirely different from peroneal spastic flat foot with tarsal anomalies. To describe its true nature, it should be referred to as "arthritic flat foot with peroneal spasm." The orthopedic treatment of these cases may require manipulation under anesthesia to correct the deformity, and plaster casts to

maintain the correction. The Whitman type of foot supports is useful.

Treatment of the rigid flat foot with tarsal anomalies is usually surgical, i.e., fusion of the subtalar and talonavicular joints is usually required. The author performs this operation through a medial incision in order to expose and remove the synostosis, which he believes is essential. In severe cases a lateral incision also is required to lengthen tight tendons.

In children too young for fusion of the tarsal joints, it may be necessary to resort to manipulations under anesthesia followed by corrective plaster casts. Whitman plates may give the necessary support in less severe deformities. NEWTON C. MEAD, M.D.



In selected cases arteriotomy and removal of the thrombus, followed by heparinization, may permanently re-establish the circulation

In venous thrombosis the author limits the use of heparin to patients whose general condition contraindicates the operation and to those in whom thrombosis is confined to the lower leg, because ligation of the popliteal vein may augment the obstruction. Ligation of a major vein just above the thrombus should be supplemented by the administration of heparin. In selected cases ligation above and below the thrombus, in order to prevent its spread in either direction, may prove beneficial.

The author performed thrombectomy in 4 cases of acute venous thrombosis, in 2 the results were excellent while in the other 2 the thrombosis recurred after cessation of the heparin treatment. The corresponding artery is temporarily clamped, the vein is incised, a circular compression is applied from the foot in the proximal direction, and the arterial clamp is released.

The author advocates more extensive use of arteriography or venography, respectively, in vascular occlusions.

JOSEPH K. NARAT, M.D.

#### Unexplained Thrombosis of the Internal Carotid Artery

H. R. I. WOLFE *Lancet*, Lond., 1948, 2: 567

The case is reported of a 26 year old white female, apparently in good health, who suffered an acute onset of severe temporal headache, muscular collapse without loss of consciousness, and aphasia and weakness of the right arm. Three days later weakness of the right leg occurred, after which she enjoyed a gradual but incomplete recovery. Nine days after the onset, arteriography revealed thrombosis of the internal carotid artery and periarterial stripping was carried out at the same time. Because of gradual deterioration of the condition a superior cervical ganglionectomy was performed on the left side 11 months after the onset, and the left external and internal carotid arteries were divided between ligatures. A firm white thrombus, incompletely canalized, occluded the internal carotid artery. Eighteen months after the onset there were slight mental deterioration and aphasia, and remnants of hemiplegia were observed on the right side.

Syphilis, tumor, arteriosclerosis, thromboangitis, berry aneurysm of the circle of Willis, early Christian Schueller's disease, minute injury to the vessel because of muscular exertion or abnormally developed fascial bands, and cardiovascular disease are mentioned as possible causes of the lesion on the basis of 32 cases reported elsewhere. The transient

nature of the early signs and symptoms, and the usual progressive later course are suggestive of cerebral vascular disease, but arteriography is necessary for the precise diagnosis.

Neither heparin nor dicumarol seems to have been used in the cases reported in the literature and the author suggests that if the diagnosis in his case had been determined earlier, alteration of the clotting time might have prevented further extension of the thrombus. In about half of the 33 cases reported in the literature and diagnosed by arteriography, there has been a gradual amelioration of the symptoms. There were 7 deaths, 2 being due to intercurrent infection.

ALLAN D. CALLOW, M.D.

#### Histopathologic Contribution to Our Knowledge of Buerger's Disease (Obliterating Thromboangitis)

(Contributo istopatologico alla conoscenza del morbo di Buerger (Tromboangiite obliterante))

ALFONSO TROJANIELLO *Ann. Ital. Chir.*, 1948, 25: 555

Histologic studies made by the author on two lower extremities which had been amputated because of gangrene due to Buerger's disease led to the following conclusions:

Inflammation, presumably of an infectious character, is an important factor in the pathogenesis of Buerger's disease. Usually a constitutional organic condition is present.

As a rule, the initial changes in the intima of the affected blood vessels are of a degenerative and proliferating character. Gradually a parietal thrombus develops. The second phase of the condition is characterized by cellular infiltration, with endothelial, polynuclear, histiocytic, and lymphocytic formations participating in the process. The changes lead to the organization of a thrombus. A new formation of blood vessels contributes to canalization of the thrombus, which may result in a partial re-establishment of the circulation through the obstructed blood vessel.

The veins accompanying the arterial trunk, and the fibrous sheaths participate in the process. A new formation of blood vessels tends to create a collateral circulation and may thus be regarded as a functional compensatory factor.

The proliferative process involves also the perineurium, endoneurium, and the vasa nervorum.

The author's findings emphasize the importance of the vascular spasm in the thrombotic process. Such spasm accentuates the ischemia of tissues which eventually may cause gangrene.

JOSEPH K. NARAT, M.D.

# SURGICAL TECHNIQUE

## ANTISEPTIC SURGERY, TREATMENT OF WOUNDS AND INFECTIONS

**Rapid Disinfection of Clean Unwashed Skin** A D GARDNER and E VINCENT *Lancet*, Lond., 1948, 2 760

There is little object in using slow methods of disinfecting skin in preparation for surgery when more rapid methods are as good or better. In some emergencies, moreover, rapid skin disinfection is indispensable. Thus, experiments were carried out to test the effectiveness of various agents on areas of the shaven, but not specially washed, skin of the forearm which were infected with the *Pseudomonas pyocyanea*, in most cases. Agar plates were employed to culture such areas of infection as well as control areas.

These studies revealed that 1 per cent iodine in 70 per cent ethyl alcohol was effective in the least time taken for the disinfectant to dry on the skin, i.e., 15 to 20 seconds. If the solution was allowed to act in the wet state for 30 seconds, 0.5 per cent iodine was found to be sufficient. No iodine was necessary when the interval was extended to 2 minutes, 70 per cent alcohol alone serving adequately. The detergents, zephiran 30 per cent, and cetrimide 10 per cent, both in 70 per cent ethyl alcohol, were found, in 30 to 45 seconds, nearly to equal the performance of alcoholic iodine as rapid disinfectants.

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DAVID H. LYNN, M.D.

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Advantageous results are reported following the use of this method in 127 consecutive operations performed upon 55 patients. The necessity for diligent vigilance in the successful employment of this method is emphasized. Patients of this type usually have a diminished respiratory reserve and it is essential that they be protected from the potentially depressant qualities of this combination of drugs.

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by the blood count, sedimentation rate, and kidney function, including the tests for nonprotein nitrogen or blood urea nitrogen, clearance of phenolsulfonphthalein, and the presence of albumin, sugar, casts, and cellular elements, the dosage of bacitracin, both systemic and local, the symptoms and signs of infection before and during treatment, the time relationship of any surgical procedure, the blood levels, the percentage of bacitracin excreted in the urine, a complete bacteriologic analysis of the infection before, during, and after treatment and the results obtained.

It was hoped by these investigators that the value of bacitracin could be demonstrated in those cases in which the antibiotic was superior to other forms of treatment.

The results obtained by the systemic administration of the new antibiotic, for the most part in those patients who had failed to respond to the sulfonamides and to the other antibiotics, revealed a wide diversity of conditions.

There was an overall favorable response in about 70 per cent of these cases, and in about one-fifth of them the results were dramatic.

Three cases of extensive progressive bacterial synergistic gangrene were of particular interest in that these patients responded within 72 hours and recovered without the necessity for surgical excision. In the three largest groups of patients, namely, the "cellulitis," "deep abscess," and "infected accidental wound" groups, favorable results were obtained in 78 per cent of the cases.

In the group with dramatic results, the causative organisms were for the most part in the staphylococcal and streptococcal groups. In the latter classification were found hemolytic, nonhemolytic, microaerophilic and anaerobic streptococci. In a considerable number of staphylococcal strains, the authors found a resistance to penicillin and a susceptibility to bacitracin.

In 14 per cent of the cases the results were questionable, and in a slightly higher percentage the results were frankly nil. In most of these cases the causative organisms were resistant to bacitracin.

In the majority of the patients studied in the whole series, there was a transient albuminuria which disappeared either during continued treatment or soon after treatment was discontinued.

Some of the later preparations of bacitracin have shown evidence of nephrotoxicity. Thus, the authors have suggested that when the presently available bacitracin is used systemically, there should be repeated tests for dysfunction of the kidney, and treatment should be discontinued if there is any indication of serious damage.

However, with doses which are not damaging to the kidneys, favorable and sometimes dramatic results should be expected in surgical infections caused by organisms which are susceptible to bacitracin. As has been indicated, these organisms include a wide range of bacteria and are commonly found in surgical infections.

JOHN E. KARABIN, M.D.

# SURGICAL TECHNIQUE

## ANTISEPTIC SURGERY, TREATMENT OF WOUNDS AND INFECTIONS

**Rapid Disinfection of Clean Unwashed Skin** A D GARDNER and E VINCENT *Lancet*, Lond, 1948, 2 760

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is used in a 0.1 per cent concentration, with or without the addition of epinephrine, in a 1 to 11,000 to 1 to 21,000 concentration. It is believed that pontocaine, when given in dilute solution, is relatively non-toxic and possesses physical properties which accurately control its spread within the subarachnoid space. The anesthetic is prepared by dissolving the pontocaine hydrochloride crystals (niphonoid) in distilled water. The pH of this solution is 5.6 and its specific gravity at 37 degrees is 1.003 and at 45 degrees is 1.001. It produces maximum sensory analgesia with minimum anterior motor block.

With the patient placed in a prone position, the needle was introduced into the subarachnoid space and from 7 to 15 c.c. (average, 10 c.c.) of the 0.1 per cent pontocaine solution was injected. To this was added epinephrine in a 1 to 11,000 concentration, which combination gave satisfactory anesthesia for a period of 3 to 4 hours or more.

A noteworthy feature of spinal anesthesia induced with the smaller doses of hypobaric pontocaine was that tension produced by the surgeon on a nerve root often gave rise to pain over this area of distribution. This often aided in the location of pain similar in character and distribution to the pain complained of preoperatively. In the series of 135 patients treated in this manner there were no severe complications or sequelae directly attributable to the method.

MARY KARP, M.D.

**Spinal Epidural Block** ELIAS D. LAWRENCE *Anesthesiology*, 1948, 9: 601

Epidural block is a valuable method of anesthesia that has been neglected in this country because of an incorrect impression of its difficulties and dangers. The author hopes that the present article will stimulate an interest in the use of this block for the relief of pain. His work confirms previous reports that there is no negative pressure in the epidural space. He reviews the essential anatomy of this space and describes a technique for performing epidural block. The apparatus includes a special needle which has a large bore and a blunt bevel point.

MARY FRANCES POE, M.D.

**The Problem of Anesthesia in Switzerland** (Le problème de l'anesthésie en Suisse) P. DECKER *Helvet. chir. acta*, 1948, 15: 423

There is no doubt that, in the matter of inhalation anesthesia, the Anglo-American surgical clinics are much more advanced than most of the clinics of continental Europe, and some of the most important developments of surgery during the past few years are connected with the progress of inhalation anesthesia made in the Anglo-American countries. The reason for this superiority lies in the fact that in those coun-

tries the anesthetics have long since been performed by specialists who devote all of their time to this work. Some are licensed physician anesthetists, but the greatest number are specially trained nurses. In Switzerland there are no such specialists and it would take a long time to develop them. In addition, there is another problem: whereas in the large clinics of England and America a constant stream of operations are going on throughout the day, in Switzerland nearly all operations both at the hospital and in town are performed in the morning, with the result that if a specialized anesthetist would work at the hospital, the modest salary which he would receive would not amount to a living, and if he would work in town the hospital services would be without an anesthetist. Undoubtedly a few specialists would be able to earn a living in the largest cities, but this would not solve the problem of modern anesthesia for the country at large.

In continental Europe the surgeons have developed, to the limit, local anesthesia which is non-toxic and nonasphyxiating, yet allows long operations. Local or regional anesthesia and inhalation anesthesia each have their advantages and their indications; those of local anesthesia are numerous.

With regard to inhalation anesthesia, if the intervention is short in a subject who is in good health and whose respiratory apparatus remains outside the operative field, the procedures used up until the present in Europe—semi-closed ether and even chloroform—can still be utilized without inconvenience to the patient. Nitrous oxide is excellent for induction, but also for the complete operation if it is not too long (from 1 to 2 hours), if respiration is not impeded, and if the circulation is not deficient. For the remainder of surgery, including all chest operations with open pleura, closed circuit ether-oxygen anesthesia, with or without an intratracheal tube, is believed to be sufficient and is the least dangerous for the patient.

Local anesthesia may be carried out by the surgeon's assistants who may also attend to semi-closed ether anesthesia, but nitrous oxide and closed circuit ether, with or without an intratracheal tube, must be administered by specialized anesthetists. The author believes that intelligent nurses who are well trained and have the necessary character for the work could administer anesthetics as well as some anesthesiologists who are scientists rather than practicing anesthetists; consequently it is not necessary to reorganize completely the anesthetic services to enable Swiss surgeons to apply, under favorable conditions, their newly acquired surgical knowledge. On the other hand, the use of cyclopropane and curare must be left to physicians.

RICHARD KEMEL, M.D.

# PHYSICOCHEMICAL METHODS IN SURGERY

## ROENTGENOLOGY

**Rotary Kymography at 100 Revolutions** (La kimo grafía rotatoria a centros múltiples, dos años de vida de mi método kimográfico) MARIO LENZI *Radio logia, B Air, 1947, 10 83*

Lenzi describes his method of kymography and the results obtained after a number of years' study in this type of work. It is possible to outline the contour of the heart with mathematical precision, as well as other moving organs of the body. This would include the diaphragm, stomach, aneurysms, pulmonary cavities, and the like. The method employed requires considerable knowledge of mathematics and physics, hence the ordinary practitioner or roentgenologist will find considerable difficulty in obtaining exact quantitative measurements. The basic principle of the machine is founded on a rotary grill, the speed of which is known as well as the distances between the radiant spokes.

STEPHEN A. ZIEMAN, M.D.

**Diagnosis of Pulmonary Stenosis by Angiocardiography** MERL J. CARSON, THOMAS H. BURFORD, WENDELL G. SCOTT, and JAMES GOODFRIEND *J. Pediat, S. Louis, 1948, 33 525*

The authors have found angiocardiography of considerable aid in establishing, more exactly, the diagnosis in several types of congenital cardiac anomalies, and of particular value in differentiating the various types in which cyanosis is a prominent symptom. The method has proved applicable to patients of all ages, including infants and children so small that cardiac catheterization is impractical.

An autograph capable of making 10 radiographic exposures within 10 seconds is used. The patients are fasted for 4 hours before the procedure, but those with cyanosis and polycythemia receive subcutaneous fluids preoperatively to prevent dehydration, and are given oxygen during the period of anesthesia. Infants and very young children receive general ether anesthesia, for older patients, local novocain is sufficient.

An antecubital vein is cannulated after ligation of its distal portion. Patency is assured by a slow saline drip, and then a few drops of 70 per cent diodrast are injected through the cannula. If within several minutes no reaction has occurred, the final injection is made, i.e., from 10 to 18 c.c. of the contrast medium for infants 3 to 24 months of age, 20 to 30 c.c. for children of 2 to 10 years of age, and 30 to 40 c.c. for children between 11 and 15 years of age. The injection period should not be longer than 2 seconds, and injection should be begun immediately after the first roentgen exposure. The rest of the series of roentgenograms is made in quick succession during and immediately after the injection of diodrast.

The authors find the left anterior oblique and the anteroposterior views to be the two most useful views, and their article is accompanied by an excellent sequence of films of the normal in each position. The particular advantage of the oblique view over the frontal view is that in the former the shadows of the pulmonary arteries are separated from those of the aorta, such separation being essential in the types of cardiac abnormality in which the pulmonary artery and aorta fill simultaneously.

Angiocardiograms of 4 cases are presented, to illustrate the value of the method in differentiating various types of cyanotic congenital heart disease. Included are a nonfunctioning right ventricle with tricuspid stenosis, persistent truncus arteriosus, the tetralogy of Fallot, and the Eisenmenger complex. Autopsy proof cannot be offered, but 2 of the cases were explored surgically.

The electrocardiogram of a 1 year old cyanotic infant showed right axis deviation, and plain roentgenograms revealed decreased pulmonary ventricular markings, enlargement of the right ventricular salient, slight concavity of the region of the pulmonary conus, and a clear aortic window. A tentative diagnosis of the tetralogy of Fallot was made and confirmatory evidence was sought in the angiocardiograms. These revealed early filling of the left ventricle, which was believed indicative of an interventricular septal defect, small pulmonary conus, very small pulmonary arteries, and simultaneous filling of pulmonary arteries and aorta, suggestive of an overriding aorta. At operation there was evidence of pulmonary stenosis. It is pointed out that the decreased caliber of the pulmonary arteries in itself allows differentiation of the tetralogy of Fallot from Eisenmenger's complex, for in the latter condition the angiogram shows the pulmonary arteries to be of normal or increased size.

Angiocardiograms of a 16 months old cyanotic infant with cardiac enlargement showed the diodrast entering successively the superior vena cava, the right auricle and a very large right ventricle, from whence it appeared to spill over into the left ventricle, and visualized the beginning of a large common arterial pathway from which very small pulmonary arteries appeared to arise. These findings were interpreted as being those of an interventricular septal defect with persistent truncus arteriosus.

The remaining case was that of a cyanotic infant of 14 months in whom the opaque material failed to flow into the expected region of the right ventricle, and instead appeared to pass directly from the right to the left auricle and then into the enlarged left ventricle. Both the normal sized aorta and the small pulmonary conus appeared to come off the left ventricle and to fill simultaneously. It was concluded that the right ventricle was either absent or occluded from the circulation by an atretic tricuspid valve. At opera-

## MISCELLANEOUS

### CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

**Traumatic Shock and Curare** (Squasso traumatico e curaro) L IMPERATI, G D'ERRICO, and A RUGIERO *Gior ital chir*, 1948, 4 635

The authors studied the effects of curare on 10 rabbits and recorded the results in each experiment. Their objective was to determine the results produced upon the circulatory system and upon the blood concentration. From these experiments they derived the following practical information:

- 1 There is a great variability of individual tolerance to tubocurarine (Tubarine-Wellcome)

- 2 Through individual hypersensitivity, high dosage, or rapid administration, there can be produced a state of shock which may be severe enough to cause death, or other phenomena of severe central irritation resulting in convulsions and cardiac damage

- 3 In the majority of cases this drug can be given without any great repercussions, either hemodynamic or humoral

- 4 Curare must be given with great precaution as errors may cause very grave accidents

The authors recommend that curare should be given slowly and in small doses. Large doses or rapid administration of regular doses may be followed by central nervous phenomena manifested by tonic convulsions or by shock with drop in blood pressure accompanied by hemoconcentration and hyperproteinemia.

LUCIAN J FRONDUTI, M D

**Experimental Study of Wound Healing. A New Technique and a Study of the Effect of Detergents and of an Antacid on Wound Healing** S SCHEINBERG, S P BRALOW, and H NECHELES *Surgery*, 1948, 24 972

The authors devised a technique for studying wound healing by observing a standard punch-inflicted wound through a covering of transparent x-ray film supported by a lucite ring and sealed with methacrylate polymer solution. The guinea pig was the experimental animal and the authors believed that contraction of the wound was prevented by their technique.

Wound healing is expressed as the size of the healed area in per cent of the original wound. Some confusion arises since the tables are headed "Percentage Rate of Healing" but the conclusions drawn indicate that percentage of healing rather than percentage rate of healing is represented.

The experiment was designed to test the effect of detergents on wound healing—sodium lauryl sulfate (Dreft), tetramethylammonium-hydroxide (Triton NE), and alkyl-dimethyl-benzyl-ammonium-chloride (Zephiran) being used. Methyl cellulose was used

as a base because of its low absorbability and its transparency which tended to make observation of the wounds easier. A control on methylcellulose showed no statistically significant effect on wound healing.

In addition, one antacid (sodium carboxymethylcellulose) was tested alone and in combination with magnesium oxide, sodium bicarbonate, and sodium lauryl sulfate.

Variations in body weight, red cell count, hemoglobin, and total proteins, as well as low grade wound infections were found to be insignificant in their effect on wound healing as they occurred normally within the limits of this experiment.

The results of the experiment indicate a statistically significant improvement in healing with (1) 1 per cent sodium lauryl sulfate in methylcellulose, (2) 2 per cent sodium lauryl sulfate in methylcellulose, (3) sodium carboxymethylcellulose alone or in combination.

The authors do not draw conclusions concerning the specific reasons for the effects observed, and point out that the detergent action, the alkaline pH, and the presence of a good supporting base are at least factors which might be of importance.

JOHN H KAY, M D

**Infection. A Hospital Problem** SYDNEY D RUBBO *Med J Australia*, 1948, 2 627

A comparison is drawn between problems of infection in the hospital during the nineteenth century and those during the twentieth century.

Progress in surgery and obstetrics is shown to be due in part to the assimilation of the germ theory of disease.

The work of Lister and of Semmelweis on antiseptic treatment is briefly reviewed.

The importance of asepsis is stressed and the principles underlying this practice are defined.

The problem of infection in the hospital today is illustrated by an analysis of postoperative wound infections in 253 cases of radical mastectomy and by a brief description of an outbreak in the hospital of gastroenteritis due to *Salmonella* derby.

The problem of control of infection in the hospital is discussed under the following headings: the control of primary and secondary reservoir of infection, the use of physical and mechanical barriers against spread of infection, the development of increased host resistance by chemoprophylaxis and immunoprophylaxis.

An indication is given of how detection of carriers of infection should be incorporated into routine hospital practice.

A dressing technique applicable to surgical wards is described.

Oiling of floors and bedclothes is demonstrated as a most effective means of dust control.

The use of electrostatic air filtration and positive pressure ventilation for dressing stations and operating theaters is recommended. The importance of masking as a means of controlling droplet infection is stressed. Other methods of droplet control, such as barrier nursing and the use of ultraviolet light and of aerosol sprays, are briefly discussed. The use of mild antiseptics in dressing noninfected wounds at the time of operation is recommended as a prophylactic measure. Bacillus Calmette Guérin vaccination of nurses and patients who fail to react to tuberculin, and diphtheria immunization of susceptible children whose stay in the hospital will be longer than 6 weeks, is suggested. Blood transfusion for puerperal patients suffering from anemia (hemoglobin value of less than 70 per cent) as a prophylaxis against anaerobic streptococcal infection is recommended.

JOHN J. MALONEY, M D

**Air Infection with Dust Liberated from Clothing**  
J P DUGUID and A T WALLACE *Lancet*, Lond., 1948, 2 845

The present study concerns itself with measuring the bacterial contamination of air produced by liberation of dust from the skin and personal clothing during bodily movement, the duration of air carriage of the bacteria-carrying dust particles, and the effectiveness of gowning as a means of preventing such contamination of air.

The tests were carried out in a specially constructed chamber from which air was withdrawn by a short tube through the wall to a slit sampler outside for bacteriologic examination. The samples were placed on either ordinary blood agar or heated blood agar. Four healthy men were used for the principal experiments, these being subjected to the following standard activities within the chamber: standing motionless, slight activity, vigorous activity, undressing and dressing and brushing clothes. Seventeen experiments were performed with each subject. Large numbers of bacteria-carrying dust particles were liberated by even slight activity and the number increased considerably as the activity became more vigorous. Some 10 per cent of these bacteria-carrying dust particles remained air-borne for over half an hour. Observations with two nasal carriers of *Staphylococcus* showed that the air was infected with this pathogenic organism more regularly, and to a greater degree, by the liberation of dust from clothing than by sneezing. *Staphylococcus aureus* was present in about 0.1 per cent of the bacteria-carrying dust particles which entered the air from the clothing or carriers.

Air contamination with dust-borne bacteria from clothing reduced only a little (to about half) when the usual surgical type of sterile loose cotton gown was worn over ordinary clothing. However, when a sterile dustproof gown was employed, contamination was reduced to a tenth or a twentieth. Hence, under

ordinary circumstances, dissemination of infection from the respiratory tract via clothing dust to the air constitutes a means whereby surgical aseptic technique may be breached.

DAVID H. LYNN, M D

**Plaster of Paris as Source of Infection in Tetanus and Gas Gangrene**  
E G D MURRAY and G D DENTON *Canad M Ass J*, 1949, 60 1

This is the first of three articles published simultaneously in the Canadian Medical Association Journal, dealing with the potential hazard of plaster of paris as an agent in the contamination of wounds with the organisms of tetanus and gas gangrene. The authors report one fatal case of tetanus which followed an elective arthrodesis of a tuberculous knee.

Two and one-half weeks after operation and the application of a long leg cast, the wound was seen to be infected, but no bacteriological study was made. On the thirtieth postoperative day signs and symptoms of tetanus were recognized, and the wound exudate was studied. *Clostridium tetani* was found, together with *Pseudomonas aeruginosa*, *Aerobacter aerogenes*, and an anaerobic streptococcus. The patient died the next day. The strain of *Clostridium tetani* isolated antemortem was completely characteristic. It produced fatal tetanus in a guinea pig not protected by antitetanus serum but did not affect a protected animal. Postmortem material from the wound yielded a growth of *Clostridium tetani*, *Clostridium perfringens*, and *Pseudomonas aeruginosa*. The specimen removed from the knee at the original operation had yielded only *Mycobacterium tuberculosis*.

A thorough search for a source of contamination threw suspicion on the plaster. Unfortunately both casts worn by the patient had been discarded, and the supply of bandages from which these casts had been made had been exhausted. Two newer bandages of the same manufacture were examined and both were found to contain clostridial organisms, one *Clostridium tetani*. This organism was recovered from a piece of the second bandage which contained only two square inches of material. Twenty-eight other bandages representative of batches made in 1945, 1946, 1947, and 1948 were examined by culture of the whole roll. All but one of these specimens exhibited anaerobes, usually in combination with pathogenic aerobes. *Clostridium welchii* was found in 24 of the bandages.

Experiments with the sterilization of plaster bandages indicated that single rolls could be sterilized by heating to 200 degrees C for a period of 5 minutes. When the rolls were heated in their original containers, 6 bandages to the package, this temperature had to be maintained for 2 hours to kill all organisms. Autoclaving was found to be unsatisfactory because moisture spoils the plaster. Dry heat for more than 2 hours at 200 degrees C was found to destroy the fabric of the bandage.

The authors conclude that until only recently the serious infective potentialities of plaster of paris

have not been properly appreciated or guarded against  
BENJAMIN F LOUNSBURY, M D

**Chronic Progressive Infectious Gangrene of the Skin** F A SIMEONE and H. L. HARDY *Ann Surg*, 1948, 128 1112

The authors' report concerns a 33 year old hair-dresser who for 2 years had shown signs of unusual susceptibility to infection. She was admitted to the hospital for treatment of a large gangrenous external hemorrhoid and a blisterlike pustule on the leg. Subsequently she developed a similar blister in a broad right paramedian abdominal scar. Both blisters broke spontaneously. The one on the leg healed, that in the abdominal scar left an ulceration which spread progressively until the surface of the entire scar and another abdominal scar sloughed away. Among the numerous laboratory examinations, only 2 were of positive interest, namely, the increased sedimentation rate and a leucopenia without agranulocytosis. The patient was acutely ill with a severe general systemic reaction. No pus could be obtained from any of the ulcerated nodules. A culture from one of the ulcerated areas showed *Escherichia coli*, *Staphylococcus aureus*, and alpha-hemolytic streptococci. A block excision of involved skin was done after the lesion had failed to respond to conservative therapy, with an immediate improvement in the patient's condition. Split-thickness skin grafts were applied to the granulating area and healing was obtained.

Because of the peculiar hematologic response and impaired liver function, it was suspected that there was a factor of intoxication in this case. The only possibility that could be disclosed was the presence of thioglycolic acid or thioglycolates in "cold wave" solutions which the woman handled in her work. The possible relationship between the manifestations of the infection and exposure to these substances is discussed.  
JOHN L. LINDQUIST, M D

**The Effects of Streptomycin on the Eighth Nerve System** M R DIX *J Lar Otol*, Lond, 1948, 62 735

The author's observations confirm the results of Brown and Hinshaw (1946), Fowler and Seligman (1947), Glorig and Fowler (1947), that streptomycin has a selective toxic action upon the vestibular apparatus. The precise locus of this action remains obscure.  
JOHN J. MALONEY, M D

**The Frontiers of Banti's Disease** (Les frontières de la maladie de Banti) EMILE HOUCKE *Bruxelles méd*, 1948, 28 2657

The author discusses the symptomatology, etiology, pathology, and treatment of Banti's disease. He believes, and offers pathological findings, that Banti's disease may have many causes, including syphilis and tuberculosis. The disease is the result of an alteration in the reticuloendothelial system of

the spleen primarily, and secondarily involves the liver. The causes inciting this change are multiple but the response of the reticuloendothelial system is constant. The author's pathological criteria for the diagnosis include diminution of the malpighian corpuscles, sclerosis of the central artery of the follicle, hypertrophy of the reticulum, and atrophy of the sinuses of the spleen. Cirrhosis of the liver develops slowly, is less intense, and is reversible if splenectomy is done early in the disease. In 1 patient splenectomy caused a complete regression of the liver sclerosis with ascites.

Although Banti considered this disease as affecting only the young, the author believes that older individuals are frequently afflicted. He states that the peripheral blood picture is inconstant and never absolutely diagnostic, but that leucopenia, thrombocytopenia, and anemia usually occur.

He considers splenectomy the treatment of choice and believes that a complete cure will result if this procedure is accomplished early in the disease.

JOHN H. FLYNN, M D

**Carcinoma Developing in Sebaceous Cysts** JOSEPH C PEDEN, JR. *Ann Surg*, 1948, 128 1136

Microscopic studies of 832 surgically removed sebaceous cysts revealed 14 cases of carcinoma, an incidence of 1.7 per cent. In 5 cases histologic evidence of the origin of carcinoma in the sebaceous cysts was not conclusive so that other evidence of such origin was taken into consideration. The average age of the patients was 51.6 years.

The relatively low incidence of carcinoma in sebaceous cysts does not justify considering sebaceous cyst as a precancerous lesion. However, in older patients who have had a sebaceous cyst of long duration on the face or scalp, perhaps ulcerated, and in which a recent change in character, such as an increase in size, has been observed, carcinoma should be suspected. The most common type of cancer found in sebaceous cysts is a well differentiated squamous cell carcinoma of low grade malignancy, and usually these have not metastasized when first seen. Basal cell carcinomas occur much less frequently.

Sebaceous cysts which are suspected of fostering carcinoma should be treated by wide local excision. Immediate lymph node dissection is not generally necessary, although markedly anaplastic growths may justify such a procedure. Evidence of lymph node metastasis subsequent to previous local excision should be treated by block removal of the nodes.

With adequate treatment the prognosis is good. Ten of 11 patients with adequate follow up treatment have been cured. The one uncured patient had unresectable lymph node metastasis. Routine histologic examination of all sebaceous cysts removed is advocated.  
JOHN L. LINDQUIST, M D

# SURGERY GYNECOLOGY AND OBSTETRICS

## With International Abstracts of Surgery

*Official Journal of the American College of Surgeons*

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# SURGERY

## GYNECOLOGY AND OBSTETRICS

VOLUME 89

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NUMBER 3

### LATE RESULTS IN TREATMENT OF PANCREATIC CYSTS BY INTERNAL DRAINAGE

DAVID HENRY POER, M D, F A C S, and ROBERT H STEPHENSON, M D,  
Atlanta, Georgia

PANCREATIC cysts are encountered so infrequently in the clinical experience of any one surgeon that the question of treatment of such a lesion when it presents may pose a problem of difficult decision. The diverse etiology, association with acute and chronic pancreatitis and biliary pathology, and the tendency to drain for long periods and to recur, all serve to complicate any outline of treatment. The purpose of this paper is to consider briefly the classification, etiology, diagnosis, and treatment of cysts of the pancreas, and to report 3 cases, 2 of which have been observed for a period of 7 to 8 years, following internal drainage.

#### CLASSIFICATION

In the literature one may find many classifications of pancreatic cysts (11, 20, 21). The classification used by Mahorner and Mattson (15, 12) is one of the best.

- 1 Cysts due to defective development
  - a In infants
  - b Associated with polycystic disease of kidneys
  - c Dermoid cysts
  - d Inclusion
- 2 Cysts due to trauma
- 3 Retention cysts
- 4 Neoplastic cysts
  - a Cystadenoma
  - b Cystadenocarcinoma
  - c Teratoma
- 5 Cysts due to parasites

Cysts are spoken of as true cysts and pseudocysts. The former term implies those with a lining completely formed by epithelium or by pancreatic tissue. The pseudocysts, which are predominately formed by trauma, vascular or degenerative changes, frequently do not lie entirely within the pancreas, but are located within the lesser peritoneal sac, between the stomach and liver or between the leaves of the mesocolon. Practically speaking, it is frequently impossible to distinguish at operation between true and pseudocysts, as the former may lose their epithelial lining after some time, and present the appearance of a pseudocyst.

Pancreatic abscesses or collections, as Pinkham prefers to call them, may also present a differential diagnostic problem, as these may result from the same factor as pseudocysts. Here the rapidity of appearance, plus signs of infection, helps to distinguish them. This group of pancreatic collections might well form a sixth group in the classification scheme presented, as being due to acute and chronic pancreatitis, pancreatolithiasis with infection, and concurrent biliary disease.

From the Whitehead Department of Surgery, Emory University, Georgia, and the Surgical Services, Grady Memorial Hospital, Atlanta, Georgia.

## ETIOLOGY

In their article in 1931, Mahorner and Mattson considered in some detail the etiology and pathology of pancreatic cysts (15, 12). In general, their discussion follows closely the classification given by them.

Probably the most common cyst is the simple retention type, which is frequently an incidental finding at necropsy (16). These are small, may be multiple and result from the occlusion of a duct or several acinar openings, by fibrosis, inflammation, or neoplastic changes (4). Occasionally, pancreatic calculi are found in association with these (17).

Cysts which result from defective development are rare, and may be seen in children and infants with other congenital anomalies, such as polycystic kidneys and congenital heart disease. Dermoid and inclusion cysts may be included in this category.

Neoplastic change in the pancreas can produce cystic degeneration by occlusion of main ducts or smaller branches. In cystadenocarcinoma, new cysts may be formed by acinar proliferation and secretion. This is rather unusual, however, since most pancreatic tumors present as solid growths.

The production of cysts of the pancreas by parasites is rare, and is due to encystment of the organisms or blockage of the duct system.

A history of trauma is elicited in a significant number of pancreatic cysts (2, 12, 15, 21, 22). This need not be severe, or recent, and may follow minor blows and inconsequential abdominal injury. The pancreas, a relatively immobile abdominal organ, is caught between the force applied to the abdomen anteriorly and the spine posteriorly, with resulting laceration, contusion, or hemorrhage. Almost all cysts resulting from trauma are pseudocysts, with a portion of their wall being formed by the lesser peritoneal sac or mesocolon.

A mass may present early or late trauma. The insignificant amount of trauma required may be forgotten by the patient and the appearance of the cyst be considered as without due cause. The pathologic changes which occur may be hemorrhage with later degeneration, autolysis by pancreatic ferments, or a combination of the two.

Recently, the role of acute and chronic pancreatitis in the pathogenesis of pancreatic cysts has been emphasized (19, 26). The processes probably account for a greater proportion of cysts than has formerly been recognized. Pinkham points out that both true and pseudocysts may be formed. The part played by degeneration, obstruction, and concurrent biliary disease are all to be considered. Each case must be individualized and the final summation of opinion may not be possible even after laparotomy.

## DIAGNOSIS

The most frequent symptom of pancreatic cyst is abdominal discomfort or pain (1, 2, 5). This is experienced in the hypochondrium, epigastrium, or back, is constant in nature and of dull aching nature. The presence of pancreatitis concurrently or previously will modify to some extent the degree of pain (19).

Symptoms from pressure of the cyst on the stomach, duodenum, or colon may be noted. These take the pattern of anorexia, nausea, vague indigestion, eructations, and even vomiting. In the presence of chronic pancreatitis or biliary pathology, there may also be fatty food intolerance and signs of pancreatic or biliary insufficiency (20).

A palpable mass may be found on physical examination, is the most reliable single finding, and is almost essential for diagnosis. The mass may occupy almost any position in the upper abdomen, but is characteristically high, relatively immobile, and somewhat tense.

Roentgenologic examination (8) may demonstrate a slight opacity in the area and displacement of gas-filled organs such as the stomach, duodenum, or colon. Gastric pneumograms are especially helpful (19). Pyelography and barium enema may reveal further displacement of surrounding organs. More contributory evidence may be gained from cholecystograms revealing biliary dysfunction.

Determination of serum amylase levels may be of value in dealing with trauma, acute pancreatic degeneration, or pancreatitis. Laboratory studies may reveal mild diabetes mellitus (with abnormal glucose and insulin tolerance curves), free stool fat, and a paucity of pancreatic ferments in duodenal drainage specimens.

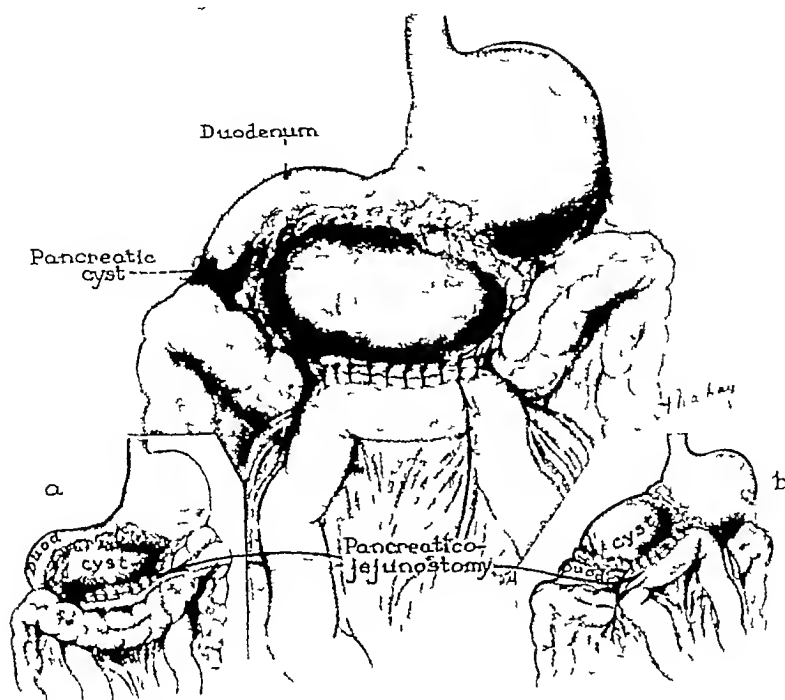


Fig 1 Anastomosis of pancreatic cyst to jejunum. Insert (a) depicts retrocolic anastomosis through mesocolon for cases in which stomach is displaced upward. Insert (b) shows antecolic anastomosis used when the cyst presents superiorly. In each instance, the width of the stoma is not less than 4 centimeters.

#### SURGICAL TREATMENT

Surgical intervention is indicated in every case of suspected or proved pancreatic cyst. Conservative management makes the patient vulnerable to possible rupture (13) into the peritoneal cavity with resultant hemorrhage, shock, or peritonitis, or internally into some portion of the gastrointestinal tract.

Three methods of surgical treatment may be employed in management (3, 5, 6): total excision which is admittedly the ideal, simple drainage by catheter or marsupialization, and internal drainage by anastomosis of the cyst to the stomach, duodenum, or jejunum.

Total excision may be possible in the case of small cysts, particularly those located in the tail of the pancreas. Excision is to be performed whenever possible because of small size or freedom from intimate involvement of surrounding structures.

Simple drainage (3, 18, 23, 24) by means of a large rubber catheter, a cigarette drain, or

marsupialization of the cyst may be employed in those cases unsuitable for excision. The specific method of drainage to be used is indicated in part by the position of the cyst and its relations to adjacent structures. Disadvantages of simple drainage are the persistence of draining fistulas, excoriation of the skin, and tendency to recur.

Internal drainage (1, 10, 14, 25) by anastomosis of the cyst wall to the stomach or small intestine will obviate the disagreeable features of external drainage and will insure adequate drainage. Although the site of anastomosis depends somewhat on the location of the cyst, the usual procedure is a cystojejunostomy with the use of two layers of sutures.

#### CASE REPORTS

**CASE 1.** P. P., aged 49 years, white male, was admitted to the Piedmont Hospital on August 5, 1946 with the chief complaint of severe epigastric pain of 30 hours' duration. The pain had begun suddenly, remained constant, and was accompanied by per-

sistent nausea and vomiting. Physical examination revealed a robust man of middle age, in acute distress. Temperature was 101 degrees F, pulse 120, blood pressure 90/60. The abdomen was slightly distended with moderate rigidity and hypoactive peristalsis. Roentgenologic examination revealed no free air in the peritoneal cavity. Diagnosis of acute pancreatitis was made, and conservative therapy instituted. After 24 hours, the abdomen became progressively more distended, pain was still present, and there was muscle spasm. Exploratory laparotomy was performed. A marked hemorrhagic necrosis of the pancreas was found, drains were placed down to the area, and the abdomen closed. Following operation, convalescence was uneventful except for transient jaundice and glycosuria. The operative wound healed by primary intention and drainage stopped on the seventeenth hospital day. He was discharged home on the twenty-first hospital day, free of symptoms.

Approximately 2 months later, on October 11, 1946, the patient was readmitted because of the appearance of an upper abdominal mass associated with nausea and vomiting. Physical examination revealed a palpable mass in the epigastrium. Pancreatic cyst was suspected, and abdominal exploration performed. Upon opening the peritoneal cavity, the pancreas presented a large cystic mass posterior to the mesocolon and below the stomach. The cyst was opened and a large amount of serosanguineous fluid and blood clots removed. The biliary tree was distended and of a deep greenish-brown color. Cholecystostomy was performed and the pancreatic cyst marsupialized. The postoperative course was uneventful and the patient was discharged home on the twentieth hospital day with drainage present from both openings.

During the ensuing 10 months he was under close observation as an outpatient. Drainage continued from both the cholecystostomy and pancreatic fistula with minimum skin irritation. Blood clots were passed intermittently, however there was no pain or gastrointestinal symptoms to indicate biliary or pancreatic dysfunction. His appetite remained good and he gained weight. An incisional hernia, noted 2 months after operation, gradually increased in size.

Eleven months after operation, drainage ceased and the fistulous tract closed. During the following year the patient remained asymptomatic, returned to work, and continued to gain weight. All laboratory studies subsequent to hospital discharge were within normal limits.

The patient was admitted to the hospital in May 1948 for further study and repair of the incisional hernia. Laboratory studies revealed a normal glucose tolerance curve. Stool examinations were negative for occult blood and free stool fat, urinalyses were negative. Oral cholecystogram revealed normal filling of the gall bladder with no evidence of stones. Ventral herniorrhaphy was performed, the wound healed well, and patient was discharged home on the fourteenth hospital day with a well healed

wound. At the time of this report he is in excellent health and asymptomatic (3 years).

**CASE 2** (Patient of Dr W A Selman) G J, aged 46 years, colored female, was admitted to the Grady Memorial Hospital May 4, 1939, complaining of an upper abdominal mass of insidious onset and without previous pain or gastrointestinal upset. There was no history of abdominal disease or trauma. Physical examination revealed an obese female with no discomfort. Temperature, pulse, and respiration were normal. Blood pressure was 130/70. The abdomen was moderately obese, and there was palpable in the epigastrium a large, smooth, tense, nontender mass which appeared to be fixed posteriorly and did not move with respiration. Roentgenologic study revealed a retroperitoneal mass displacing the stomach anteriorly. A provisional diagnosis of pancreatic cyst was made and exploratory laparotomy performed. A large pancreatic cyst posterior to the stomach was marsupialized. Postoperative course was uneventful, the cyst drained well, and the patient was discharged home on the fourteenth postoperative day with a draining fistula, to be followed in the outpatient department. After draining for 3 weeks, the cyst opening closed, and no further drainage occurred. The patient remained asymptomatic until approximately 2 years later, when in August 1941, she was seen in the outpatient department, complaining of recurrence of the mass in the same location. There was a sensation of epigastric fullness, eructation, and occasional vomiting without pain. A diagnosis of recurrent pancreatic cyst was made, and re-exploration performed. The cyst was found to have reformed, and was considerably larger than on the previous operation. Because of recurrence following simple drainage, it was thought that internal drainage was indicated. Cystogastrostomy was done, in which the cyst wall was anastomosed to the posterior wall of the stomach. Postoperatively the patient's progress was good, and the cyst decreased in size. Dehiscence of the operative wound down to peritoneum occurred on the fifth postoperative day. Secondary suture was performed, and the wound healed well. The patient was discharged home on the twenty-eighth postoperative day. At this time and on follow-up a month later, she was free of gastrointestinal symptoms, was eating a regular diet, and there was no palpable abdominal mass. A small incisional hernia was present, however, at that time it was not deemed advisable to repair it.

From 1941 until November 1947, the patient was seen at irregular intervals in the surgical outpatient clinic. Repair of the incisional hernia was advised upon several occasions, but refused by the patient. There were occasional bouts of nausea and vomiting, diarrhea, and an intolerance to fatty foods. In November 1947, she was seen in the emergency clinic with nausea, vomiting, and mild abdominal pain. Examination revealed a large incisional hernia with no evidence of intestinal obstruction. She was admitted to the surgical service for study and possi-

ble repair of the wound defect. Temperature, pulse, respiration, and blood pressure were normal. The patient had gained considerable weight since the last hospital admission, and the abdomen was markedly obese. A large upper abdominal incisional hernia was present, and through the defect palpation of the upper abdominal viscera was possible. No masses were felt and there was no tenderness.

Roentgenologic study of the gastrointestinal tract was entirely normal, and revealed no defect in the outline of the stomach, and no filling of the cyst through the previous cystogastrostomy. The gall bladder was not visualized by an oral cholecystogram. Laboratory studies, including glucose and insulin tolerance tests, revealed no diabetic trends. Blood studies and urinalyses were normal. Free fat was demonstrable in the stools. The serum amylase level was within normal limits. A diagnosis of chronic pancreatitis was made, and therapeutic dosage of pancreatin was given with considerable relief of symptoms. Fatty food intolerance disappeared, there was a diminution in the number of daily stools, and free stool fat was no longer demonstrable.

Herniorrhaphy was again refused and the patient was discharged home on a high protein, low fat diet, with therapeutic doses of pancreatin. During subsequent outpatient visits, and at the time of this report, she is asymptomatic.

**CASE 3** C.L.C., aged 17 years, white male, was admitted to Grady Memorial Hospital on February 17, 1940, complaining of severe upper abdominal pain. Forty-eight hours before admission he had fallen across a large stone, receiving a sharp blow to his epigastrium. Nausea without vomiting developed, and there was pain on deep respiration. The patient was reported to have voided urine which was grossly bloody.

Physical examination revealed a young man in acute distress, with shallow respiration and complaining of severe abdominal pain. Temperature was 101 degrees F, pulse 90, blood pressure 140/90. The abdomen was rigid, exquisitely tender, with hypoaactive peristalsis. No masses were palpable. There was tenderness in the left costovertebral angle.

Laboratory studies revealed a white cell count of 24,000 with a neutrophilic response. Urinalysis was negative except for an occasional red blood cell.

Roentgenograms of the upright abdomen revealed no free air under the diaphragms and an increased density in the epigastrium. Retrograde pyelograms were normal in appearance.

Surgical intervention was deferred and conservative therapy instituted. The patient improved steadily and was discharged on the eleventh hospital day, asymptomatic except for residual tenderness in the epigastrium. He continued to improve until March 31, 1940 when, shortly after an airplane trip, he became nauseated and vomited. Thereafter he vomited from one to three times daily without nausea. On April 3, 1940, he was readmitted for study.

At this time his temperature, pulse, and respiration were normal. Blood pressure was 164/80. He appeared acutely ill and a large cystic mass filled the epigastrium. Exploratory laparotomy was performed on April 5, 1940, and the lesser peritoneal sac was found to be distended with approximately 1500 cubic centimeters of serosanguineous fluid. A pancreatic pseudocyst was drained with two soft rubber drains. Examination of the fluid revealed the presence of pancreatic ferments.

Drainage was profuse and continued for 25 days, when it ceased abruptly. The mass began to re-form and 6 days later operation was performed to re-establish drainage. This persisted for 2 months and caused considerable excoriation of the surrounding skin.

On July 12, 1940, a second laparotomy revealed a rent 3 centimeters in length in the anterior surface of the pancreas. This was closed with interrupted chromic catgut sutures and drains placed down to this area. Postoperatively, the volume of drainage steadily decreased, and on August 2, 1940, patient was discharged to be followed in the outpatient clinic. Six weeks after discharge the fistula closed, and the epigastric mass reappeared. The patient was readmitted and given conservative management. The mass disappeared in 10 days. The patient was discharged, and throughout the next 12 months was seen at frequent intervals in the outpatient department. The cyst recurred and was evacuated on 10 occasions by aspiration, yielding amounts varying from 750 to 1800 cubic centimeters. During this period, he occasionally exhibited evidence of hypoglycemia. He was admitted for study, and though the fasting blood sugar levels were at the lower limits of normal, the glucose tolerance curves were normal and his symptoms could not be reproduced by starvation.

The mass was still present 14 months after the last operation in July 1940. The patient was readmitted and on September 24, 1941, through a high left rectus incision, an antecolic cystojejunostomy was performed, two layers of interrupted silk sutures being used. Postoperative course was uneventful, and he was discharged from the hospital on October 12, 1941.

One year later, he was readmitted for study. The opening into the cyst could not be demonstrated on fluoroscopic examination of the barium-filled intestine. Glucose tolerance tests were normal.

Nothing further was heard from the patient until April 1, 1946, when he was transferred to a nearby army camp. He had entered the service early in 1943 and later was taken prisoner. He had been well throughout this period and had suffered no symptoms of hypoglycemia even while on a very low caloric diet during a 9 month period of incarceration in an enemy prison camp. At the time of examination, he appeared to be well nourished and in excellent health. No abdominal mass or tenderness could be detected. All laboratory studies, including glucose tolerance tests, were within normal limits.



## DISCUSSION

The etiology and classification of pancreatic cysts are matters largely of academic interest, since treatment is in nearly all cases identical. Exploration is strongly indicated in every instance of a palpable upper abdominal mass for several reasons. An operable malignant lesion may be present in association with the cystic mass. Temporization in the case of a true or pseudocyst may allow spontaneous or traumatic rupture to occur. In a series of 6 cases of rupture reported by Koucky, there were 4 deaths (66 per cent mortality). Moreover, chances of spontaneous internal drainage or regression are rare.

Of the three methods available for treatment, internal drainage is the treatment of choice. Total excision is an ideal seldom attainable. External drainage or marsupialization offers the advantages of ease of performance and low mortality, but entails prolonged drainage, varying degrees of skin excoriation, and the possibility of cyst recurrence.

Properly performed internal drainage, while presenting a more difficult technical problem, secures adequate drainage without external irritation or need for prolonged dressings. The loss of fluid, enzymes, or electrolytes is obviated by their passage into the alimentary tract for utilization or absorption. The experience of other authors, together with the 2 cases reported, does not substantiate the tentative objection that internal drainage allows ingress of gastrointestinal juices to keep active inflammation in the cyst wall, and thus to encourage persistence of the cyst cavity. Roentgenologic studies at various time intervals following internal drainage usually fail to reveal filling of the cyst or any abnormality of the gastrointestinal tract at the site of the anastomosis.

Cystojejunostomy is preferable to cystogastrostomy (10) or cystocholecystostomy because of the accessibility of jejunal loops and avoidance of tension on the suture lines. Use of the gall bladder for anastomosis seems to be decidedly unphysiological and is contraindicated in the presence of coexistent biliary disease. A two layer anastomosis is used, and the stoma is made adequate (3 to 4 centimeters).

The question of pancreatitis is to be considered apart from that of cysts, even though it may be a predecessor. The treatment of the acute form is reasonably well established, is conservative, and surgical intervention is indicated only when diagnosis is not well established or upon appearance of a mass. Pancreatic abscess subsequent to acute pancreatitis requires drainage by catheter or marsupialization similar to cysts. Fistula formation can result and the drainage from this type of fistula causes marked skin irritation.

Manifestations of pancreatic insufficiency (hyperglycemia, abnormal glucose tolerance tests, digestive disturbances, and steatorrhea) are reported to accompany pancreatic cysts in relatively few instances. Tests for pancreatic function should be performed routinely and the presence of chronic pancreatitis ascertained. If present, medical management alone is indicated.

The results obtained with internal drainage reported by Adams and Warren, as well as in the 2 cases reported, would seem to compare favorably in morbidity and mortality with other methods of treatment. This is indicated by the satisfactory results which were obtained in each of the 2 reported cases after recurrences had followed previous attempts at external drainage.

## SUMMARY

A brief review of the problem of pancreatic cysts is presented.

The frequent association of trauma is stressed as well as antecedent pancreatitis in certain cases.

Methods for treatment are outlined and the merits and disadvantages of each considered.

In the light of recent experience, internal drainage of pancreatic cysts which cannot be totally excised is the method of choice.

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# CICATRICIAL CONTRACTURES OF THE THUMB

FORREST YOUNG, M D , F A C S , Rochester, New York

**C**ONTRACTURE limiting function of the thumb can occur in any of the surrounding soft tissue structures

However, most motion limiting contractures of the thumb are due to injuries to, or losses of, skin of the palm, thenar eminence, or thumb-index web. It is true that scar tissue may extend deeply but, in most instances, the problem is mainly one of supplying sufficient good skin to allow free motion after the limiting scar has been removed.

In the normal hand the skin is so constructed that it fits snugly when the hand is at rest but can glide or fold to allow motion from this position. When the thumb is in maximum abduction, the palmar skin and that over the thenar eminence are stretched smooth, while the skin between the thumb and index finger is drawn out into a web. On true adduction, the skin of the thenar eminence and adjacent palm folds in accordion fashion in lines parallel to the palmar creases, while the thumb-index web completely reverses from the widely abducted position and becomes relaxed into folds transverse to the line between thumb and index finger. On the motion of opposition-adduction the skin of the thumb-index web,

thenar eminence, and adjacent palm becomes one functioning unit, the skin folding in parallel lines radiating outward from a point at the base of the index finger and then curving circularly around the base of the thumb from the proximal phalangeal joint to the cleft between the thenar and hypothenar eminence (Fig 1).

It is obvious that the ideal replacement of skin over this moving area must be supple, large enough to accommodate to the extremes of motion, and set into the area in a manner which will not allow the formation of restraining scar lines.

## PRINCIPLES OF CORRECTION

In most adduction contractures of the thumb, skin replacement is the key to complete correction. This skin must be set into the hand intelligently if full correction is to be maintained. The skin replaced should join normal skin in line with the natural folds present when the thumb is in adduction or opposition-adduction. No suture line should cross the roughly triangular space formed by the thenar eminence, proximal palmar flexion creases, and the thumb-index web. In addition, the new skin covering should not join the normal skin along the line of the web formed between the abducted thumb and the index finger. This

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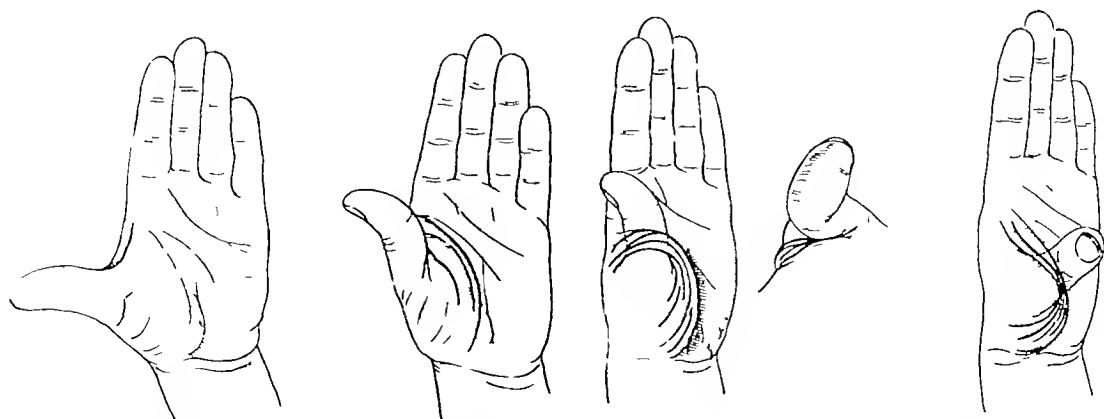


Fig 1 Schematic drawing made from photographs of normal hand to show the mobility of the skin and the lines

of folding which are present when the thumb is in various positions

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Even though the correction be com-  
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#### METHODS

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Transposition of flaps. If there is a thin,  
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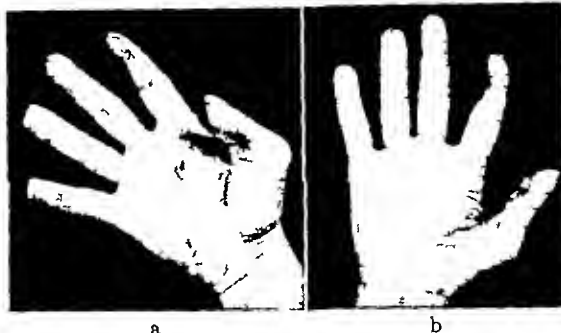


Fig 2 a, Scar contracture limiting extension and ab-  
duction of the thumb. This occurred following a midline  
incision made in a primary repair of the flexor tendon. b,  
Correction by tendon graft, covering tendon with soft  
tissues, and free full thickness skin graft.

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They are either used to gain partial correction  
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2. Correction by local flaps. It is uncom-  
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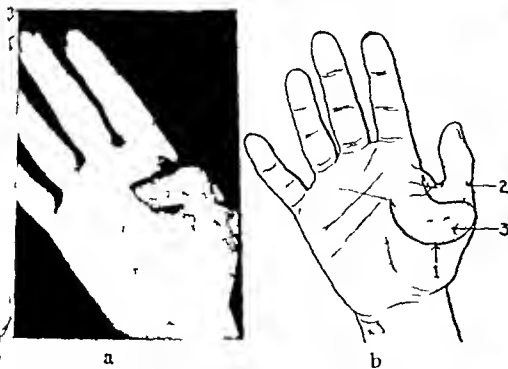
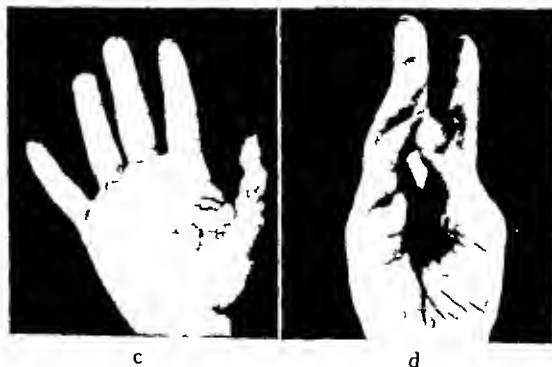


Fig 3 a, Extreme limitation of extension and abduction  
to scar following gunpowder explosion. b, Diagram of  
flap shift (1, 2) and free split thickness skin graft (3)  
over area from which flap was taken. c, d, Result. Good  
abduction was shifted into the thumb-index web and over the  
dorsal surface of the thumb. This allows good spread with



out restraining bands between the thumb and index finger  
and, of course, gets the thumb into opposable position. The  
line of junction of the graft and flap is, however, incorrect  
and because of this abduction is limited about 50 per cent.  
Perhaps the greatest advantage in this type of correction is  
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It is obvious that the ideal replacement skin over this moving area must be large enough to accommodate the full range of motion, and set into the area in such a way which will not allow the formation of permanent scar lines.

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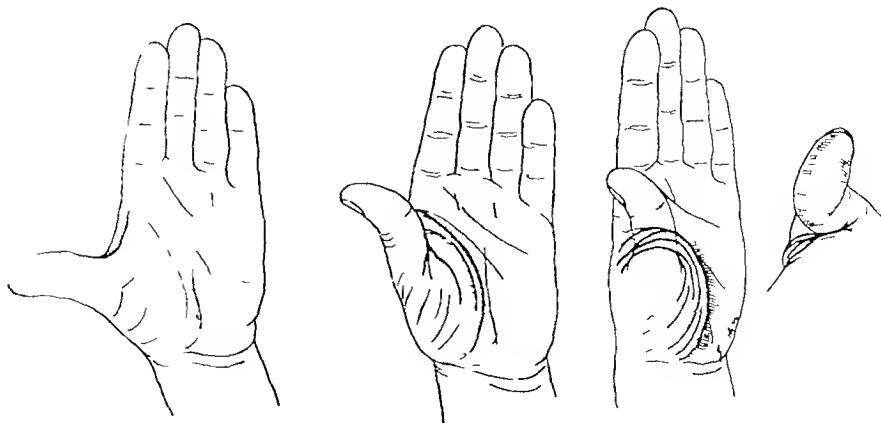


Fig 1 Schematic drawing made from photographs of normal hand to show the mobility of the skin and the lines

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mistake is commonly made because most scar contractures of the thumb are primarily due to scarring on only one side of the hand, the other side being unaffected. This is so because most burns and similar injuries of the hands are received in such a manner that one or the other, either dorsal or volar aspect, receives the brunt of the trauma. It should, however, be borne in mind that if the replaced skin is joined to normal skin where the scar excision ends, a suture line will usually fall in the abduction fold between the thumb and index finger. Even though the correction be complete, this scar line will later contract and limit abduction.

#### METHODS

There are four possible methods which may be used singly or in combination in the correction of thumb contractures due to scar replacement of lost skin.

1. **Transposition of flaps.** If there is a thin, well vascularized web between the thumb and index finger, a Z transposition of flaps may be sufficient to deepen the thumb-index cleft satisfactorily. If enough tissue is available, this is an adequate procedure. The suture lines fall within the correct areas and recontracture of the lines of junction are not likely to occur.

Various modifications of Z-plasty are useful in the correction of all scar bridges and it does have some usefulness in relieving thumb contractures. However, this usefulness is limited. It cannot be used when there has been loss

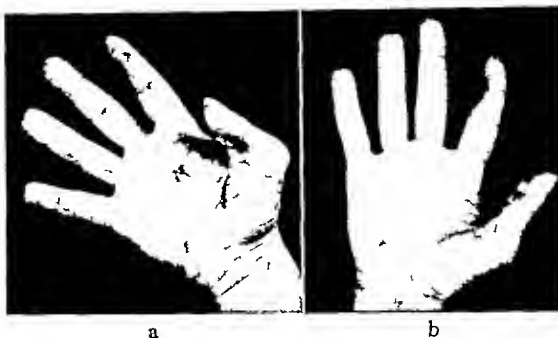


Fig 2 a, Scar contracture limiting extension and abduction of the thumb. This occurred following a midline incision made in a primary repair of the flexor tendon. b, Correction by tendon graft, covering tendon with soft tissues, and free full thickness skin graft.

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2. **Correction by local flaps.** It is uncommon that the shift of local flaps is applicable in the correction of scar contractures of the thumb. In deep but limited scars of the central palm which limit abduction of the thumb

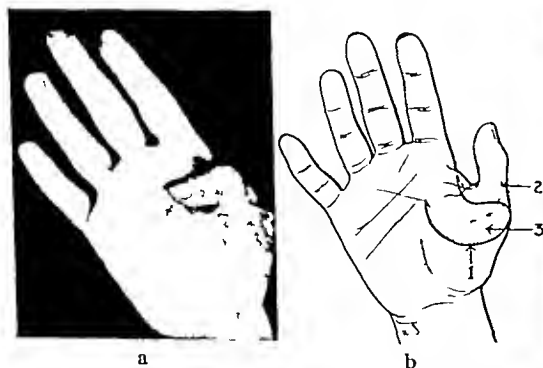
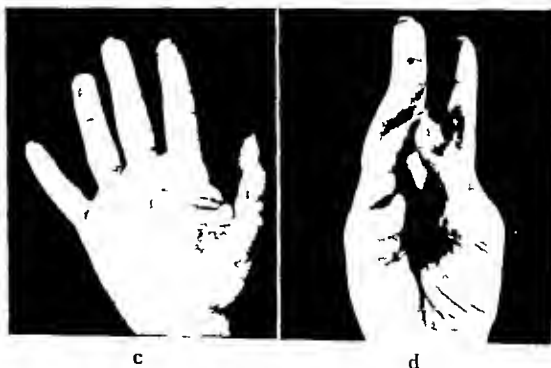


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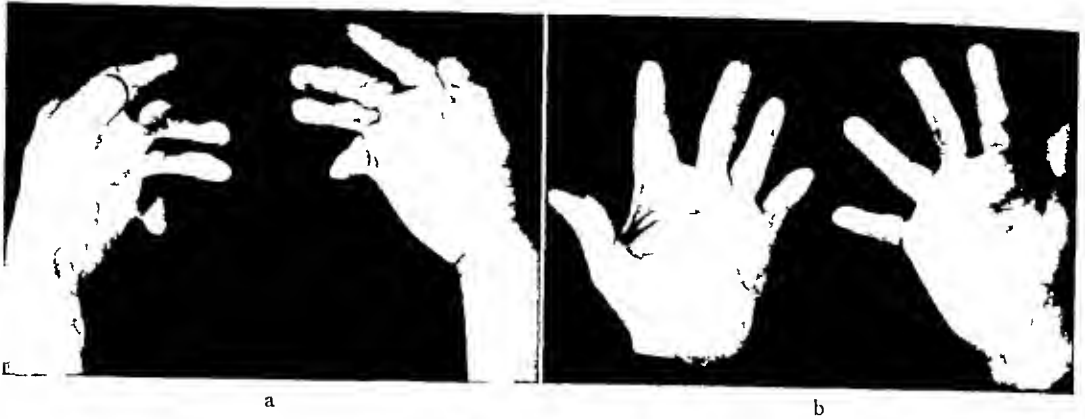


Fig 4 a, Old burn contracture involving fingers and thumb b, The result from free split skin grafts and utilization of Z flaps 8 years after correction There has been no appreciable recontracture of the fingers and the palmar grafts stand up under manual labor The thumbs are in

functional position but the grafts were not well placed and hence there has been some circular contraction This illustrates that the graft edges should cross and not be in line with the lines of function In this instance a triangle should have gone across the midlateral line on either side

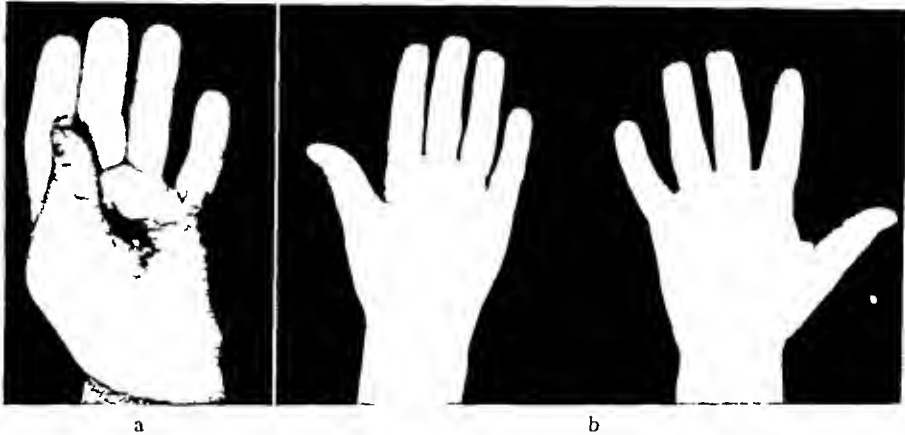


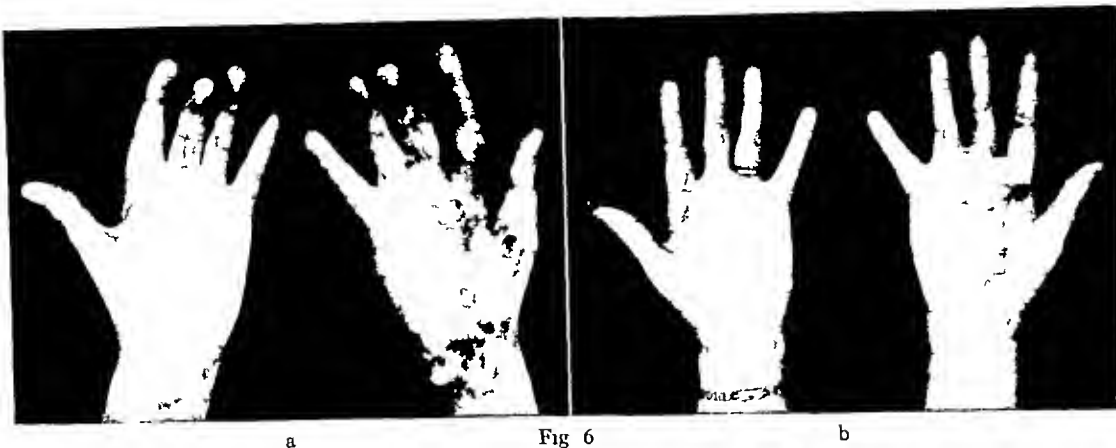
Fig 5 a, Adduction contracture of thumb from palmar scarring Scar caused by third degree burn b, Right and left hands for comparison 3 years after excision and release of scar, the defect being covered with a heavy split thickness skin graft The graft has not contracted appreciably, but the scar line at the junction of graft and skin in the thumb index web limits abduction Due to the contraction of this line about 40 per cent of the correction has been lost

a flap can be shifted from the ulnar side of the hand to cover the vital structures exposed by scar excision This flap is based proximally and usually includes all the skin and subcutaneous tissues of the hypothenar eminence and extends distally to the base of the ring and little fingers It is correct in principle and affords a one operation method of correcting limited deep palmar scars

In shifting flaps on the palm of the hand it is rarely advisable or possible to close the defect from which the flap was shifted The palmar skin is tight and inelastic and does not

mobilize easily The defect is covered with a free skin graft The maneuver is essentially a shift of the skin and subcutaneous tissue to cover structures over which a free skin graft cannot be safely applied and in so doing a defect which will take a free skin graft is substituted

In most instances in which release and excision of binding scar expose bone tendon or capsular structures of the thumb a flap can be shifted from the thenar eminence with its base distally over the metacarpal heads of the index and long fingers and a free skin graft can



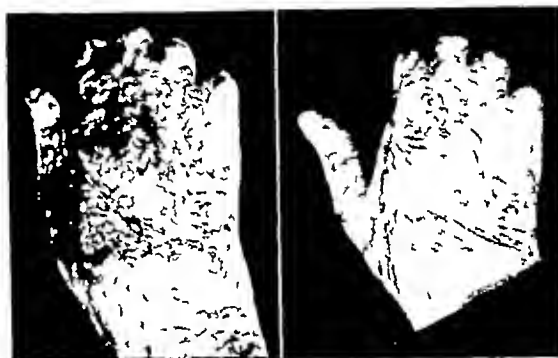
a

Fig 6

b

Fig 6 a, Burn scarring of palmar surface both hands, causing flexion contracture of fingers and adduction of the left thumb b, Various contractures corrected by using small scar flaps and inserting split skin grafts. The fingers have maintained good position but the left thumb contracture has partially returned. In this instance the graft, which was inserted in the palm somewhat correctly, has wrinkled, pigmented, and shortened.

Fig 7 a, Webbing of thumb and amputation of fingers following severe burn. The condition of both hands was identical. He was so disabled that he had a valet in constant attendance b, Result following release of scar and resurfacing thumb-index cleft with split skin graft. The graft correctly goes well past the line of pull and folding between index finger and thumb.



a

Fig 7

b

be applied over the thenar eminence. This shift is not as well conceived as the hypothenar flap. Its blood supply is adequate, it provides good covering for the thumb and a satisfactory thumb-index web, but a scar line crosses the palm more or less transversely and does tend to limit wide abduction (Fig 3). These flaps are useful but should be limited in their application to small areas of deep scarring.

3. Correction by free skin grafts. In perhaps the majority of contractures about the thumb which limit motion, a fairly satisfactory correction results if the scar is cross-cut, dissected free and the skin supplemented with free skin grafts. The possibility of using this method hinges upon whether one thinks the limiting scar is superficial to the deep structures. In the usual burn contracture the scar is superficial enough that a plane of normal tissue is present between the external taut scar

and the nerves, vessels, and tendons. When this plane is found, the tight scar gapes and with minimal dissection its edges can be gradually pushed apart. The line in which the scar is severed should be selected with care, with the definite plan of having the edges of the defect so created to coincide with the lines of normal skin folding as nearly as possible. In some instances the scar is actually excised, but in more extensive scarring the defects are created by release of scar tension and insertion of grafts to increase the overall skin area (Fig 6). Again if possible one must avoid scar lines across the triangular palm area bounded by the thenar eminence and the palmar flexion creases, scar lines in the long axis of the thenar eminence and extended thumb, and between the thumb and the base of the index finger. If the edges of excision coincide with these lines, it is wiser to cross-cut normal skin and insert the graft in circular fashion to avoid the



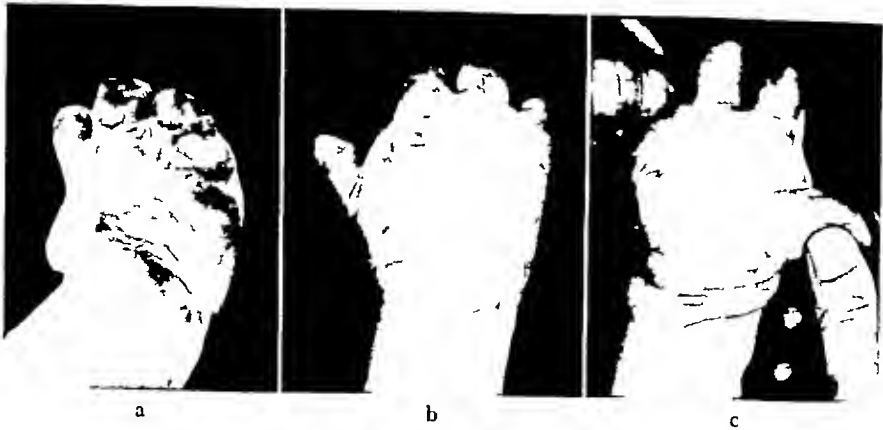


Fig 8

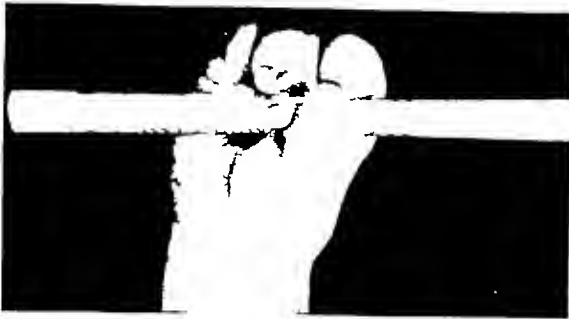


Fig 8, d

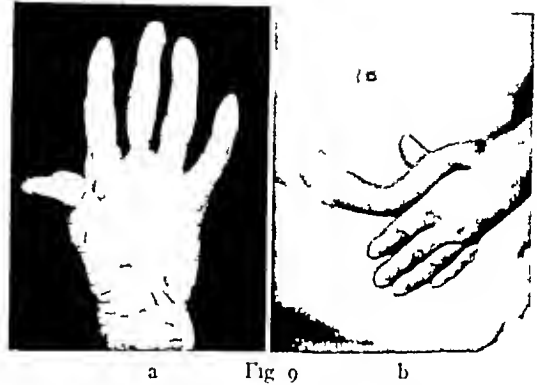


Fig 9

Fig 8 a, Appearance of severe healed burn in an infant hand. There are three stubs of fingers which are almost completely grown together and contracted into hyperextension. The thumb is healed into the general mass. b, c, d, Scar dissected off dorsum of hand, fingers, and thumb, web resurfaced with heavy split skin grafts. In c, a triangular insert of skin into a cross-cut in the line of normal palmar skin between the base of the index finger and the thumb can be seen. Useful function gained.

Fig 9 a, Severely contracted palm following an avulsion injury. The thumb is held in pronounced adduction. b, In

such injuries it can be anticipated that the scar extends deeply. Its removal will expose the superficial vascular arch, digital nerves and flexor tendons. This will prevent the use of a free skin graft and in such instances flap repair is mandatory. The tube graft shown in b is first delayed and thinned as a flap. It is further thinned, and tubed at the time of attachment. The attachment to the dorsum of the hand just above the thumb index cleft allows smooth positioning and draping in the palm. The tube cleft at attachment is severed, scar in hand released and excised flap unfolded, and placed in position at one operation.

possibility of limitation by linear contracture at these vulnerable points (Fig 7).

Of course, cicatricial contraction limiting thumb motion can occur on either dorsal or palmar aspect of the hand although the majority are mainly palmar. Free skin grafts are more gratifying on the dorsum of the hand. In fact, they are superior to any other method in correcting superficial scar contractures on the dorsum when the deep structures are uninvolved. The dorsal thumb index cleft can be satisfactorily reconstituted with free grafts if the points mentioned are kept in mind.

In my experience free skin grafts are not as satisfactory in correction of palmar scar contractures. In general the dorsal hand skin is usually in the stretched position when the hand is at rest or grasping. Under the same conditions the palmar skin is relaxed, wrinkled, and folded. This may be the reason that free skin grafts on the dorsal aspect of the hand remain beautifully smooth and eventually almost defy detection while on the palm they often tend to wrinkle and contract.

The character of the skin on the two surfaces is normally different. Free skin graft

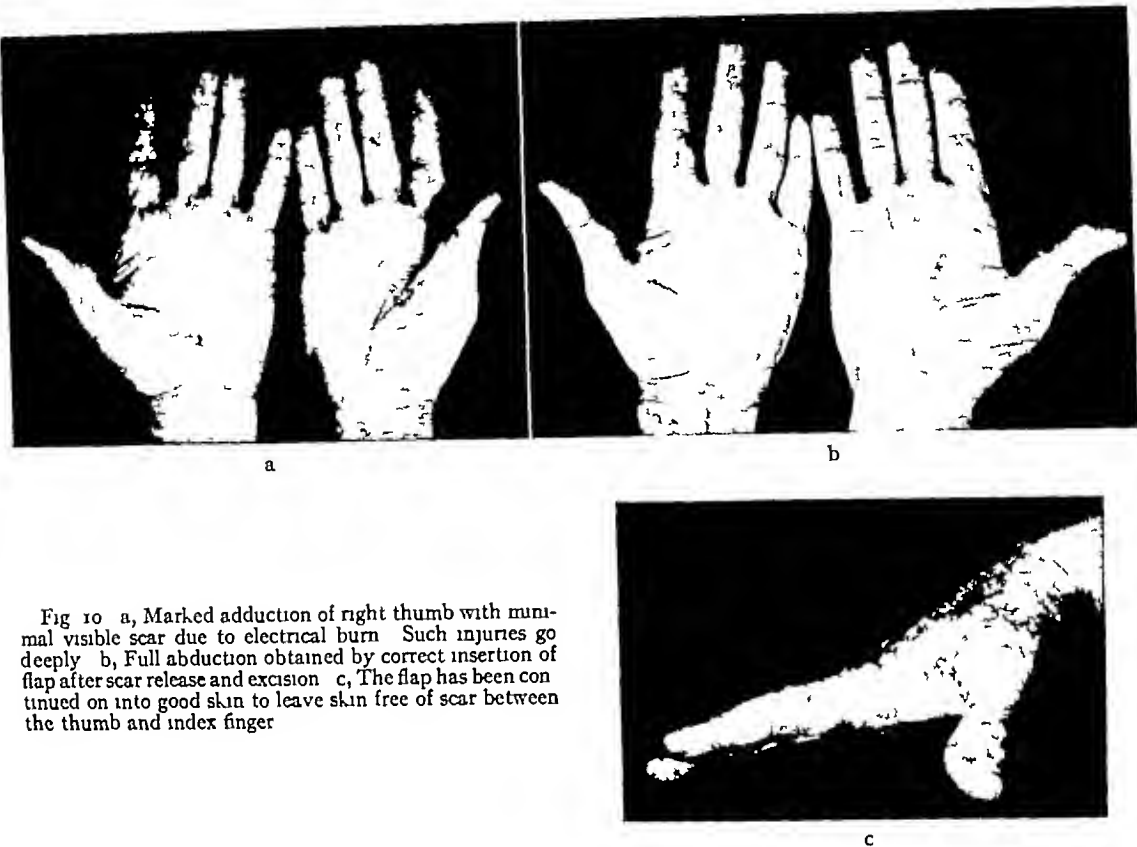


Fig 10 a, Marked adduction of right thumb with minimal visible scar due to electrical burn. Such injuries go deeply. b, Full abduction obtained by correct insertion of flap after scar release and excision. c, The flap has been continued on into good skin to leave skin free of scar between the thumb and index finger.

more nearly resemble dorsal skin since there is normally almost no subcutaneous tissue present. The palmar skin is thicker, tougher, and pretty well padded. Free grafts do not have these characteristics and hence will not stand the hard usage that palmar skin must take at times. In spite of these objections fair to good corrections can be gained and permanently maintained by properly applied thick dermatome type free skin grafts in palmar contracture. The fact that good function of a badly contracted thumb can be gained in one operation in this manner weighs heavily in its favor. Moreover it can be used in children to gain functional position for growth, when flap transfers would be impossible (Fig 8). If partial recontracture occurs, the operation can be repeated after a year or two with still fewer operative steps than are necessary in correction by flaps.

4. Correction with pedicled flaps. There are a number of things to take into considera-

tion before making the decision to use pedicled flaps in the release of thumb contractures. In general this type of repair gives the best and most permanent correction. Perhaps the most important consideration is the depth of the scar and whether bone, nerve, or tendon repair must be carried out. If the scar is obviously deep, a flap must be used. The necessity for the later repair of deep structures makes a flap replacement necessary.

The location of the restraining scar must be considered. In general free skin grafts are more satisfactory on the dorsum of the hand, flaps on the palmar surface. The age of the patient is important. Infants are poor subjects for the immobilization necessary for a successful flap transfer. Flaps are also more risky in middle aged and elderly patients especially if they are obese. The ideal patient is a young thin male.

The fact that most indications for flap repair are on the palmar surface makes the prob-

lem more difficult since it is an awkward place to use a direct or delayed open flap

I have gradually evolved the following procedure. If flap repair is mandatory and the patient is in the middle aged, obese or moderately fat group, a flap of sufficient size is outlined on the contralateral lower anterior chest-abdominal wall with its base laterally and its long axis following the rib curve. Its end extends to the midline. About 50 per cent of this flap is elevated, thinned of fat, and delayed. When edema and induration have subsided, the remaining 50 per cent is elevated and thinned. At the third step the flap is completely elevated, tubed, and its medial end attached to the dorsum between the thumb and index finger (Fig 9). This attachment is left until the tube is soft and edema free. The attachment on the dorsal aspect just behind the thumb-index cleft allows the arm a normal position of right angled elbow flexion and forearm pronation while circulation is becoming established. At the fourth step the tube is severed at the chest, unfolded, and further thinned if necessary, the scar dissected free in the palm, and the flap fitted in place. At the final step after circulation is well established, the dorsally attached end is detached, trimmed,

and brought across the thumb-index line. I believe it is important to have the flap thinned to the point where no further intervention in the hand will be necessary thus preventing scarring as much as possible.

#### CONCLUSIONS

1 In the normal hand the skin of the thumb-index web, thenar eminence, and midpalm is a functioning unit which allows the thumb to move almost as a universal joint.

2 Scar contracture of this region can be relieved by one of four methods.

(a) Z plasty, applicable to thumb index webs only of rather minor restraining character, (b) local flap shifts, useful occasionally in small deep areas of scar, (c) free skin grafts, most suited to dorsal scars, but giving fair correction in superficial palmar contractures, particularly useful in infants, (d) thinned pedicle flap transfers, for deep palmar scarring and thenar eminence scarring.

3 Any one of the methods must be used intelligently so that no scar lines cross the folding areas of the thumb-index web, thenar eminence, and midpalm if a permanent maximum correction of the contracted thumb is to be obtained.

# PEPTIC ULCER FOLLOWING SPLANCHNICECTOMY

## A Report of Thirteen Cases

STEPHEN C MASON, M D, and H M POLLARD, M D, Ann Arbor, Michigan

THE purpose of the present report is to call attention to the effects of splanchnicectomy on the course of peptic ulcer. Since splanchnicectomy deprives the gastrointestinal tract of its sympathetic innervation, this resection can be expected to produce (a) alterations in visceral sensation and, possibly, (b) alterations in function of the stomach.

Afferent fibers from the gut pass from the sympathetic trunk to the dorsal root by way of the white rami communicantes and, like somatic afferents, their cell bodies are in the dorsal root ganglia. The pathway to the sympathetic trunk runs through the celiac plexus and then goes up through the diaphragm by way of the splanchnic nerves. The greater splanchnic nerve reaches the sympathetic trunk by branches to the fifth through the ninth or tenth thoracic ganglia, the lesser splanchnic usually to the ninth and tenth, and the lowest splanchnic to the last thoracic ganglia or the lesser splanchnic nerve (28). Preganglionic fibers pass outward from the cord by the same pathways. It has been demonstrated by Bain, Irving, and McSwiney (3) that afferent components of the splanchnic nerves enter the spinal cord by way of the white rami communicantes of all the spinal nerves from the third thoracic through the first lumbar. Balchum and Weaver have shown by distending the stomach of dogs with a balloon and watching for a certain typical change of respiration which indicated to them the threshold of pain, that the greater splanchnics carry most of the visceral afferents from the stomach and that the left carries more than the right. Their findings indicate also, that the distribution of afferent fibers from the stomach enter the cord in a widespread pattern. It was necessary to transect the posterior roots of the fourth

thoracic through the third lumbar ganglia before all pain from the stomach was abolished. They suggest further that though, under normal circumstances, the fibers mediating pain in the spinal segments of the eighth thoracic through the thirteenth thoracic ganglia carry the majority of impulses, it is possible that more impulses pass over other pathways when the main routes are interrupted and thus bring the pain threshold more toward the normal level.

The second group of effects of splanchnicectomy on the gastrointestinal tract concerns the alterations in function which might result from the interruption of the sympathetic efferent fibers of the stomach.

That there are alterations in function is suggested by a great many experimental studies. Most of the earliest investigation was centered about the production of peptic ulcers in animals by excision of the celiac ganglia, many of these workers reported lesions of the gastroduodenal mucosa varying from hyperemia to small ulcers. The reader may consult Koennecke for a review of this work.

More recently splanchnic nerve resections on dogs or rabbits were done by Durante, Brancati, Koennecke, and Koga, and they reported that ulcers developed in some of their animals. Alvarez and associates found gastric ulcers after 1 to 5 weeks in 5 of 7 rabbits surviving splanchnicectomy. Lium removed the celiac and mesenteric ganglia from 9 dogs and all of them developed a bloody diarrhea. At autopsy 4 of these dogs had peptic ulcers but Lium considered that inanition due to the diarrhea was partly responsible for the ulcers.

Keller (25) did thoracolumbar sympathectomies on 20 dogs and found no evidence of peptic ulcer when these animals were sacrificed after a postoperative period varying from 1 to 14 days. However, when thoraco-

From the Department of Internal Medicine, University Hospital, University of Michigan, Ann Arbor, Michigan.

lem more difficult since it is an awkward place to use a direct or delayed open flap

I have gradually evolved the following procedure. If flap repair is mandatory and the patient is in the middle aged, obese or moderately fat group, a flap of sufficient size is outlined on the contralateral lower anterior chest-abdominal wall with its base laterally and its long axis following the rib curve. Its end extends to the midline. About 50 per cent of this flap is elevated, thinned of fat and delayed. When edema and induration have subsided, the remaining 50 per cent is elevated and thinned. At the third step the flap is completely elevated, tubed, and its medial end attached to the dorsum between the thumb and index finger (Fig 9). This attachment is left until the tube is soft and edema free. The attachment on the dorsal aspect just behind the thumb-index cleft allows the arm a normal position of right angled elbow flexion and forearm pronation while circulation is becoming established. At the fourth step the tube is severed at the chest, unfolded, and further thinned if necessary, the scar dissected free in the palm, and the flap fitted in place. At the final step after circulation is well established, the dorsally attached end is detached, trimmed,

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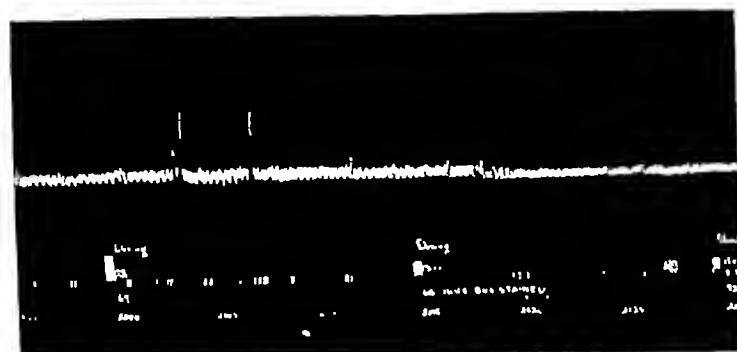
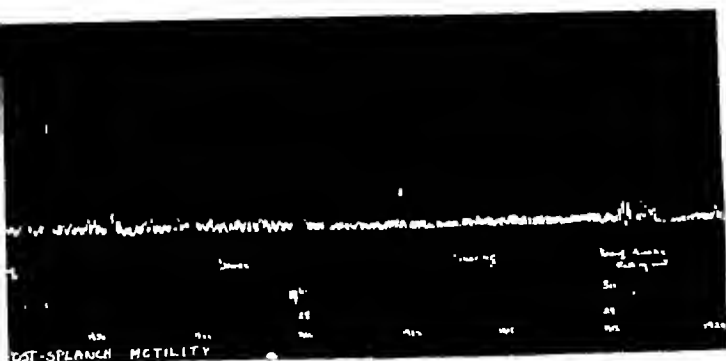
#### CONCLUSIONS

1 In the normal hand the skin of the thumb-index web, thenar eminence, and midpalm is a functioning unit which allows the thumb to move almost as a universal joint.

2 Scar contracture of this region can be relieved by one of four methods.

(a) Z plasty, applicable to thumb index webs only of rather minor restraining character, (b) local flap shifts, useful occasionally in small deep areas of scar, (c) free skin grafts most suited to dorsal scars, but giving fair correction in superficial palmar contractures, particularly useful in infants, (d) thinned pedicle flap transfers, for deep palmar scarring and thenar eminence scarring.

3 Any one of the methods must be used intelligently so that no scar lines cross the folding areas of the thumb-index web, thenar eminence, and midpalm if a permanent maximum correction of the contracted thumb is to be obtained.



carried out through Figures 1 to 6) Postsplanchnicectomy balloon kymograph 19 months after operation  
12, carried out January 6, 1947

the influence of sodium luminal, the inhibitor response which had previously predominated was now converted to an augmentor response, and that current of any strength or frequency would produce only this response

Bilateral splanchnicectomy has been done on dogs by a number of investigators and the effects on the stomach observed. McCrea (30) did transabdominal splanchnotomies on dogs, cats, and rabbits, and observed the animals for 7 months following. The temporary changes he noted were increased depth of peristalsis and the stomach appeared small and tubular. These gradually became less marked and the organ returned to the normal state. However, permanent changes were noted (by x-ray examination) in the emptying time. The initial emptying time was markedly shortened and there was an appreciable decrease in the total emptying time. This fact he attributed to the increased activity of the stomach. McSwiney (32) tabulated the results of previous workers on

splanchnotomy and concluded that it produced accelerated function of the stomach. Cerqua studied the stomach after splanchnotomy and observed a decreased initial emptying time but, in his dogs, the total emptying time returned to normal after a few weeks. However, by following the emptying time by both x-ray examination and by means of gastric fistula, he found that, when olive oil or acid test meals were used, the total emptying time for these was greatly reduced from the expected values. He attributed this fact to a possibly decreased duodenal pyloric reflex. He found no constant change in the intensity or rate of gastric contraction when a balloon was inserted through the fistula so that he attributed the change in the initial emptying time to the presence of a patulous pylorus.

Barron (5, 7, 8) made a long series of balloon kymograph studies in 2 juvenile diabetic patients who had had a two stage splanchnicectomy. Shortly after left splanchnicectomy,

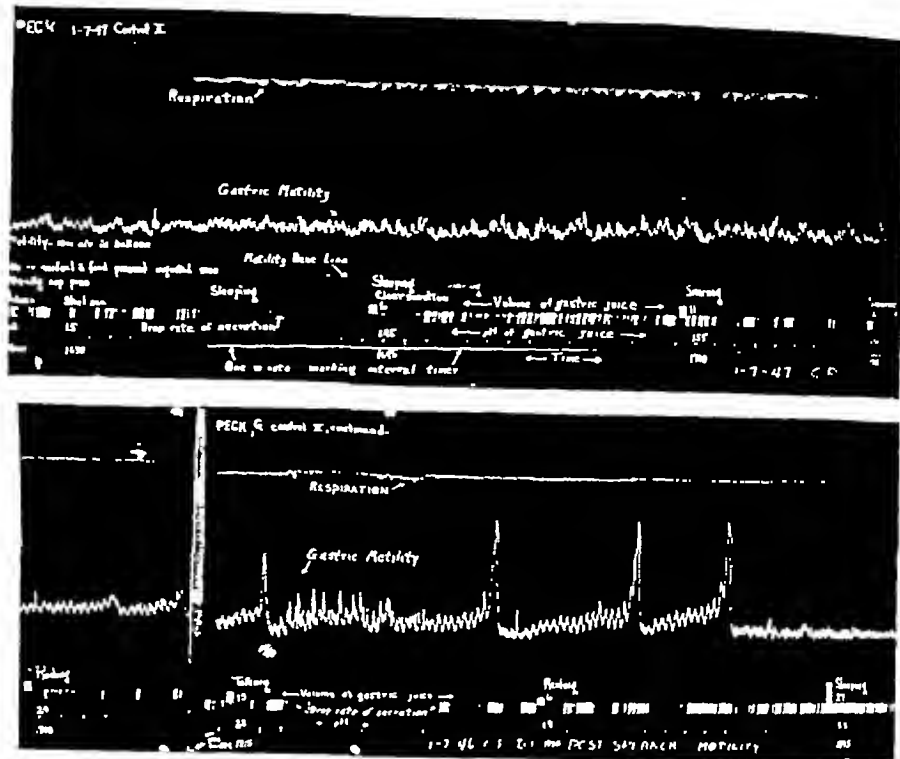
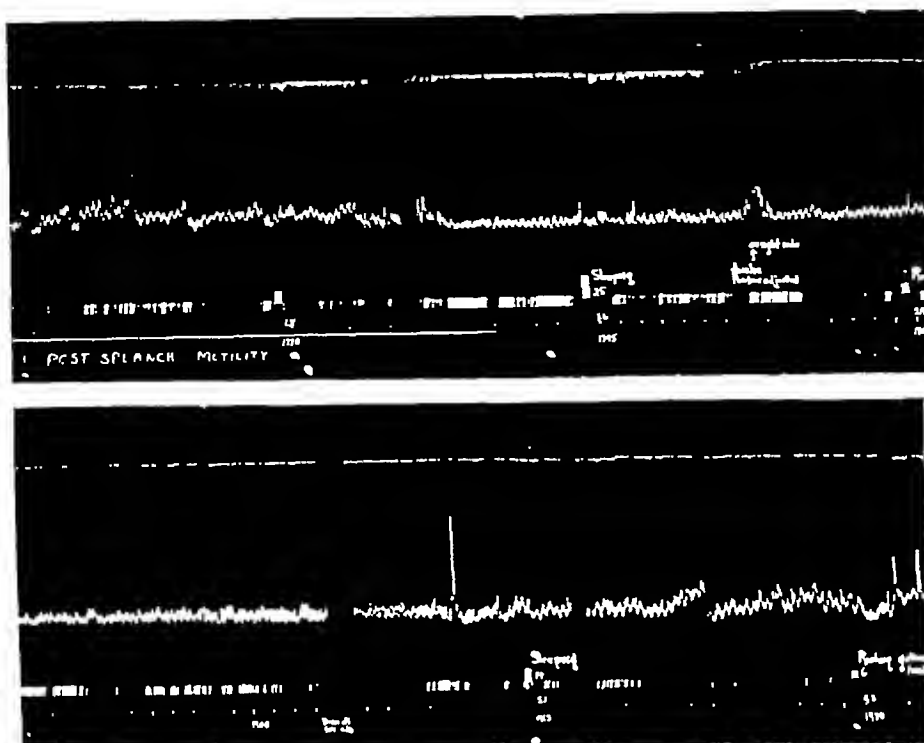


Fig 2 Control study II, Case

short periods of intense gastric motility were noticed, interrupted by short periods of quiescence. The periods of activity soon became longer and, occasionally, would last throughout a 4 to 5 hour period of observation or, more typically, there would be a period of motility which ended in gastric tetany. After a short period of quiescence the motility would resume and continue throughout the period of observation. After right splanchnicectomy, the results were similar. There was continued prolonged intense gastric motility and this lasted without change for the 7 months that one patient was followed. Gastric emptying time was studied in 1 of these patients and, while no significant decrease was noted after right unilateral splanchnicectomy, the average total emptying time decreased from 4 hours and 45 minutes to 3 hours and 30 minutes following the bilateral splanchnicectomy. Barron (6) concludes that splanchnicectomy removes the inhibitory effect of the sympathetic nervous system, inhibition being its predominant effect, and places

the stomach under the unopposed action of the vagus.

From these studies, the change in function, according to the reported work on man and on animals, seems to be in the direction of increased activity of the motor mechanism of the stomach. Whether this change in function is permanent has not been settled by the data in the literature. McCrea (30) acknowledges that the increase in activity seemed to be persistent, but he suggested that it probably would diminish in time. Much more evidence should be accumulated before these points will be established. Barron's 2 patients, it must be remembered, underwent splanchnicectomy for the treatment of diabetes, and though their insulin requirement was found to decrease postoperatively, they still required insulin. Barron states that the blood sugar level was well controlled by careful therapy with insulin and dextrose. But no data on this are given, and the fact that occasional "hypoglycemia periods" were observed and quickly corrected in his patients



12, carried out January 7, 1947

indicates the need of data which will avoid this possible source of error. Hypoglycemia and the fluctuations in blood sugar resulting from injections of insulin are potent factors connected with the production of gastric motility (14, 36). The 1 hypertensive patient studied after splanchnicectomy in the Gastroenterology Laboratory at the University of Michigan shows no evidence of a hypermotile stomach. Unfortunately, no presplanchnicectomy studies are available on this patient. The postplanchnicectomy balloon kymograph studies were begun 19 months after operation, shortly after a duodenal ulcer had been demonstrated by x-ray examination. Throughout the following 6 months tracings were made on 5 different occasions. Figure 1 through Figure 6 reproduce representative portions of these records. Throughout all the studies, the degree of quiescence is the most characteristic feature. The periods of activity which usually lasted 20 to 40 minutes consisted of large type I (tonus rhythm) and rather widely spaced type II (single spikes)

contractions. As a rule these periods occurred only once during a 3 to 4 hour study, and appeared while the patient was asleep, but somewhat more frequently when the patient was awake. A drop in the pH of the gastric juice to below 2.0 or 3.0 usually accompanied this activity. The insulin test, run after 3 control studies, shows the marked and early response of the gastric motility and secretory mechanism to hypoglycemia. The 15 minute samples of gastric juice were titrated and the output of hydrochloric acid during that period recorded—the wide column just above the time line represents the milligrams of hydrochloric acid output, the narrow column, the volume output of gastric juice. On the other records the single column represents the volume output. Despite the relatively small dose of insulin (10  $\mu$ ) given, a marked subjective response appeared during the hypoglycemic period, and 5 per cent glucose was started by intravenous drip, but not before the stomach had time to respond to the hypoglycemia.



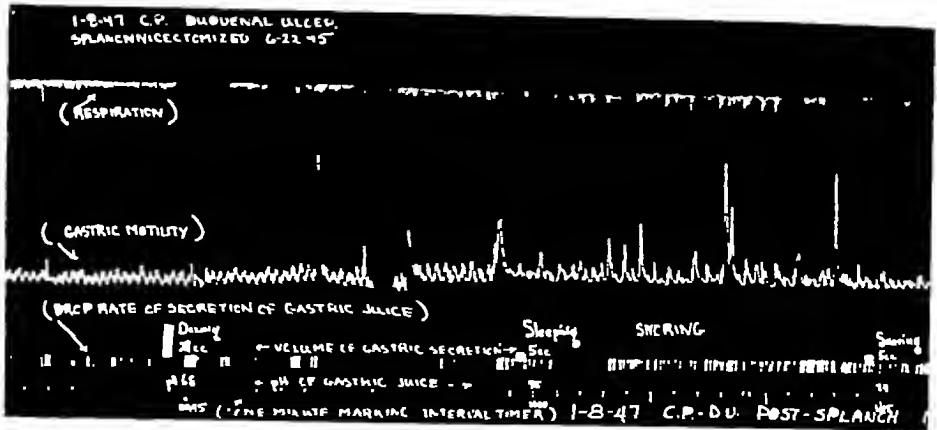


Fig 3 Control study III, Case

If more studies of this nature, however, bear out the findings of Barron, what role will the increased motor activity play in the production of peptic ulcer, and what of the secretory mechanism under these conditions? Careful, detailed work on this subject might help establish the fact that such a thing as "vagal predominance" does occur when the opposing influence of the splanchnics is removed. And if under these circumstances, ulcer could be consistently produced in a significant percentage of dogs, the neurogenic theory of production of peptic ulcer would be on a sounder footing.

#### PRESENTATION OF 13 CASES

Bilateral supradiaphragmatic splanchnicectomy and lower dorsal ganglionectomy was done in these 13 cases as treatment for es-

sential hypertension. Preceding the operation, these patients were studied completely from the standpoint of their hypertension, but for the sake of brevity these findings are not included here. The hypertensive state was of such severity as to overshadow any other condition that was present and, because of this, splanchnicectomy was considered advisable in each case.

A postsplanchnicectomy diagnosis of peptic ulcer was made in 13 of 1,498 patients who registered at University Hospital from June, 1934, to June, 1945 and subsequently underwent a bilateral splanchnicectomy and lower dorsal ganglionectomy at this hospital. Preoperatively, 3 of these 13 patients had a proved diagnosis of peptic ulcer and 4 more had a presumptive diagnosis of ulcer made on the basis of reports of clinical and x-ray

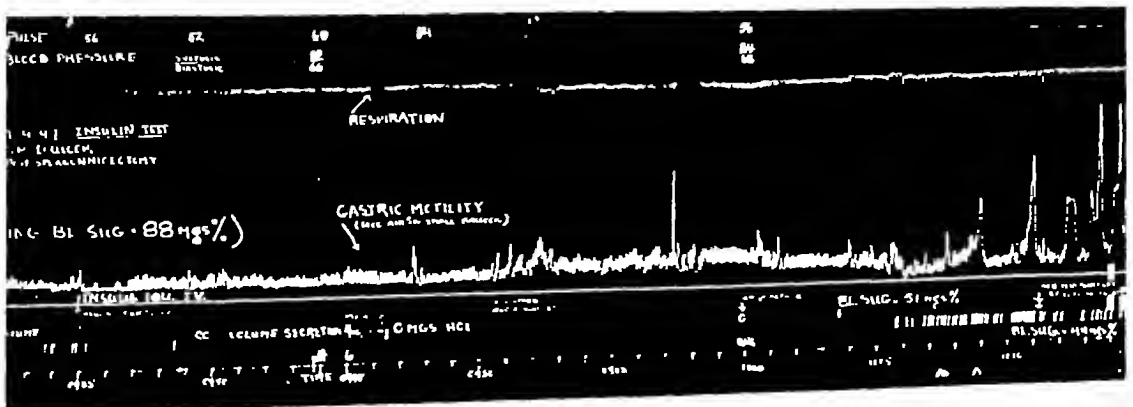
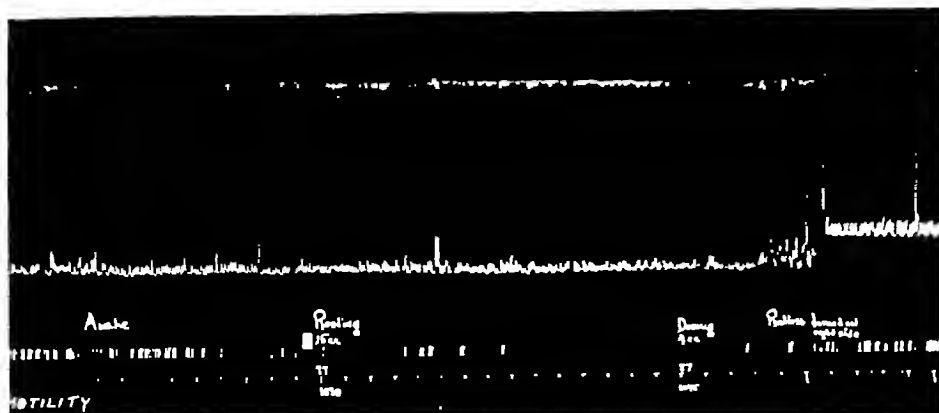


Fig 4 Insulin test, Case 12



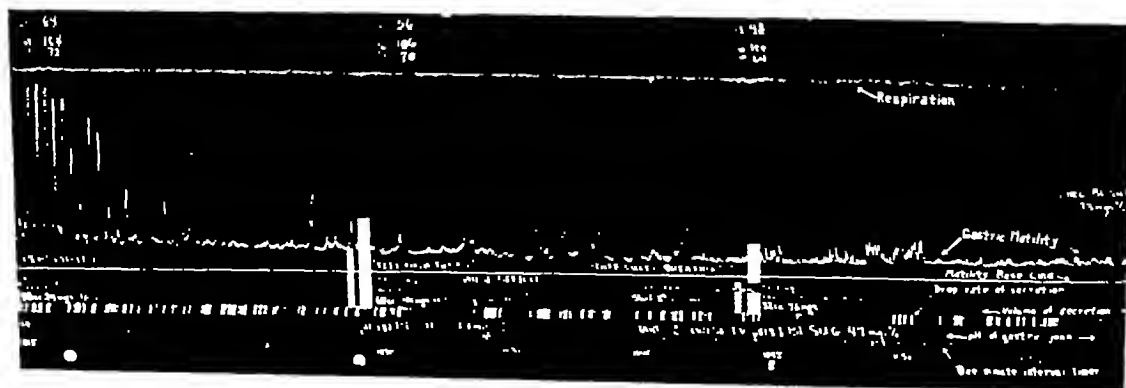
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findings preceding admission to the University Hospital. An additional 3 patients had symptoms which were only suggestive of ulcer, but, in 1 of these (Case 10) it is extremely likely that an active gastric ulcer was present at the time when the splanchnicectomy was performed.

Postoperatively, the diagnosis of peptic ulcer was proved in 9 cases while a presumptive diagnosis was reached in 3 other instances. In the remaining patient (Case 2), symptoms were suggestive of ulcer but it was not known whether or not the duodenal deformity which was seen 6 years postoperatively represented scarring which occurred before or after splanchnicectomy.

In brief, 8 of these 13 patients developed their first peptic ulcer preoperatively (Case 10 being included) while 4 developed their

first ulcer after operation. The remaining patient (Case 2) cannot be placed with any certainty in either of these two groups. In the group of patients who had an ulcer preoperatively, it would not be surprising to find recurrences after operation, considering the nature of peptic ulcer. These recurrences would probably have occurred if any other operation had been done instead of splanchnicectomy or even if the splanchnicectomy had been omitted. With the 4 new cases of peptic ulcer this explanation will obviously not apply. These 4 patients averaged 45 years of age at the time of splanchnicectomy and their first ulcer appeared on an average of less than 2 years postoperatively. One is left to speculate as to whether the psychosomatic response of each of these patients had actually changed during this period from a



carried out January 9, 1947

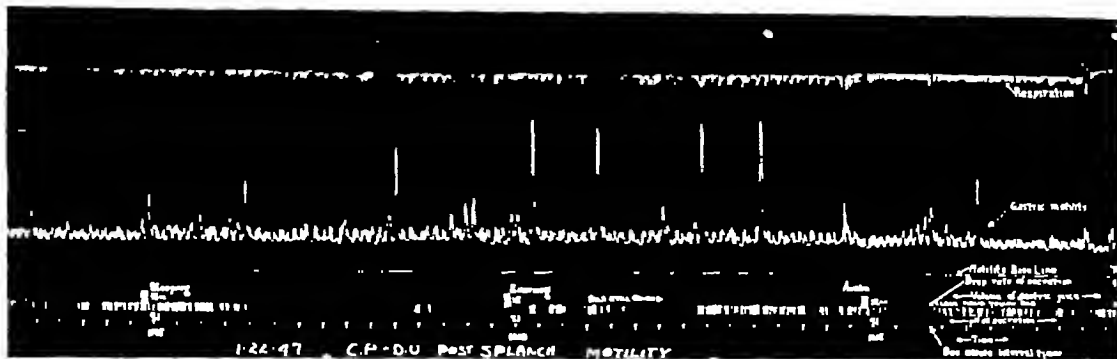


Fig 5 Follow up study, Case 12,

hypertensive pattern to one of altered gastrointestinal function or whether the splanchnic resection itself played the important role by upsetting the balance of the autonomic innervation and establishing a vagal predominance. In 1 instance, however, the patient (Case 12) complained of "sour stomach" each spring for 20 years preoperatively, which would suggest that an ulcer diathesis was already present.

In order to get an idea of the over-all frequency of peptic ulcer preceding splanchnicectomy in this large group of hypertension patients, the records of another 200 cases of splanchnicectomy selected at random were reviewed. This group of 200 patients represented a balanced sample of cases, taken from the various services at University Hospital, who had undergone splanchnicectomy during the period from 1934 to early 1948. It was found that in 3 cases a diagnosis of peptic ulcer was proved, and in another case a presumptive diagnosis of peptic ulcer was

made on the basis of x-ray findings which the patient reported. Four additional patients reported having a past history of vague gastrointestinal symptoms which were somewhat suggestive of peptic ulcer. Since 2 of the latter patients had negative upper gastrointestinal roentgenograms during a symptomatic period and the other 2 gave a very atypical ulcer history, the evaluation of their symptoms will not be attempted. The 4 patients with a definitely demonstrated ulcer would represent 2 per cent of this group of 200 cases. If this percentage is applied to the entire series of 1,498 cases and a correction made for the 8 patients being reported who had a presplanchnicectomy history of peptic ulcer, the incidence of peptic ulcer before operation would approximate  $2\frac{1}{2}$  per cent. On the basis of our data it appears that at least 21 per cent of patients with a presplanchnicectomy history of peptic ulcer will develop another ulcer in the early years following the operation. Since these recurrences

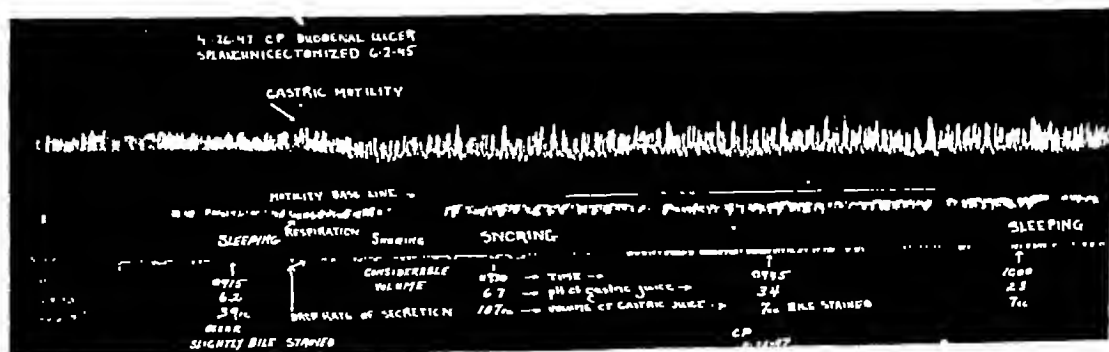
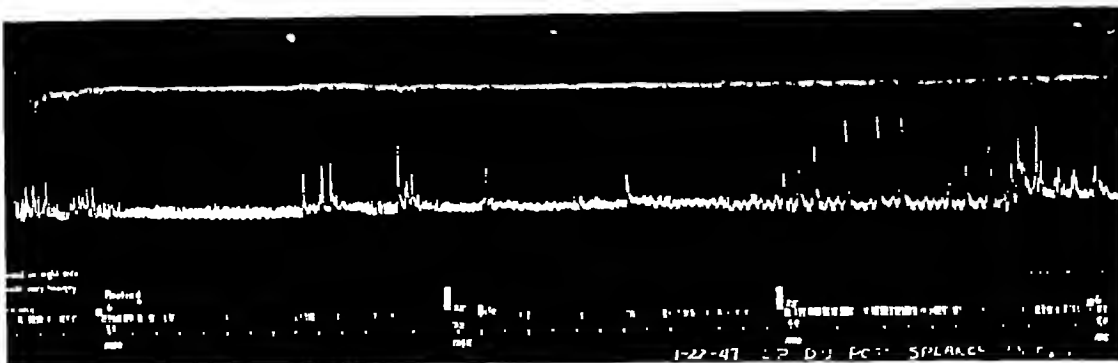


Fig 6 Follow up study, Case 12,



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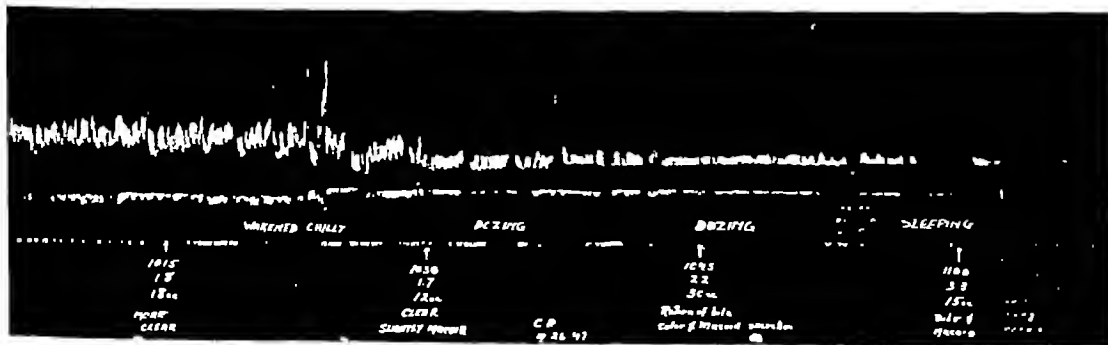
are most likely to be in a silent form, always threatening a serious complication, it would seem wise to handle these patients with peptic ulcer very cautiously after splanchnicectomy

In both the fatal cases in this series the first ulcer developed following splanchnicectomy, which fact indicates that no individual is free of this threat after operation. The person developing his first ulcer after operation is probably in greater jeopardy because he has had no previous personal experience with peptic ulcer. This factor seems to be the important thing in making patients seek attention when vague signs or symptoms of ulcer do appear, the normal sensations not being present to convince the person of the seriousness of the situation.

#### COMMENT CONCERNING COMPLICATIONS

Peptic ulcer is so characterized by exacerbations and remissions that we would expect any group of patients with a history of peptic

ulcer to have recurrences and develop occasional complications in subsequent years. However, the rate of complication in this group of patients over a postoperative period which averaged 6 years seems much greater than would have been expected if they had not undergone splanchnicectomy. In the group of 8 patients with a preoperative diagnosis of peptic ulcer (Case 10 is included), there had been 2 episodes of hematemesis and 2 other patients had melena preoperatively. By contrast, postoperatively, these same 8 people had 8 episodes of minor bleeding, 1 perforation, 1 partial obstruction, 2 massive hemorrhages, 1 from a penetrating ulcer. In the group of 4 patients that developed their first peptic ulcer postoperatively, 1 had a questionable episode of melena after 2½ years, another had melena and hematemesis after 18 months, followed by a recurrence at 23 months which necessitated a subtotal gastric resection to relieve the obstruction, and 2 died of severe hemorrhage from a duodenal



carried out April 26, 1947

tain more in the region of the back might be expected with stimulation of these pain receptors (3) According to the segmental distribution of the nervous system, visceral pain from lower portions of the bowel would enter the spinal cord at a lower level and it is more likely that some of their afferents would pass into the lumbar segments of the cord if the lumbar sympathetic ganglia are left intact, pain impulses resulting from spasm of the lower gastrointestinal tract or even from distention could readily reach the cord as either a referred or a direct visceral pain and would be experienced by the patient (4) The possibility of visceral pain from the stomach itself would necessitate a widespread distribution in the cord of the visceral afferent fibers from the stomach. The work of Balhum and Weaver in dogs suggests this as a possibility. They had to section posterior roots of the fourth thoracic through the third lumbar ganglia before they could completely eliminate response to distention of the stomach. If this is also true in humans, then the leaving of the lumbar ganglia undisturbed should permit a certain amount of visceral sensation from the stomach and duodenum to persist.

The comparison of patients who have had splanchnicectomy and lower dorsal ganglionectomy with those who have had a thoracolumbar sympathectomy should help to clarify this point and epigastric pain should be the best indication of this persistence. Jones has shown by balloon distention of various portions of the upper gastrointestinal tract that, as the balloon is successively advanced and redistended, the pain is referred to a point progressively lower in the abdomen, but always somewhere near the midline. When the stomach or the duodenum was distended, sharply localized pain in the midepigastrum was obtained in most cases.

In the examination of the pain noted immediately postoperatively, we find that in only 2 cases was epigastric pain mentioned. It was present on only 1 day in each case, this day being soon after operation on the first postoperative day in Case 4, and on the second postoperative day in Case 10. Oddly enough, both these patients soon had a serious compli-

cation and required immediate laparotomy. One patient (Case 1) complained of epigastric distress during the seventh postoperative day. This was relieved by initial ulcer diet and Sippy tablets. Various abdominal pains are reported, most of these being in the right lower quadrant or right upper quadrant when localization is mentioned. The thing most frequently associated with these pains is distention, and this could probably explain away a good share of the early postoperative pains. The pain could originate in the lower bowel (the portion with afferents to the lumbar segments of the cord) either by distention of this part or pressure on this part by distention in another part of the bowel. Distention, in addition, can cause tugging on adhesions and send painful sensations from the parietal peritoneum. Perhaps the frequent localization in the right upper quadrant and right lower quadrant is due to the presence there of adhesions from old inflammatory processes. From our data it is evident that nausea is not unusual after splanchnicectomy.

In examining the pains mentioned in the later postoperative course of the 8 patients who had abdominal symptoms with their ulcers, it was noted that 5 complained of some kind of vague epigastric sensation, variously described as discomfort, distress, soreness, fullness, pressure, burning or dull ache. Of the other 8 patients, 1 had had a partial gastrectomy (Case 4), 4 made no mention of pain, 1 patient experienced only nausea and vomiting with his ulcer (Case 12), and 1 had a single instance of pain in the abdomen which lasted for several days, 2 months before death. Tenderness of some degree was noted in 4 of the 8 patients with symptoms. In all the patients the typical midepigastric pain of peptic ulcer was absent. However, the presence of a vague type of epigastric distress suggests that some sensation directly from the stomach and duodenum still remained intact. Ulcer management (diet and antacids) effectively eliminated these complaints. Assuming that the stimulation of peripheral nerves and visceral afferents in lower bowel would give a localization other than epigastric, there yet remains the vagus. Can visceral sensation reach consciousness by way of the vagus? A study of

abdominal pain present after more extensive resections of the sympathetic nervous system than have been done at this hospital should provide important evidence in answering this question

#### SUMMARY

In a group of 1498 patients who underwent a splanchnicectomy for hypertension during an 11 year period, there were 13 cases of peptic ulcer following the operation. Three of these had proved ulcers preoperatively, while in 4 a presumptive diagnosis of ulcer was made, and in 3 others symptoms which were suggestive of peptic ulcer were present. Postoperatively an ulcer was demonstrated in 9 cases and a presumptive diagnosis was made in 3 other patients. In 1 instance there were only suggestive symptoms of peptic ulcer both before and after operation and it was not known whether the scarring of the duodenum seen 6 years postoperatively had been present before splanchnicectomy.

Approximately 2½ per cent of the entire group of 1,498 patients were considered to have a definite preoperative history of peptic ulcer and 21 per cent of these reported a recurrence following splanchnicectomy.

Preoperatively only 4 patients had a complication of their ulcer. In each case this complication was hemorrhage and it was usually of no great severity. By contrast, 11 of the 12 ulcers which appeared after splanchnicectomy were complicated. It was frequently only by this complication that the ulcer definitely announced its presence. Five of these patients had severe complications, 2 were fatal and the other 3 required emergency laparotomy. One of these was for the closure of a perforation, the other 2 were necessary to ligate arterial bleeders in the base of the ulcer. Of the latter 2 patients, one had an active ulcer at the time of splanchnicectomy and the other probably also had one.

It seems clear that, following splanchnicectomy, frequent and severe complications of peptic ulcer developed in these 12 patients because the normal epigastric pain sensations were either abolished or greatly reduced so that the ulcers were permitted to advance to dangerous proportions without

giving the usual warning. Whether the splanchnicectomy, itself, caused the ulcers or not cannot be concluded from the findings presented, however, 4 patients developed their first ulcer postoperatively and 2 of these resulted in fatal hemorrhages. The patients with the longest history of peptic ulcer before operation usually developed the more serious complications. Patients with recently healed ulcers, and especially patients with active ulcers, developed complications most rapidly after splanchnicectomy, and these complications were among the most severe that were present in this group of patients.

Epigastric pain was present immediately after splanchnicectomy in 2 patients, and in both of these severe complications finally developed. Vague epigastric distress months to years postoperatively was noted by 5 of the 8 patients in whom mention of abdominal symptomatology was made. Severe pain was described by 3 of the patients and this appeared as the ulcer was penetrating or perforating. It is felt that more attention should be paid to vague abdominal signs and symptomatology following splanchnicectomy. Prompt diagnosis and rigid medical management in these cases would reduce the frequency of complication when peptic ulcer is present.

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# SIGNIFICANCE OF AN ULCERATING LESION IN THE STOMACH FOLLOWING GASTROENTEROSTOMY

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THE development of an ulcerating lesion in the stomach after gastroenterostomy is not uncommon, and yet we have been unable to find any reports in the medical literature in which such lesions have been discussed. For this reason and because we had the distinct impression that the incidence of malignancy was high for gastric cancer that developed after gastroenterostomy, it seemed worth while to review in detail these cases at the Mayo Clinic during the ten year period from January 1, 1938, through December 31, 1947, in which a gastric lesion requiring surgical intervention developed subsequent to gastroenterostomy for duodenal ulcer.

This series of patients does not include every patient in whom a gastric lesion was demonstrated after gastroenterostomy, for many patients were seen at the clinic during this period who declined operation, who were operated on frequently elsewhere or who were treated conservatively. This study does include all patients in whom a demonstrable gastric cancer followed gastroenterostomy and who went through surgical treatment, including distal gastrectomy or partial gastrectomy.

It has been accepted generally that the coexistence of an active duodenal ulcer and a gastric cancer is very rare. The high gastric acidity and the increased peptic activity that is associated with an active duodenal ulcer tend to prohibit or delay the development of a malignant neoplasm in the stomach, as suggested by Wilbur and Rivers. Bockus has stated that "patients with this disease (duodenal ulcer) are much less likely to develop cancer of the stomach than those who have no such disease whatever." Eusterman and others have expressed the opinion that "the incidence of duodenal ulcer is in a certain sense

an insurance against carcinoma of the stomach." They reported that of 15,985 patients who underwent roentgenologic examination of the stomach for digestive disturbance, 2,047 (12.8 per cent) demonstrated deformities of the duodenal cap which were characteristic of duodenal ulcer, 167 (1 per cent) had roentgenologic evidence of gastric ulcer, 24 (0.15 per cent) showed evidence of both duodenal and gastric ulcer, and in none was there evidence of a duodenal ulcer which was associated with what was apparently a malignant lesion in the stomach.

In 9,171 consecutive postmortem examinations at the Cook County Hospital, Portis and Jaffé found 240 benign gastric ulcers, 215 duodenal ulcers, 19 benign gastric ulcers associated with a duodenal ulcer, but in no patient did they find a duodenal ulcer associated with a gastric carcinoma. Smithies and Ochsner, however, have reported on 12 patients in whom gastric cancer was coexistent with benign peptic ulcer, in 8 of whom the peptic ulcer was located in the duodenum. Wilbur and Rivers in 1932 reported on 33 patients who had duodenal ulcer associated with gastric cancer. Four of these patients had undergone a previous gastroenterostomy for duodenal ulcer. In 20 of the 33 patients the gastric lesion was a malignant ulcer, whereas in the remaining 13 patients a massive gastric carcinoma was found. In all of the 33 patients the nature of the lesion was proved at operation or necropsy.

Fischer, Clagett, and McDonald found records of only 48 cases of coexistent duodenal ulcer and gastric cancer in the surgical and postmortem files of the Mayo Clinic from 1911 through 1944. In only 1 of these 48 patients had a previous gastroenterostomy been made for duodenal ulcer. During this same period of 34 years, there were approximately 600 instances in which a coexistent duodenal and a benign gastric ulcer were seen on roentgeno-

the Division of Surgery, Mayo Clinic and Mayo Found-



TABLE I — GASTRIC LESIONS FOLLOWING GASTROENTEROSTOMY 1938-1947 (INCLUSIVE)

Year	Gastroenteric stoma discontinued and partial gastrectomy done	Gastric lesions following gastroenterostomy for					
		Duodenal ulcer		Gastric ulcer		Other reasons	
		Benign	Malignant	Benign	Malignant	Benign	Malignant
1947	65	5	1	0	0	0	0
1946	98	3	2	0	1	0	0
1945	100	0	1	1	1	0	0
1944	87	3	0	1	0	0	0
1943	79	4	2	0	1	0	0
1942	76	4	3	1	0	0	0
1941	8	2	1	0	1	0	1
1940	76	4	1	2	1	0	0
1939	81	4	0	0	1	0	0
1938	81	1	0	0	0	0	0
Total	825	30	11	5	6	0	1
Percentage benign or malignant		73	27	45	55	Insignificant	Insignificant

logic examination at the clinic. The association of a duodenal ulcer and a benign gastric ulcer appears therefore to be about 12 times as common as the association of a duodenal ulcer and a gastric carcinoma (a ratio of 600.48 in approximately 45,000 patients).

There were 825 patients seen at the clinic during the 10 year period between January 1, 1938, and December 31, 1947, in whom a previously established gastroenteric stoma for duodenal or gastric ulcer had to be discontinued owing to subsequent complications and for whom a partial gastrectomy was carried out as a secondary procedure. These subsequent complications which followed the original gastroenterostomy and for which surgical treatment was advised included jejunal ulceration near the gastroenteric stoma, malfunctioning gastroenteric stoma, gastric ulcer and gastric carcinoma, listed in order of their incidence. In Table I may be seen the relative incidence of benign and malignant lesions in this series of patients.

Forty-one gastric lesions developed after a gastroenterostomy for duodenal ulcer, of which 11 (27 per cent) were gastric cancers and 30 (73 per cent) were benign gastric ulcers. The

association of an old duodenal ulcer with subsequent gastric cancer in a stomach that has undergone gastroenterostomy appears to be more common perhaps than one would think in view of the few cases on record in which this association has been found in routine studies of patients not subjected to previous gastric operations. Of 11 gastric lesions that developed or were retained after a gastroenterostomy for gastric ulcer, 6 (55 per cent) were proved to be malignant and 5 (45 per cent) were proved to be a benign gastric ulcer at the time of the subsequent gastric resection. Included in this study was 1 patient in whom a gastroenteric stoma had been made elsewhere for no demonstrable ulcer and in whom a gastric carcinoma that required surgical intervention developed several years later.

In the routine study of patients who are examined roentgenologically on account of gastric complaints, the ratio of gastric ulcer to gastric carcinoma has been found to be about 13 at the clinic (2). In our small series of 53 patients in whom a previous gastroenteric stoma had been made for duodenal or gastric ulcers (in all instances except 1), the ratio of gastric ulcer to gastric cancer is almost reversed, being 21 (35:18). It appears that a patient with an ulcer diathesis is less likely to have gastric carcinoma.

#### GASTRIC LESIONS THAT FOLLOWED GASTROENTEROSTOMY FOR DUODENAL ULCER

Of the 41 patients in this group 30 had benign gastric ulcers and 11 had gastric cancers that followed previous gastroenterostomy for duodenal ulcer.

Of the 30 patients in whom benign gastric ulcers developed, 12 had undergone gastroenterostomy at the clinic. The average age of these patients at the time of gastroenterostomy was 39.3 years and at the time of the subsequent gastric resection 52.3 years, thus giving an average time interval of 13.0 years between these 2 operations.

Of the 11 patients in whom carcinoma developed, 2 had undergone gastroenterostomy at the clinic. The average age of these patients at the first operation was 35.9 years and at the second 50.9 years, an average time interval of 15.0 years between these 2 operations.

*Symptoms* In the group with benign gastric lesions, all patients complained of distress which was characteristic of peptic ulcer. In the group with malignant gastric lesions, 5 of the 11 patients gave a definite history which strongly suggested peptic ulcer, 2 presented a less clear-cut history, 1 gave no characteristic story, and 3, on the other hand, presented a history pointing toward malignancy, that is, anorexia, progressive weakness, loss of weight and so forth. The average loss was 8.5 pounds (3.8 kgm) for the patients with benign lesions and 16.5 pounds (7.5 kgm) for those with malignant lesions.

*Clinical findings* The value of free hydrochloric acid in the gastric contents averaged 25.6 units in the patient with benign lesions. It was absent in 3 (10 per cent) of this group, but 1 patient had a gastrojejunocolic fistula and another had a gastroileac stoma, which had been made elsewhere, so that the apparent achlorhydria could be accounted for in 2 of the 3 patients. The value for free hydrochloric acid averaged only 9 units for the 8 patients with malignant lesions for whom it was determined, and free acid was entirely absent in 4 (50 per cent). The quantity of hemoglobin averaged 12.6 grams per 100 cubic centimeters of blood for patients with benign lesions and 11.8 grams for those with malignant lesions.

*Roentgenologic findings* In the group of patients with benign lesions the roentgenographic diagnosis was "gastric ulcer" in 20 (67 per cent), "gastroenteric stoma free" in 6, "gastrojejunocolic fistula" in 2, "obstruction" in 1, and no examination was done in 1 who was bleeding. In patients with malignant lesions the roentgenographic diagnosis was "carcinoma" in 5 (45 per cent), "ulcerating lesion" in 4, "gastrojejunitis" in 1, and "obstruction" in 1.

*Comment* The benignancy of the gastric lesion was suggested frequently by the patient's symptoms and by the clinical findings, a gastric carcinoma was concealed and was revealed only at the time of operation. The clinical diagnosis was difficult in those patients who harbored malignant lesions of the stomach in the presence of an old gastroenteric stoma and an old duodenal ulcer. In 2 of these patients the preoperative clinical impression was "gas-

tric ulcer," in 2 "malfunctioning gastroenteric stoma," and in 3 "stomach ulcer," but at operation they were all found to have carcinoma of the stomach. The 3 case reports which follow illustrate how frequently a malignant gastric lesion in a stomach that has undergone gastroenterostomy can simulate a benign condition.

"Gastric ulcer" was the clinical impression in the following 2 patients in whom a malignant gastric lesion was found at operation.

A male, aged 36 years, gave a history of epigastric pain and vomiting for 1 year. Thirteen years previously he had undergone gastroenterostomy elsewhere for duodenal ulcer. The roentgenographic examination revealed an "ulcer on the lesser curvature below the angle, associated with diffuse gastritis." The free hydrochloric acid in the gastric contents measured 38 units, and the total acids measured 48 units after the usual test meal. At operation a scirrhous, colloid, grade 4 adenocarcinoma (Broders' method), arising on the lesser curvature 3 centimeters above the pylorus, was found. The tumor, which measured 7 by 5 by 2 centimeters, already had invaded the serosa and regional lymph nodes of the stomach. A partial gastrectomy was carried out, but the patient survived only 6 months after operation. The carcinoma was 5 to 6 centimeters from the gastroenteric stoma (Fig. 1).

A male, aged 56 years, had a gastroenterostomy performed for a subacute perforating duodenal ulcer 29 years previously at the clinic. Symptoms referable to the stomach had recurred only 1 month prior to his present admission and consisted of diffuse upper abdominal and lower thoracic pain associated with some fatigue. The diagnosis, by means of roentgenography, was "large ulcer on the lesser curvature, just below the angle, associated with extensive gastritis." The quantity of free and total acids in the gastric contents was not determined. A rigid regimen of medical management was instituted in the hospital and within 11 days his subjective symptoms had disappeared. Surgical treatment was advised, however, and at operation an extensive, grade 4 colloid adenocarcinoma, involving the lesser curvature with spread to the serosa and regional lymph nodes, was found. The lesion was of the linitis plastica type and demonstrated only a small area of mucosal ulceration. The patient died 12 months after a partial gastrectomy was done.

"Stomal ulcer" was the clinical impression in the following patient who was found to have a malignant lesion at operation.

A male, aged 40 years, had had a gastroenterostomy for duodenal ulcer 22 years previously. Symptoms referable to the stomach, consisting of high abdominal distress which was consistent with peptic

TABLE II —PATHOLOGY OF CARCINOMA OF STOMACH FOLLOWING GASTROENTEROSTOMY FOR DUODENAL ULCER

Gross description	Number	Size cm	Grade (Broders')	Type (Dukes)
Ulcer type	5	3x3x2	2	C
		5x5x0.5*	4	A
		5x5x1.5	2	C
		9x6x2	4	C
		3.5x4.3x1.2	4	C
Massive growth	3	7x5x2	4	C
		6x6x1.5	4	-
		7x10	4	C
Linitis plastica	2	10x9x2	2	C
		"Large"	4	C
Polypoid type	1	5x4x1	3	B
Total	11		3 grade 2	1 A
			1 grade 3	1 B
			7 grade 4	8-C

\*Thought to be a benign ulcer at operation

ulcer, had recurred 9 years prior to his present admission, and during the last 4 years his pain had become gradually more severe. He had lost 20 pounds (9.1 kgm). The quantity of free hydrochloric acid in the gastric contents was not determined but roentgenographic examination revealed an "ulcer high on the lesser curvature of the stomach, associated with extensive hypertrophic gastritis." At operation a grade 4 ulcerating, mucous adenocarcinoma was found on the lesser curvature near the angle. It was a superficial lesion, measuring 5 by 5 by 0.5 centimeter and fortunately the serosa and regional lymph nodes showed no evidence of invasion. The carcinoma was about 4 centimeters above the gastroenteric stoma (Fig. 2).

**Pathologic features** In the group of patients with benign lesions, the ulcers averaged 1.5 to 2.0 centimeters in diameter and none measured over 3.5 centimeters. A microscopic diagnosis of benign gastric ulcer was made in each instance. All the old duodenal ulcers were either healed or entirely inactive at the time of the second operation.

Of the 11 patients with malignant lesions, 5 had gross ulcerating lesions, 3 had massive carcinomas, 2 had diffuse carcinomas of the linitis plastica type with involvement of the entire thickness of the gastric wall, and 1 had a polypoid carcinoma (Table II). Most of these lesions were of high grade (Broders'

classification) and 7 (64 per cent) were classified as grade 4 carcinomas. Invasion of the serosa and regional lymph nodes had occurred in 8 (73 per cent). It is interesting to note that of the 5 malignant ulcers, 4 measured 5 centimeters or less in diameter. One of these was thought to be a benign gastric ulcer until it was examined microscopically by the pathologists and found to be a superficial mucous adenocarcinoma, grade 4.

#### GASTRIC LESIONS THAT FOLLOWED GASTROENTEROSTOMY FOR GASTRIC ULCER

Of the 11 patients in whom gastric lesions developed after gastroenterostomy for gastric ulcer, in 5 the lesions were benign gastric ulcers, but in 6 they were malignant neoplasms.

Of the 5 patients in whom a benign gastric ulcer was found, 2 had had a previous gastroenterostomy at the clinic. In these 2 and in 1 other patient, local excision of the gastric ulcer was carried out concurrently with the gastroenterostomy. The average age of the patients at the time of the second operation was 57.8 years. The average time interval subsequent to the gastroenterostomy was 17.0 years.

Of the 6 patients in whom a malignant neoplasm was found, 2 had had their gastroenterostomy at the clinic. The average age of the patients at the time of gastrectomy was 51.0 years, and the average time interval between the gastroenterostomy and the second operation was only 6.0 years. In 5 patients this time interval was 2 years or less. It is significant to note that in no instance was a biopsy or local excision of the gastric ulcer done in this group at the same time that gastroenterostomy was performed.

**Symptoms** Of the 5 patients who had a benign gastric ulcer, all gave a history that was quite characteristic of peptic ulcer, but of the 6 patients who had a malignant lesion, only 3 gave a history suggesting peptic ulcer, whereas 1 gave a less definite history of ulcer and 2 gave a history which was not suggestive of peptic ulcer. The average loss of weight prior to admission to the clinic was 9.8 pounds (4.4 kgm) for the patients with benign lesions and 22.5 pounds (10.2 kgm) for those with malignant lesions.

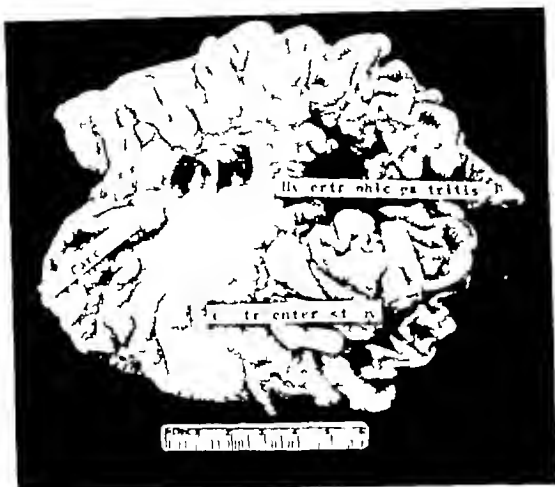


Fig 1 Ulcerating grade 4 mucus producing adenocarcinoma on the lesser curvature of the stomach. A gastroenteric stoma for duodenal ulcer had been made 13 years previously.

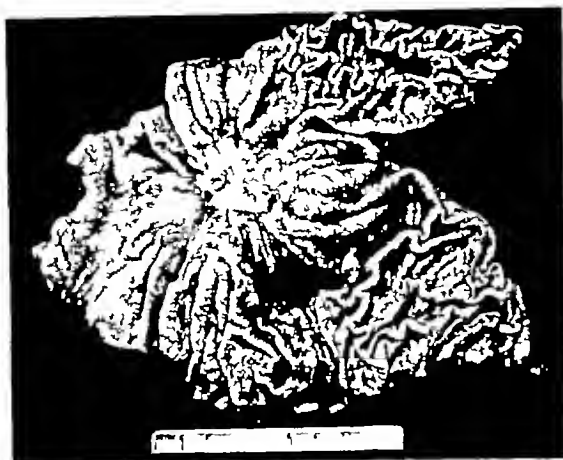


Fig 2 Superficial grade 4 ulcerating mucous adenocarcinoma on the lesser curvature and posterior wall of the stomach. A gastroenteric stoma for duodenal ulcer had been made 22 years previously.

**Clinical findings** The quantity of free hydrochloric acid in the gastric contents ranged from 26 to 50 units in the group of patients with benign ulcers. It was also present in 3 of the 6 patients with gastric cancer, the quantity ranging from 14 to 36 units.

**Roentgenologic findings** In the 5 patients with benign lesions, the roentgenographic diagnosis was "gastric ulcer" in 4 and "deformity" of the gastric wall in the remaining 1, who actually had scarring of the wall from a previously excised gastric ulcer. In the 6 patients with malignant lesions, the diagnosis was "carcinoma" in 3, "ulcerating lesion" in 2, and "obstruction" in 1.

**Comment** The gastric lesion for which the gastroenterostomy had been done apparently had failed to heal in the majority of these patients for 7 of the 11 patients required further surgical treatment within 4 years after their gastroenterostomy for gastric ulcer. This is particularly important in the case of the 6 patients who harbored a malignant process at the second operation. The true nature of the neoplasm evidently had not been recognized at the time of the gastroenterostomy in the 5 patients who, within 2 years following the first operation, had gastric resections for carcinoma. A biopsy for the purpose of establishing a microscopic diagnosis would have been

of immense value at the time of the gastroenterostomy and probably would have altered the surgical attack at the earlier and more favorable period. The following case report illustrates the point, although this patient was more fortunate in the outcome than are many others.

A male, aged 62 years, had undergone exploration at the clinic 1 year previously for an ulcer high on the posterior wall of the stomach, just below the insertion of the esophagus. The ulcer was about 2.5 centimeters in diameter. A posterior gastroenterostomy was carried out because a direct attack seemed impossible on account of the inaccessible position of the lesion and the large number of adhesions already present from a previous laparotomy.

The patient returned to the clinic 1 year later because of symptoms referable to the stomach. These consisted of persistent bloating and epigastric distress. The free hydrochloric acid in the gastric contents measured 36 units and the total acids 52 units after the usual test meal. Roentgenographic examination again demonstrated the gastric ulcer, though it appeared to be smaller in size after the gastroenterostomy. Operation was advised and approximately four-fifths of the stomach was resected. A superficial colloid carcinoma on the posterior wall of the stomach just distal to the insertion of the esophagus was encountered. The lesion had not invaded the serosa nor the regional lymph nodes. The patient soon returned home and progressed well from the standpoint of the stomach for 5 years when he died from some cause which could not be determined in our follow up.

TABLE III — PATHOLOGY OF CARCINOMA OF STOMACH FOLLOWING GASTROENTEROSTOMY FOR DUODENAL ULCER

Gross description	Number	Size cm	Grade (Broders)	Type (Dukes)
Ulcer type	3	5 cm in diameter*	4	B
		3x2x0.5*	3	B
		3x1x2*	4	A
Massive cancer	3	7x5x2	4	C
		7x6x4	2	C
		Large	4	C
Total	6		2 grade 4	1 A
			1 grade 3	2 B
			3 grade 4	3 C

\*Thought to be a benign ulcer at operation

**Pathologic features** Of the 6 malignant lesions in this group, 3 were malignant ulcers but all were thought to be benign gastric ulcers until they were examined microscopically by the pathologist (Table III). One of these patients had also an associated smaller benign gastric ulcer, 0.5 centimeter in diameter, about 6 centimeters distal to the malignant ulcer on the lesser curvature. Three were grade 4 lesions (Broders' classification) and the serosa and regional lymph nodes had been invaded in 3 instances.

#### GASTRIC LESIONS THAT FOLLOWED GASTROENTEROSTOMY FOR OTHER REASONS

One patient was included in this study because she had a gastric cancer that followed gastroenterostomy that had been done 23 years previously for some indeterminate lesion.

A female, aged 65 years, had complained of daily intractable epigastric distress since gastroenterostomy had been made. The first impression of the clinicians on her admission to the clinic was that her complaints were functional in nature but with further study operation was advised because of her history of persistent symptoms and because the roentgenographic diagnosis of probable jejunal ulcer and jejunitis. An extensive, diffuse grade 4 small cell adenocarcinoma involving the lower half of the stomach and first portion of the duodenum was found. It had invaded the serosa and regional lymph nodes. The lesion was of the limit plastica type and was associated with marked inflammatory reaction in the gastric wall as well as around the gastroenteric stoma. A palpable partial gastric

tomy was carried out. The patient, however, succumbed 4 weeks later from complications, probably peritonitis.

#### SUMMARY AND CONCLUSIONS

A review of data on 53 patients in whom lesions in the stomach developed after gastroenterostomy has confirmed the impression of the authors that such lesions will show a high incidence of malignancy. Eighteen (34 per cent) of the 53 patients in this series had malignant lesions of the stomach requiring subsequent gastric resection. Of the 53 gastroenteric stomas, 41 had been made on account of duodenal ulcer, 11 on account of gastric ulcer and 1 for other reasons.

Eleven of the 41 patients who had gastroenterostomy for duodenal ulcer experienced malignant lesions of the stomach, as demonstrated subsequently at the time of operation. It has been found to be extremely difficult to determine clinically the true nature of a lesion in a stomach that has undergone gastroenterostomy. The clinical history and findings may mask the real nature of such a lesion and give the impression that a malignant neoplasm is benign. Five of the 11 patients in whom carcinoma of the stomach developed gave a history that was quite characteristic of peptic ulcer, and in 4 of these 11 patients appreciable quantities of free hydrochloric acid were found in the gastric contents.

Six of the 11 patients who had had a gastroenteric stoma made for gastric ulcer were found to have malignant lesions of the stomach which either had gone unrecognized at the time of gastroenterostomy or had developed later. At operation some of these malignant lesions appeared to be benign grossly. Gastroenterostomy alone without local excision or biopsy of the gastric ulcer was done in 8 persons, in 6 of whom malignant gastric lesions were found at the time of operation. A biopsy or local excision of the gastric ulcer at the time of the original operation would have been of immense value and might have changed the surgical attack to a more radical one.

The roentgenographic examination of a lesion in the stomach following gastroenterostomy has been found to be more than usually difficult owing to the marked structural

changes, inflammatory conditions and obstructive features that are so often encountered. An accurate roentgenographic diagnosis has been found to be almost impossible when the new lesion has developed in the portion of the stomach distal to the old gastroenteric stoma.

In view of the high incidence of malignancy in the ulcerating lesions of the stomach following gastroenterostomy, the importance of suspecting and ruling out carcinoma before any conservative management is instituted cannot be emphasized too strongly.

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# ANALYSIS OF POSTOPERATIVE CHOLANGIOGRAMS

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THERE is a lack of precision in descriptions of the common bile duct. In an effort to clarify this subject we have analyzed delayed, or indirect, cholangiograms (6, 20, 21, 26). These studies have been supplemented by clinical and post-mortem observations.

## METHOD

The cholangiograms were made of patients 5 or more days postoperative by the injection of contrast substances into a tube indwelling in the biliary tract. Cholangiography was usually performed 3 hours after the midday meal. Fifteen minutes before examination the patient was given a sublingual dose of nitroglycerine (0.006 mgm.).

Twenty cubic centimeters of diodrast was warmed to body temperature in a syringe fitted with a No. 21 gauge needle. All air bubbles were eliminated. The hypodermic needle was inserted into the external limb of the tube as close to the abdominal wall as conveniently possible and a (curved) hemostat clamped across the needle and tubing to create a fluid tight junction.

Two to 5 cubic centimeters of diodrast were injected into the tubing under fluoroscopic observation. After 20 to 40 seconds, an additional 2 to 10 cubic centimeters were injected. During and after this observation period, localized roentgenoscopic films were made, so that at least 2 anteroposterior and 1 right lateral 10 by 12 film exposures were made, with the Bucky diaphragm and with 100 milliamperes tube current. More diodrast was injected if necessary. In some cases, re-examination was done after 30 minutes while the external limb of the indwelling tube was

clamped. After completion of radiographic studies, the tube was irrigated with normal saline solution.

Injection studies were performed upon fresh autopsy specimens after removal of the duodenum, hepatic pedicle, and the adjacent pancreas. The proximal and distal openings of the duodenum were ligated, or clamped. In some instances, air was injected into the duodenal canal in order to overcome serosal agglutination and to separate mucosal folds. The pancreatic and common bile ducts were identified and cannulated at an adequate distance from the duodenal wall. Ureteral catheters or metal needles were tied into place. Five to 15 cubic centimeters of diodrast or iodochlorol were injected into each duct and roentgenograms were made.

## OBSERVATIONS

A total of 50 cholangiograms on 41 patients was reviewed. In this series of cholangiograms there was no mortality due to the examination. The procedure was complicated in only 2 cases, and in those by clinical symptoms of pancreatitis which appeared for 2 to 4 days following cholangiography. Three patients who died subsequently in the hospital were autopsied. One died because of a stone impacted in the common bile duct, 1 because of myocardial failure and hepatocellular disease, and 1 as a result of hemorrhage from the hepatic artery into the common bile duct (31).

*The normal cholangiogram.* Under fluoroscopic observation the contrast media injected through the T tube normally entered the common bile duct and duodenum without delay or obstruction. The origin of the common bile duct was estimated to be in the right half of the median sagittal plane of the body at approximately the twelfth thoracic intervertebral space. The capacity of the normal common duct varied from 5 to 10

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cubic centimeters Fluoroscopically and roentgenographically (Fig 1) in the anteroposterior plane, the contrast substance was seen to follow a continuously curving course. It first was curved slightly medially, then it passed laterally and nearly parallel to the midline. As the duct terminated there was a sharp change in direction with angulation toward the right lateral abdominal wall and a concomitant decrease in the diameter of the common duct.

On lateral view, a flat double curve was seen in the course of the common duct which was in the ventral vertical plane. At first the common duct curved anteriorly, then, inferiorly and posteriorly to the level of the duodenum. In this area it usually overlaid the vertical axis of the anterior border of the vertebral column. The common duct finally coursed slightly anteriorly and inferiorly to end within the duodenal canal.

In 50 cholangiograms the widest diameter of the common bile duct varied from 4 to 23 millimeters, averaging 11 millimeters. Excluding 25 instances in which definite abnormalities of the common bile duct existed it was found that the diameter of the normal common bile duct varied from 4 to 10 millimeters, with an average of 7 millimeters.

A decrease in diameter of the terminal segment of the extraduodenal common bile duct, associated with a straightening of the duct wall was found in 16 patients. The narrowed segment measured from 4 to 18 millimeters in length (mean and average was 10 millimeters). This narrowed portion probably represented the transpancreatic portion of the extraduodenal common bile duct.

The transduodenal segment of the common duct was visualized on 42 cholangiograms. Of these, 21 were considered to be normal in appearance. The duct terminated at approximately the level of the second lumbar transverse process in the majority of cases, and varied from levels of the first to the third transverse processes. The average length of the transduodenal segment ("papilla") of the common bile duct was found to be 14 millimeters (32).

The lumen of the common bile duct decreased in diameter as it crossed the duo-



Fig 1 Normal cholangiogram made after injection of diodrast into the T tube. Diodrast entered the duodenum without delay. There is a medial convexity to the extraduodenal common bile duct. The distal segment of the common duct is seen to taper slowly in diameter to empty into the medial aspect of the descending portion of the duodenum, at approximately the level of the transverse process of the third lumbar vertebra.

denal wall. Its sides presented a double concavity, or scalloping, which gave the lumen of the duct the appearance of a funnel. The duct finally terminated as a thin filamentous canal. The terminal orifice of the common bile duct measured 1 millimeter or less in diameter in 16 cases, between 1 and 2 millimeters in 25 cases, and was 4 millimeters in diameter in 1 case. Normally the duodenal canal filled rapidly above and below the terminal orifice of the common bile duct.

The transduodenal (pars intestinalis) segment of the common bile duct was seen most clearly on injected fresh postmortem specimens (Fig 2a). The lumen appeared as a curving funnel which gradually decreased to a filamentous channel. The axis of the transduodenal segment entered the duodenal wall at slightly less than a right angle and usually traversed the greater portion of the duodenal wall parallel to the axis of the duodenal canal. As it terminated, the common bile duct





Fig 2 a, *Cholangiogram* made after injection of common bile duct with diodrast through catheter. The terminal portion of the common duct is seen as a tapering continuously curving funnel, ending as a filamentous channel. b, *Pancreatic ductogram* made after injection of common bile duct with diodrast and of pancreatic duct with lipiodol. The common duct is visualized as in a. The lipiodol has diffused through the pancreatic ductal system. Some of the oil has emptied into the duodenum through a small separate orifice, adjacent to the termination of the common bile duct.

turned to empty into the duodenal lumen at approximately a right angle to the duodenal axis.

On the pancreatic ductogram (Fig 2b), the pancreatic duct was seen as a gently curving arc which approached the termination of the common bile duct to empty into the duodenal canal after an acute bend in its axis toward the orifice of the common bile duct. Separate orifices for pancreatic and common bile ducts were usually visualized.

*The abnormal cholangiogram.* Abnormalities were observed in 25 of the 50 cholangiograms. These were choledocholithiasis, 12 cases, spasm, 6 cases, reflux into pancreatic duct, 4 cases, stricture of common bile duct, 3 cases.

Fluoroscopic observation revealed 17 instances in which there was delay in the entrance of the dye into the duodenum. This was due to (a) residual calculi within the common duct and an irregular transduodenal

segment in 13 cases, (b) to spasm associated with dyskinesia in 3 cases, and (c) to an artificial choledochoduodenostomy in 1 case.

*Choledocholithiasis.* When injected through the external limb of the T tube in patients with choledocholithiasis, diodrast entered the duodenum sluggishly. The capacity of the duct was 15 to 25 cubic centimeters. The common bile, common hepatic, and frequently the hepatic ducts were dilated. Calculi appeared as radiolucent defects. They were usually circular, crescentic or irregular in contour. Stones were most frequently impacted at the termination of the extra-duodenal course of the common bile duct (Fig 3). Diodrast, which passed beyond a calculus, filled the tapering filamentous lumen of the termination of the "pars intestinalis" of the common bile duct.

In 1 instance reflux was seen from the common bile duct to the pancreatic duct simultaneously with the impaction of a stone

in the common bile duct (Fig 3) In this case, the site of the stone impaction was 1 centimeter proximal to the location of the reflux

It was important to distinguish artefacts, such as air bubbles, from calculi The former were typically inconstant in location and were not faceted Congenital folds in the mucous membrane of the duct wall were also confusing

*Spasm* In patients with active spasm of the sphincter of Oddi, diodrast was injected into the external limb of the T tube against resistance It entered the duodenum as a slow trickle However, free flow into the duodenum commonly occurred at some time during the cholangiography The injection was usually painful, although pain was relieved when the duct emptied The capacity of the common bile duct was 15 to 20 cubic centimeters in these patients with spasm On the roentgenogram there was increased angulation between the extraduodenal and transduodenal segments of the common bile duct At its termination the lumen of the common bile duct tapered rapidly to a narrow filament, usually more irregular and longer than normal

*Reflux into pancreatic duct* In most patients who were found to have reflux from the common duct into the pancreatic duct, diodrast injected in the external limb of the T tube entered the duodenum almost immediately During the interval between additional injections of diodrast it was observed that the terminal portion of the pancreatic duct was filled with contrast media from the common bile duct (Fig 4a) In other cases, the pancreatic duct was partially filled before the contrast medium was seen in the duodenum (Fig 4b) The length of the common channel for pancreatic and common bile ducts varied from 2 to 10 millimeters At its termination, the lumen of the common channel measured from 1 to 2 millimeters in diameter

Clinical pancreatitis was present (31) in 1 of the 4 patients with reflux (Fig 4a) Signs and symptoms of transient pancreatitis appeared after cholangiography in 1 patient who had reflux, and in 1 patient without re-



Fig 3 *Choledocholithiasis and reflux* Cholangiogram made after injection of diodrast into the T tube The contrast medium entered the duodenum very sluggishly and was injected against marked resistance The biliary ducts are dilated The pars intestinalis of the common bile duct is seen as an S shaped filamentous termination in the medial aspect of the descending duodenum The terminal portion of the pancreatic duct is visualized adjacent to the pars intestinalis through reflux from the common bile duct A circular shadow of a calculus is impacted in the distal portion of the extraduodenal common bile duct, proximal to the site for reflux into the pancreatic duct This stone disappeared after Pnbraam therapy

flux Another patient who presented reflux on one examination did not present it on subsequent studies

*Stricture* In the presence of a complete stricture of the common duct, diodrast injected through the external limb of the T tube entered the common bile duct against marked resistance Diodrast did not enter the duodenum, the hepatic radicles were markedly dilated and reflux of contrast medium occurred along the T tube

In these cases with stricture the content of the biliary tree was 25 to 35 cubic centimeters The diameter of the lumen of the common bile duct was greater than 18 millimeters The distal portion of the common bile duct was distorted and blunted with con-



Fig 4 a, *Reflux (CM)* Roentgenogram made after injection of diodrast into the T tube. The diodrast entered the duodenum without obstruction. The proximal segment of the common duct is displaced laterally because of extrinsic pressure from a pseudocyst of the pancreas. The distal segment of the common bile duct ends as an S shaped curve terminating in the medial portion of the descending duodenum at the level of the third lumbar transverse process. There is slight diminution in the caliber of the common bile duct; the terminal portion of the pancreatic duct appears of equal or greater diameter than the bile duct in the area of the pars intestinalis. The distal centimeter of the pancreatic duct is visualized, as well as 7 to 8 millimeters of the common channel present in this case for the common bile and pancreatic ducts. Duodenal canal filled prior to demonstration of reflux. b, *Reflux (LC)* Roentgenograph taken after injection of diodrast into the T tube. The course and diameter of the common duct are normal. The termination (pars intestinalis) of the common duct cannot be clearly identified. At the papilla the termination of the pancreatic duct and approximately 1 centimeter of its distal course is visualized. Pancreatic duct reflux occurred just prior to appearance of contrast medium in the duodenal canal. Diodrast entered the duodenum rapidly. A cholangiogram repeated 10 days later revealed no evidence of reflux. The patient has been asymptomatic for 2 years.

velocity directed caudad. Diodrast was not visualized in the transpancreatic or transduodenal portions of the common bile duct.

#### DISCUSSION

Routine cholangiography in patients following common duct operations has increased knowledge of the physiology and anatomy of the common bile duct and their surgical significance (5, 6, 7, 10, 11, 13, 15, 22).

However, a lack of uniform terminology exists as well as an inadequate description of the normal and abnormal common bile duct (8, 10, 14, 27, 28). The major deficiencies are (a) insufficient description of the fluoroscopic findings, (b) lack of existing standards for measurement of the common duct diameter, (c) insufficient description of

the details and character of the termination of the duct, and (d) incomplete definition as to the location of the duct and its divisions.

In addition, reference is made in the literature to the "ampulla" and the "papilla" of Vater as if they were interchangeable terms. However, the "ampulla," as a "dilatation" exists only in the early embryo as a result of the merging of the hepatopancreatic duct with the duodenal canal and rapidly recedes to nonexistence (3, 8, 12, 29). The "papilla," or "swelling" is a definite portion of the termination of the common duct in the adult (12). It represents an increase in tissues comprising a sphincter-like mechanism identified by Oddi (23). It, most likely, originates in the mesenchymal structures peculiar to the common duct tissues (8, 29).

The common bile duct may be divided into extraduodenal and transduodenal segments. The transduodenal segment is equivalent to the "papilla" or the "pars intestinalis" (8, 12). The extraduodenal segment, in certain instances, may present a transpancreatic portion (7, 27). These divisions of the common bile duct can be identified, on roentgenography, by the injection of a contrast medium into the common duct.

The common bile duct presents a constantly curving axis in both anteroposterior and lateral planes. Straightening of its course may indicate an abnormality due to extrinsic pressure (Fig 4a). In the distal portion of the extraduodenal common bile duct, however, straightening of the duct may indicate that its course is transpancreatic. The course and direction of the common bile duct depends upon the anatomical disposition of adjacent viscera, but can usually be predicted in the normal individual.

Roentgenographically, the common bile duct presents its widest diameter distal to the junction of the cystic and hepatic ducts and proximal to the transpancreatic segment. The average diameter of the widest part of the normal common bile duct on the cholangiogram is 6.9 millimeters. Measurement of the same segment of the choledochus in fixed and fresh anatomical specimens indicates an average diameter of 6.3 millimeters in the normal adult (32). In these studies, the duct is abnormal when its diameter is greater than 1 centimeter.

The transduodenal segment of the common bile duct may be identified by its change in direction, and its funnel shape, as its lumen decreases in size to terminate in a filamentous canal. Frequently, this segment of the duct cannot be visualized on roentgenography. Its patency must then be inferred by the presence of sufficient contrast medium in the duodenum. Fluoroscopic observation may reveal a correlation between symptoms of biliary dyskinesia and the existence of spasm in the transduodenal segment of the common bile duct.

In this series there are 4 instances (8 per cent) of reflux from the common bile duct into the pancreatic duct. In only 2 of these

are the findings persistent, since subsequent examinations in the others did not demonstrate diodrast in the pancreatic duct. This observation contributes support to Archibald's theory (1, 2) that sphincteric muscle action at the papilla is segmental and intermittent in character and that reflux into the pancreatic duct can occur when the most distal segment of the sphincter is active. The relationship between reflux and pancreatitis (11, 13, 19, 24, 25) cannot be demonstrated in this series, since pancreatitis occurs both with and without evidence of reflux and since reflux occurs both before and after diodrast enters the duodenum from the common duct. It has been observed that papillary sphincterotomy may be indicated for relief of symptoms caused by reflux occurring into the pancreatic duct before the common duct empties into the duodenum (13).

It is of extreme interest to note that calculi are impacted at the distal portion of the extraduodenal segment of the common bile duct. It is obvious that the narrow lumen and the thickened wall of the transduodenal segment of the common duct normally act as a barrier to the passage of a calculus from the common duct into the duodenum.

In certain cases a distorted, feathery contour of the papilla and distal duct segment is accompanied by delayed entry of diodrast into the duodenum. These changes in the "pars intestinalis" are frequently transient. In many cases, they are secondary to alteration in physiologic mechanisms, necessarily occurring after a cholecystectomy, in others, a manifestation of papillary muscular spasm. In some, they are an indication of associated regional edema. This group includes patients with pre-existing choledocholithiasis. Trauma attending exploration of the common bile duct with the Bakes' dilators may be a factor in producing these findings. Because of the thin tortuous character of the termination of the normal common bile duct it is likely that papillary tissues would be injured by a forcible dilatation. In 1 case, a stricture of the termination of the duct appeared 6 months after original common duct exploration. This, as well as more transient cases, could have been secondary to tissue reaction

occurring in the papillary tissues as emphasized by Branch, Bailey and Zollinger, and Zawisch

It is recommended that only a small ureteral catheter 3 to 5 millimeters in maximum diameter be used as a probe. This type of instrument is thin, sturdy, and flexible. In addition, fluid can be injected through the ureteral catheter to demonstrate the actual patency of the choledochal canal.

#### SUMMARY

1 Fifty postoperative indirect cholangiograms on 41 patients have been reviewed. Roentgenographic and fluoroscopic descriptions correlated with clinical findings of the normal and abnormal common bile duct have been given. In this series abnormalities in the cholangiogram included (a) choledocholithiasis, (b) spasm at the termination of the duct, (c) stricture of the common bile duct, and (d) reflux into the pancreatic duct from the common bile duct.

2 The importance of careful fluoroscopic observation during cholangiography was stressed.

3 The course of the normal common bile duct has been described as a constantly curving tube which was composed of extraduodenal and transduodenal segments. The most distal portion of the extraduodenal segment was identified as "transpancreatic," when its contour was straightened and its diameter decreased.

4 The average diameter of the extraduodenal common bile duct on the cholangiogram has been found to be 6.9 millimeters. The average diameter of the orifice of the common bile duct within the duodenum was 1.5 millimeters.

5 The transduodenal segment of the common bile duct had a funnel shape and a decreasing diameter, the lumen of which terminated as a filamentous canal. There was no evidence that an "ampulla" was present. It was suggested that the termination of the common bile duct be designated only as the "papilla."

6 For routine operative demonstration of patency at the termination of the common bile duct, it was recommended that a soft, thin, flexible and hollow instrument, such as the ureteral catheter be used.

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# CHANGES IN RENAL FUNCTION FOLLOWING URETERAL TRANSPLANTATION

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AS a result of the advancements made in modern surgery, ureteral transplantation has become a procedure which is more widely employed not only by the urologist but also by the general surgeon and gynecologist. For this reason it is more important than ever to be familiar with those factors which influence success or failure in this type of operation.

In the past, emphasis has been placed predominantly on the surgical aspects of the problem and a variety of technical modifications have been devised in order to reduce the occurrence of complications characteristic of this procedure. In addition, well planned preoperative and postoperative management has been recognized to have contributed materially to the improvement of the postoperative results.

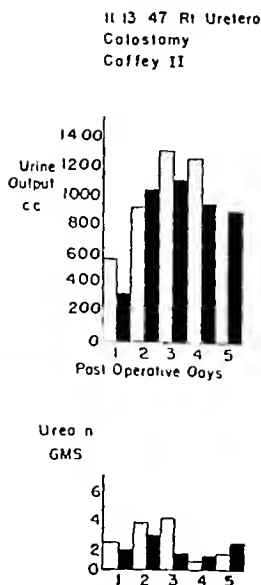
While it cannot be denied that the above mentioned factors are of major importance, it has become increasingly evident that other phenomena such as kidney function, as well as morphology and dynamics of the upper urinary tract, have an equally great influence on the outcome of each individual case. It appears from a study of the literature that the importance of these factors has not been sufficiently appreciated in the past, and it is the purpose of this report to present results of investigations which were carried out at the Roswell Park Memorial Institute in an attempt to examine the effect of ureteral transplantation on renal function. The data obtained on 20 patients who underwent various methods of ureteral transplantation are believed to be of sufficient interest to warrant their publication at this time.

In conducting these investigations the authors adopted the following procedures: Blood chemistry studies, and, wherever feasible,

phenolsulfonphthalein tests as well as quantitative determinations of the urea nitrogen output in the urine were carried out daily before and after operation. The data obtained were correlated with the findings of excretory urograms which were made subsequently at regular intervals. Accurate calculation of phenolsulfonphthalein excretion and urine urea elimination encountered no difficulties in patients with cutaneous ureterostomy where the collection of uncontaminated specimens was possible for an indefinite period of time. However, following ureterointestinal anastomoses admixture of blood did not permit, in some cases, accurate phenolsulfonphthalein determination during the first 24 to 48 hours following operation, and, as a rule, measurement of the urine urea output had to be discontinued after the 5th to 7th postoperative day because contamination of the specimen with large amounts of feces made further tests impractical.<sup>1</sup>

In the consideration of the effect of ureteral transplantation on kidney function a distinction was made between patients with no demonstrable gross disturbance of the upper urinary tract physiology and patients where evidence of obstruction suggested pre-existing kidney damage. This was done for the following reason: Postoperative impairment of renal function was the rule in the 1st group of cases, whereas improvement took place in some cases of the 2nd group. The results obtained in both categories indicate in general that the extent of changes of kidney function depended primarily on the type of transplant that was employed.

<sup>1</sup>For the purpose of separating urea nitrogen from the nitrogenous waste products of the stool the following procedure was adopted: The 24 hour specimen was filtered and an aliquot portion of it was used at first to determine the total amount of ammonia nitrogen after digestion with urease. Thereafter the ammonia nitrogen of the specimen was calculated. The difference between the ammonia nitrogen after digestion with urease and ammonia nitrogen of the specimen represents the urea nitrogen.

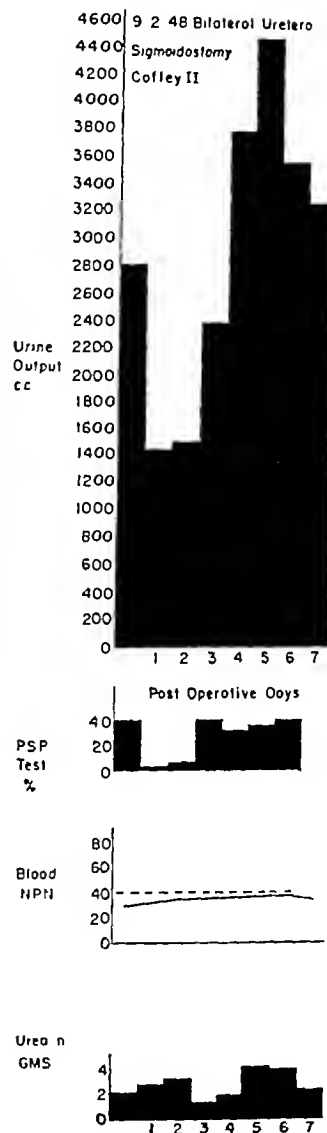


Graph 5 Demonstrates satisfactory output of urine and urine urea nitrogen following Coffey II operation

first stage Coffey I procedure obviously because nitrogen balance was maintained during the critical days by nonimplanted side

*Ureterosigmoidostomy (Coffey II)* During the further course of these investigations the question presented itself as to whether or not such a severe degree of kidney function impairment might be avoided by the employment of the Coffey II operation, where catheters assure free drainage of urine from the implanted side during the first postoperative days. To this end analogous studies were carried out in a group of patients in whom modified 1 stage bilateral or 2 stage Coffey II operations were performed. In carrying out these procedures a No. 8 or 10 F whistle tip catheter was inserted for a distance of 10 centimeters into the ureteral stump before the distal end was buried into the sigmoid colon. In all cases the catheter was expelled spontaneously between the 5th and 7th postoperative day after admixture of stool had necessitated removal of the rectal drainage tube.

The results of these investigations indicate that suppression of kidney function was much less severe following a Coffey II procedure than in the group of cases where the Coffey I technique had been employed. It is evident from Graphs 5 and 6 that urine was eliminated



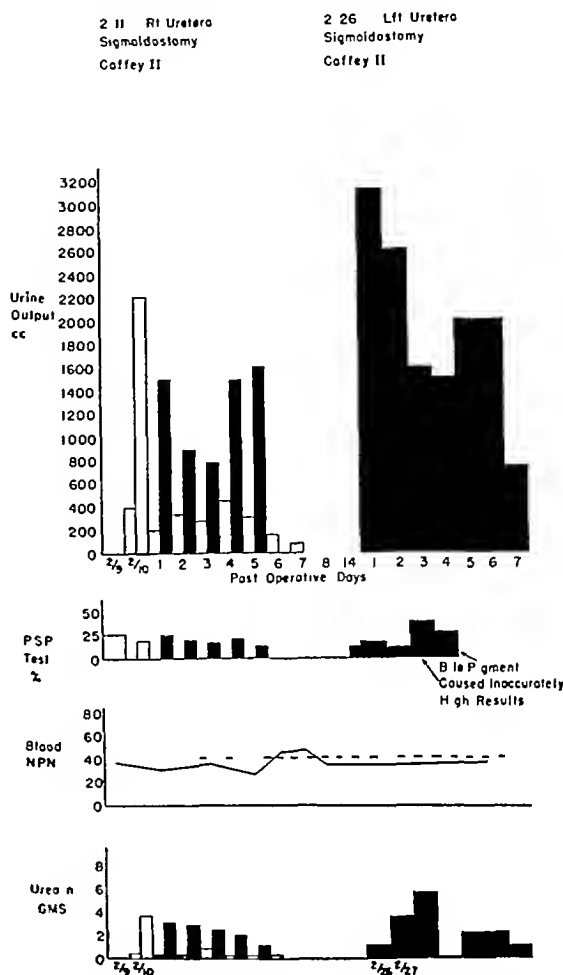
Graph 6 Adequate elimination of urine urea nitrogen and phenolsulfonphthalein following bilateral Coffey II operation

following this type of operation not only in sufficient quantities but that it contained apparently adequate amounts of urea during the early postoperative period. In one of our patients with a poorly functioning left kidney where a first stage right Coffey II transplant had been carried out, it was even observed that the output of urea from the implanted side was sufficient enough to maintain the patient's urea nitrogen balance. Accordingly

it was determined that phenolsulfonphthalein excretion showed only moderate impairment compared to preoperative values and there was no elevation of the blood nonprotein nitrogen during the first 5 postoperative days. The transient slight elevation of the nonprotein nitrogen to 44 and 46 milligrams per cent during the following 2 days might be explained by the assumption that unimpeded drainage from kidney was interfered with temporarily after the catheter had been expelled (Graph 7).

A comparison of the aforementioned data shows that the Coffey I operation produces a much more severe impact on kidney function during the early postoperative period than does the Coffey II procedure. Nevertheless, study of renal function during the later postoperative stages disclosed that, after the initial critical period had been overcome, neither of these methods was superior with regard to the ultimate functional results. This is enhanced by the fact that excretory urograms, which were made at 1 to 2 month intervals beginning on the 12th day after ureterosigmoidostomy, showed equivalent structural changes of the upper urinary tract regardless of whether the Coffey I or II technique had been employed (Fig 1). Furthermore, in both groups kidney function tests 2 to 3 weeks following the 1st stage operation showed similar degrees of functional suppression and study of the urograms suggested an equally marked quantitative difference in the excretion of dye in favor of the nonimplanted side.

Investigations of the more remote effects of ureterosigmoidostomy on kidney function by means of measuring the output of phenolsulfonphthalein and urine urea nitrogen were handicapped by the obvious difficulty in obtaining uncontaminated samples of urine for examination. However, in patients with unilateral intestinal implants who had been subjected to the routine preoperative preparation for the 2nd stage operation, it was usually possible to collect suitable samples for functional tests through a rectal tube which was inserted for 24 hours preceding surgery. In general, the interval between both stages varied from 17 to 21 days, but in 2 patients who developed postoperative complications after the first operation transplantation of the

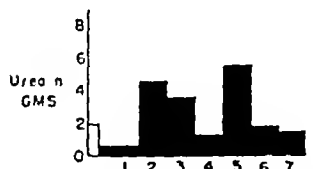
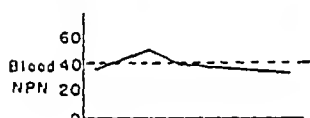
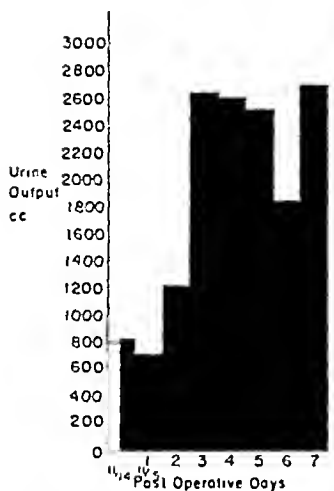


Graph 7 Nitrogen balance maintained by implanted side while other kidney ceases to function. Partial recovery of nonfunctioning kidney occurred following 2nd stage procedure (Fig 2).

opposite side was postponed for 3 and 4 months respectively. The results of these tests revealed interesting data. It was found that a marked degree of functional impairment on the implanted side continued to persist and that the extent of this impairment was usually much more severe than could be anticipated from the urographic findings. This statement is illustrated by graphs 8 and 9 from which it can be seen that the amount of urea and phenolsulfonphthalein excreted from the implanted side remained markedly reduced not only one but equally so 4 months following the 1st stage operation.



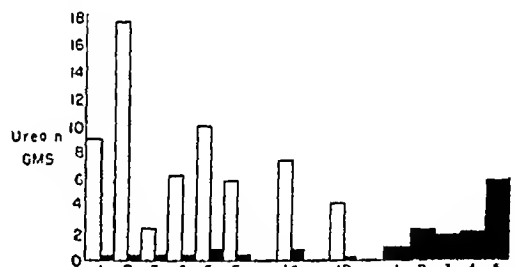
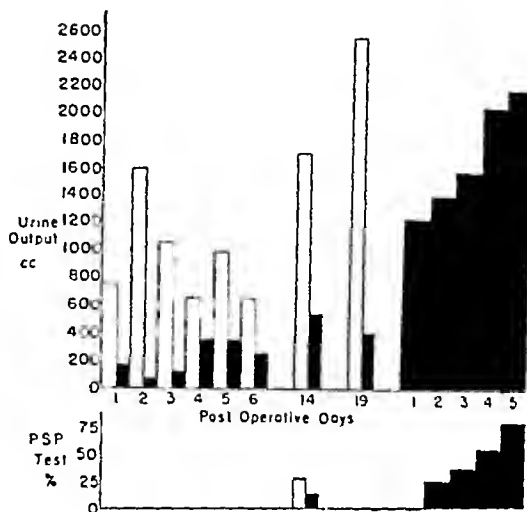
7 31 47 Rt Uretero Sigmoidostomy  
11 15 47 Lft Uretero Sigmoidostomy &  
Cystectomy  
Coffey I



Graph 8 Demonstrates marked impairment of renal function of the implanted side 3½ months following first stage Coffey I operation

11 23 47 Rt Uretero  
Sigmoidostomy  
Coffey I

12 11 47 Lft Uretero  
Sigmoidostomy  
Coffey II



Graph 9 Shows persistent depression of renal function of implanted side after Coffey I ureterosigmoidostomy. Adequate phenolsulfonphthalein and urea nitrogen elimination was maintained following 2nd stage Coffey II operation

despite the fact that diodrast was eliminated satisfactorily

In view of these findings the question presented itself as to how much reliance could be placed under these circumstances on the ability of a kidney to maintain nitrogen balance during a period of severe functional derangement of its mate which must be expected to occur if a 2nd stage Coffey I operation is planned. The results obtained during the course of these investigations indicate that the reserve power of the kidney on the implanted side is apparently greater than the functional tests performed before the 2nd operation would lead one to believe. No significant ele-

vation of the blood nonprotein nitrogen developed even in patients where a 2nd stage Coffey I procedure had been employed and the elimination of urine urea nitrogen as well as phenolsulfonphthalein excretion exceeded expectations. For instance, it is evident from graph 8 that during the 24 hour period preceding the 2nd stage Coffey I ureterosigmoidostomy the output of urine was practically equal from the rectum (830 cc) and from the bladder (800 cc). Nevertheless, the rectal sample contained only 0.6 grams of urea nitrogen compared to 1.9 grams eliminated in the bladder specimen. Following surgery the total amount of urine urea nitrogen remained satis-



Fig 1, left Excretory urogram showing no significant difference in the outline of kidney pelvis and ureters between right side (Coffey I) and left side (Coffey II)

Fig 2 Partial recovery of nonfunctioning left kidney following Coffey II ureterosigmoidostomy

factory and more or less in proportion to the quantity of urine produced. A transient elevation of the blood nonprotein nitrogen to 49 milligrams per cent which developed on the 2nd postoperative day did not cause clinical symptoms. Graph 9, where a 2nd stage Coffey II procedure was employed, demonstrates even more convincingly that marked functional impairment of the previously implanted side should not deter the surgeon from carrying out a 2nd stage operation in patients who are otherwise considered suitable for surgery.

#### EFFECT OF URETERAL TRANSPLANTATION ON RENAL FUNCTION IN PATIENTS WITH PRE-OPERATIVE RENAL DAMAGE DUE TO URETERAL OBSTRUCTION

It is obvious that the problem presented in this group of patients is entirely different. In the past cutaneous ureterostomy was considered to be the only suitable method to deviate the urinary stream in patients with renal damage due to markedly dilated ureters inasmuch as this procedure which entailed comparatively little risk was known to induce partial recovery of renal function. On the

other hand, ureterointestinal implantation was thought to be contraindicated in these cases because it was feared that such an operation would add insult to injury. However, recent workers (Ferris, Priestley, Marshall) have convincingly demonstrated that even a high degree of obstruction with markedly reduced kidney function need not necessarily be considered a deterrent for ureterosigmoidostomy. Our investigations agree. For instance, in one of our cases where the left kidney was damaged to such an extent that gradual cessation of urinary output developed between the 1st and 2nd stage operations (Graph 7), partial recovery of kidney function took place following implantation of the obstructed ureter into the sigmoid as can be seen from the excretory urogram made on the 12th day after the 2nd stage operation (Fig 2).

#### EFFECT OF EXTENSIVE NONUROLOGICAL SURGERY ON RENAL FUNCTION IN CONTROLS

No evidence of changes of kidney function was determined during postoperative course in 5 control patients who underwent major surgical procedures for gastrointestinal disease.

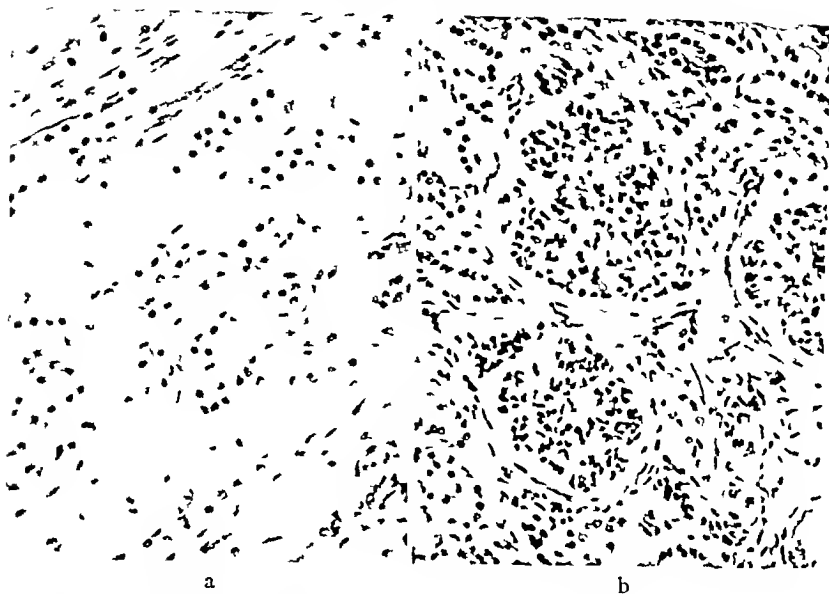


Fig 3 a, Severe degenerative changes of the collecting tubules b, Minimal degenerative changes in the renal cortex

*Comment* The aforementioned investigations represent an attempt to evaluate the importance of those factors which influence renal function following various methods of ureteral transplantation. These studies were prompted by the occurrence of uremia which developed in some of our patients following bilateral Coffey I ureterosigmoidostomy although the daily output of urine exceeded 1,000 cubic centimeters. Recent experiences at the Mayo Clinic conform with these observations. Priestley, by referring to investigations of Ferris, emphasized that a transient rise of the blood nonprotein nitrogen occurs commonly following this procedure and the alteration of the blood chemistry, which develops shortly after operation, is believed to be due to reabsorption of nitrogenous waste products from the large bowel. In support of this theory Priestley and Ferris infer that this complication may be overcome by the use of frequent irrigation of the rectosigmoid.

It was certain from the beginning that investigation of this subject, which heretofore had not been explored, presented a fascinating challenge. As was anticipated, these studies did not add materially to the present knowledge of changes in kidney function following cutaneous ureterostomy. However, during

the course of our investigations it became apparent that ureterosigmoidostomy created various degrees of derangement of renal function, the severity of which had not been sufficiently appreciated as a whole.

It must be surmised that many factors determine the extent of kidney function impairment following ureterointestinal transplantation, but the most important ones are (1) postoperative edema at the site of anastomosis, (2) injury to the blood supply of the ureteral stump, and (3) interference with the normal dynamics of the upper urinary tract. Of these, edema at the site of implantation plays the most decisive role inasmuch as it represents a complication which, although it may be reduced by perfection of the surgical technique, cannot be avoided completely. Once it becomes manifest it causes not only varying degrees of urinary obstruction but also compression of those blood vessels which maintain the blood supply of the ureteral stump within the trough. While it is realized that adequate vascularization of the implanted ureter is of vital importance for the successful outcome of ureterosigmoidostomy, it is not believed that this factor has a significant influence on renal function during the early postoperative period with which these investigations were pri-

marily concerned. Injury to the blood supply of the ureter is more apt to have an adverse effect on kidney function during the later stages when insufficient circulation may be one of the contributory phenomena to stricture formation at the site of anastomosis.

Evidence collected during the course of our investigations rather suggests that postoperative edema with resulting back pressure is primarily responsible if severe functional derangement of renal physiology develops during the initial postoperative period following an otherwise successful ureterosigmoidostomy. This statement is supported by the observation that serious kidney function impairment could usually be avoided by employing a modified Coffey II technique where catheter drainage offset the obstructing effect of edema during the first postoperative days. On the other hand, the inadequate elimination of urine urea nitrogen, which in general was observed to occur during the early stages after a Coffey I operation, indicates clearly that this procedure deprives the kidney, at least temporarily, of its ability to maintain nitrogen balance. Yet, even following a bilateral Coffey I procedure, clinical manifestations of renal insufficiency need not develop necessarily as long as adequate restoration of kidney function takes place before the blood non-protein nitrogen shows marked elevation. As a rule, partial recovery of renal function occurs after the 4th to 6th postoperative day, but, should functional imbalance persist beyond this period uremia is bound to develop and uremic death may ensue even though the patient continues to eliminate urine in satisfactory amounts. This was experienced in 3 patients who underwent a bilateral Coffey I ureterosigmoidostomy. These 3 patients were not included in this case series because they were operated upon before these investigations were undertaken. Postmortem examination in each of these 3 cases disclosed not only patent anastomoses but also absence of marked dilatation of ureters and kidney pelvis. On cut section the kidneys showed signs of pyelonephritis. Nevertheless, the macroscopic changes were not severe enough to account for uremic death. Histological study, however, disclosed characteristic findings

which seem to be peculiar to this type of renal failure. The collecting tubules which were moderately dilated showed evidence of degeneration varying in degree from cloudy swelling to complete necrosis. In some areas partially necrotic tubules were filled with casts of debris. Widespread hemorrhage and round cell infiltration into the intertubular spaces were common throughout. In striking contrast to the severity of the changes encountered in the medullary portion of the kidney was the minimal amount of involvement of the renal cortex where the glomeruli were either intact or fibrosed due to pre-existing arteriosclerotic disease. Degenerative changes of the proximal convoluted tubulus were either absent or not severe (Fig 3a and b). Altogether, the histological picture presented was quite similar to that which has been observed by Hinman during his experimental work on hydronephrosis where he states that "the tubular unit undergoes progressive dilatation, collapse and atrophy, with the glomerulus resisting longest."

In the light of Hinman's investigations on hydronephrosis these pathological changes must be considered important inasmuch as they suggest a plausible explanation for the mechanism of transient renal failure which is apt to develop following a Coffey I ureterosigmoidostomy. Compression of the ureteral lumen by postoperative edema at the site of implantation is bound to injure the functional efficiency of the kidney which is forced to secrete against rapidly developing back pressure. While increased peristaltic action of kidney pelvis and ureter may be strong enough to overcome partial ureteral obstruction at the site of anastomosis it is evident that the sudden rise of the intrapelvic pressure has a depressing effect on the function of the lower renal segments. In consideration of these factors, which are undoubtedly in part responsible for the aforementioned characteristic pathological changes, the inadequate elimination of waste products in the urine of these patients is not surprising. As long as these conditions exist it may be presumed that function of lower nephron remains depressed to such an extent that the urine eliminated represents nothing but a glomerular filtrate.

If these changes persist permanent kidney insufficiency is bound to occur and uremic death will ensue if both kidneys are involved. In most instances, however, partial recovery takes place before renal damage becomes irreversible. In this case restoration of functional balance may be due either to subsidence of the obstructive edema or readjustment of the kidney to the altered hydrodynamics.

The degree of recovery of renal function depends on several factors such as adequacy of the anastomosis, original functional efficiency of the kidney and the patient's general condition following surgery. In addition, the type and severity of secondary infection plays an important role. In patients with unilateral transplants where the recovering kidney has to compete with a normally functioning mate the principle of renal counterbalance comes into play. This principle must be taken into consideration in the evaluation of the functional reserve power of a kidney which has withstood the impact of ureterosigmoidostomy. Hinman in his discussion of the treatment of unilateral hydronephrosis emphasizes, that "stimulation to repair, even after the most highly successful treatment of the cause of the obstruction, is not so active or great as when this is the only kidney, or a similar condition or disease is present in the opposite side." This statement is in agreement with our observations which indicate that functional recovery of the injured kidney remained limited as long as function of the opposite kidney was unimpaired. However, it appeared from the results of functional tests that improvement continued as soon as the renal counterbalance was altered following the 2nd stage operation.

Our own experiences with intestinal implantation of dilated ureters are too limited as yet to permit final conclusions. However, it may be presumed that the impact of this operation on renal function will be less sudden and severe than in normal cases inasmuch as the kidney has already been exposed to pre-existing back pressure. Thus, it can be anticipated that additional alteration of the hydrodynamics will cause a much milder shock to the kidney which need not lead to renal insufficiency. Another factor reducing the adverse effects of ureterosigmoidostomy in patients with dilated

but not fibrosed ureters is the fact that edema at the site of anastomosis will not obliterate the ureteral lumen nearly as readily as in a normal case. Even if extreme narrowing occurs it can be overcome more easily by the hypertrophied musculature of the ureter.

To what extent, if any, reabsorption of nitrogenous waste products from the large bowel contributes to the postoperative elevation of the blood nonprotein nitrogen remains problematical. In an attempt to evaluate the reabsorption theory the following factors should be considered: (1) the urine eliminated into the rectosigmoid is drained uninterruptedly through an indwelling rectal tube. Thus, its contact with the intestinal mucosa is not only of short duration but the continuous stage of collapse of rectum and sigmoid reduces the mucosal surface, from which reabsorption may take place, to a minimum. (2) If reabsorption played a major role in the development of postoperative uremia it is difficult to understand why the blood nonprotein nitrogen maintains normal values during the later stages when, following removal of the rectal tube, not only the rectosigmoid but also large segments of the colon are in continuous contact with urine. (3) The observation that it is possible to avoid elevation of blood nonprotein nitrogen by employing the Coffey II technique or by performing 2 stage operations rather suggests that a rise of the nonprotein nitrogen level occurs primarily as a result of kidney failure and not as a result of reabsorption of nitrogenous waste products from the large bowel.

Despite the fact that these studies have been confined as yet to only a limited number of cases it is apparent from an analysis of the results that the severity of the physiopathological changes produced in the kidneys varies with the type of ureteral transplant employed. Our investigations of the effect of uretero sigmoidostomy on renal function suggest the following pattern of risk. The surgical risk of a bilateral Coffey I operation is greatest because both kidneys are likely to suffer simultaneous functional imbalance during the initial postoperative period. This danger can be materially reduced by the use of a Coffey II procedure where catheter drainage offsets the

obstructing effect of edema at the site of the anastomosis as long as the catheters remain in place. However, 2 stage operations offer the greatest margin of safety because nitrogen balance will be maintained by the nonoperated kidney during the period of functional depression of the implanted side.

In consideration of these factors it is suggested that a bilateral Coffey I ureterosigmoidostomy should not be employed in patients with marked renal arteriosclerosis, advanced pyelonephritis, or any other disease which may have diminished the kidney reserve. While a Coffey II transplantation represents a safer procedure in these cases, it is felt that a two stage operation should be preferred in order to reduce the risk of postoperative uremia. In cases where the result of a first stage implantation is unsatisfactory it is advocated for the same reason to select the Coffey II technique for the second stage operation.

For the proper evaluation of renal functional efficiency following ureterosigmoidostomy it is of the utmost importance to realize that the volume of urine eliminated cannot be used as the sole criterion as to whether or not the kidneys are maintaining nitrogen balance. For this reason it is imperative, at least during the initial postoperative period, to carry out daily blood chemistry studies in order to recognize renal insufficiency at the earliest possible moment. Thus antiuremic therapy can be instituted before clinical symptoms of uremia develop, and before the patient becomes unsuitable for an emergency nephrostomy.

#### SUMMARY

A report of investigations dealing with the effect of ureteral transplantation on kidney function is presented. The results of these studies indicate that the extent of changes of renal functional efficiency depends primarily on the type of transplant employed.

1. No significant immediate kidney function impairment takes place following cutaneous ureterostomy.

2. Coffey I types of ureterointestinal implantation produce such a severe impact on renal function that the urine eliminated dur-

ing the first 3 to 4 postoperative days may contain no or only inadequate amounts of nitrogenous waste products.

It follows that the urinary output alone cannot be considered a reliable criterion as to whether or not a patient is maintaining his nitrogen balance, and, in patients where functional deficiency persists over a prolonged period following a bilateral Coffey I operation, fatal uremia may ensue in spite of continued and apparently sufficient elimination of urine.

Partial recovery of kidney function takes place in these cases usually between the 4th and 6th postoperative days.

3. Coffey II types of ureterosigmoidostomy cause little or no suppression of renal functional efficiency during the early postoperative period.

The possible causes for the severe degree of functional derangement of kidney physiology which occurs following a Coffey I procedure are discussed, and it is surmised that edema at the site of the anastomosis is primarily responsible for the changes observed.

Accordingly, the following pattern of risk for ureterointestinal transplantation is suggested. The surgical risk of a bilateral Coffey I operation is greatest because both kidneys are likely to suffer simultaneous functional imbalance during the initial postoperative period. This danger can be materially reduced by use of a Coffey II procedure. However, 2 stage operations offer the greatest margin of safety because nitrogen balance will be maintained by the kidney not operated upon during the period of functional depression of the implanted side.

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# THE BEHAVIOR OF BONE GRAFTS

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THE reports on bone grafting which have emanated from military hospitals during and following the recent war, have shown a rather constant adherence of their authors to the use of well established procedures (6, 9, 13, 14, 22, 29, 33, 36) These authors have reported a 55 per cent to 126 per cent incidence of failure following the first bone graft operation in their cases In the main, they have used cortical bone, supplemented in some instances by cancellous chips or strips of bone

The use of cancellous bone to reconstruct osseous defects and to supplement cortical bone grafts in the treatment of ununited fractures and in arthrodesing operations (2, 16, 17, 30), has evolved from the work of Matti, who, in studying the fate of bone grafts, used spongia from the greater trochanter and iliac crest because he believed that this type of bone became vascularized more readily than cortical bone (4, 30, 32, 34, 35, 43) Luckey and Adams utilized iliac bone in some of their later cases of ununited fracture of the long bones (27.4 per cent of 164 cases) in the form of strips placed along the fracture site Gilson and Loadman, reporting their use of cortical and cancellous grafts in 105 initial bone graft operations with a 20 per cent incidence of failure, observed that in 23 cases in which iliac bone was used, either as slivers or as blocks with one cortical surface, the grafts united successfully in 88 per cent It was their opinion that while cancellous bone became united more rapidly than cortical bone grafts, they required protection against injury for a longer time Lambert and the writer (24) utilized iliac bone extensively in their military cases and they developed the use of massive iliac grafts which included one or more cortical surfaces, reinforcing the stability of these grafts by metallic plate fixation In their second report, they (23) had begun to realize the deficiencies of this type of bone as graft material in certain

localities and, also, they were limiting the use of the metallic plate to selected cases

The recently published work of Abbott and his coworkers (2), defining certain new principles relative to the use of cancellous and cortical bone as graft material, appeared a little too late to be applied and evaluated on the wide scale possible in military war surgery However, as the result of this report and by reason of his additional experiences, the writer's concepts regarding the use of cortical and cancellous bone as graft material have become more crystallized Specifically, this experience has been derived from the following 85 patients on whom 91 bone graft operations were performed in a military hospital, iliac bone having been used in 85 instances, cortical bone in 5 and both types of bone in one, 10 civilian patients with ununited long bone fractures in whom iliac bone grafts alone were utilized, and 25 civilian patients in whom cortical bone grafts had been employed in the treatment of the same lesion Histologic studies were made on specimens, removed at the time of reoperation, of iliac bone grafts in 6 patients and cortical bone grafts in 2 patients

## THE NORMAL BEHAVIOR OF TRANSPLANTED CORTICAL AND CANCELLOUS BONE

In discussing massive bone grafts, reference is made to the dominant osseous component, for no large graft is entirely cancellous or cortical in its structure (Fig 1)

It is generally agreed that most of the mature cells in a bone graft fail to survive the transplantation and that the only cellular elements which do survive are those which form the so called endosteal layer and a few elements in the cambium layer of the periosteum The cells in these layers appear to have osteogenic properties In a cortical graft the fully mature cells die and the only channels for the invasion of new vessels and newly formed bone are the Haversian canals and the surfaces in immediate contact with the host bed (38, 39) In the instance of a large cortical bone trans

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Fig 1

Fig 1 a, Left two specimens, are sections through the wing of the ilium, showing its cancellous structure and the outer and inner cortical surfaces which give strength to this type of graft. This factor is well demonstrated in the roentgenograms of similar sections in c. The deficiencies of this type of graft are the limitation in its length due to the normal curvature of the iliac wing and its variable thickness. a, Right two specimens, are cortical grafts removed from the tibia and fibula respectively. Note that there is some spongiosa on the deep surface of the tibial graft, and this is illustrated well in the roentgenogram of a tibial segment in b.

Fig 2 a, Ununited fracture of the ulna following a compound fracture incurred in battle, which had been treated by tibial grafting. Good union appeared to have been secured. There had been no postoperative complications or injury and the forearm had been splinted for 1 year. The center of the tibial graft has resorbed with recurrence of nonunion, 18 months following the initial bone graft operation. b, Nonunion of the femur with a gap-defect of several inches following a compound, comminuted fracture incurred in battle. The defect was bridged with a massive iliac graft fixed with screws, and by multiple silver grafts, also from the ilium and placed in a previously prepared acrylic "trough." The lower extremity was supported in skeletal traction suspension. There was no postoperative infection or injury. Six months later the grafts were observed to resorb and disappear, with recurrence of nonunion.



Fig 2

plant, new bone is deposited at first largely on its surfaces, and, indeed, a densely sclerotic graft may become incorporated within the host bone without becoming fully replaced by new bone.

Entirely different conditions prevail in the instance of cancellous bone by virtue of its sponge-like architecture (Fig 1). Here the open spaces contain cellular bone marrow and blood vessels and communicate freely, either directly or through fine apertures in the lamellae and trabeculae. What is more, each

trabecula has its own endosteal layer. The situation in cancellous bone, therefore, is more receptive for survival of cellular elements and for early invasion and replacement by new bone, and while this pertains particularly to grafts which are small and thin, it is also manifest in the more massive type of graft. Although a portion of a massive cancellous graft will fail to survive, the peripheral portions remain viable while the more central portion becomes rapidly revitalized. On the other hand, such a massive graft from the ilium, by virtue



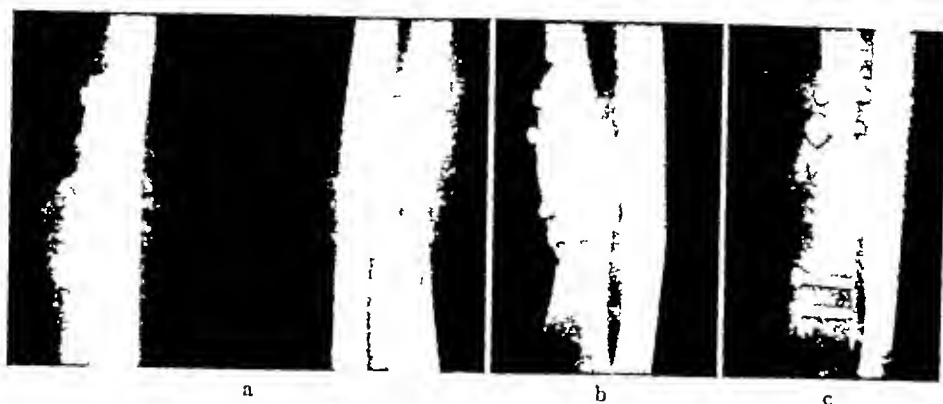


Fig 3

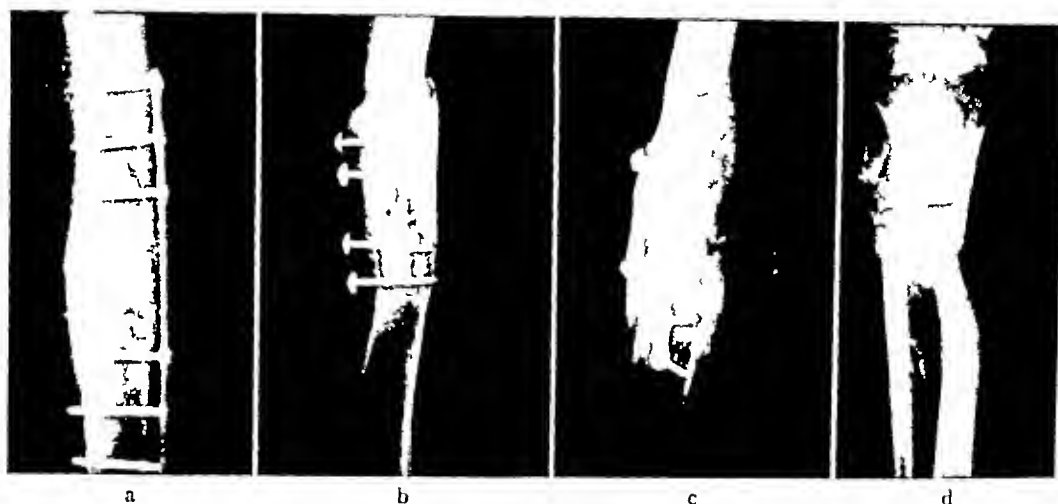


Fig 4

Fig 3 a, Ununited fracture of the radius following a compound battle fracture, treated by onlay cortical bone graft 3 months previously. Although the graft may be considered as united at its proximal and distal contacts with the shaft fragments, there is a distinct interval where it crosses the fracture site. b and c, Ilac grafts for ununited fractures of the radius following compound fractures incurred in battle 6 months postoperatively. The distal end of the ulna was resected in both instances to permit repositioning of the radial fragments and correction of the associated radial deviation of the hand and wrist. Although the bone grafts in a, b and c appear to be united to the host fragments, they still retain the architectural features of the donor bone. Until they assume features of the host bone, possibility of refracture must be guarded against.

Fig 4 a, Ununited fracture in the middle third of the femur complicating a simple fracture and treated 9 months previously by a massive iliac graft, iliac silver grafts and metallic plate fixation. The bony union is secure and the iliac grafts have begun to assume the architectural features of the host bone. b, c, A cortex and medullary cavity are now appearing. d, Compound fracture of the femur in-

curred in battle, with a gap defect and a narrow bridge of bony union posteriorly. A reinforcing iliac graft was applied anteriorly and the defect filled with iliac slivers 3 months previously. Although the graft is beginning to unite to the shaft, it retains its original features. c, Non union of the femur complicating a compound battle fracture, which had been treated by a massive iliac bone graft and metallic plate fixation 5 months previously. It is now felt that cortical bone is preferable as graft material in the shaft of long bones where cortical bone normally predominates. d, Ununited fracture of the tibia following a compound battle fracture treated by medial shifting of the upper fibular shaft following its osteotomy and transfixion by screws to the proximal tibial fragment, and the application of a massive iliac graft to the posterior surface of the fracture site without any screw fixation. The graft was not applied anteriorly because of soft tissue scarring in this area. Union of the tibial fragments is apparent 5 months postoperatively. The cancellous graft seen in its distal portion between the tibia and fibula is not too well incorporated, nor have the architectural features of the tibial shaft been reformed as yet.

of its one or more cortical surfaces gives a good measure of stability and internal fixation.

Plastic surgeons (11, 19, 37) have observed that skull and facial defects filled with cancellous

lous chips which are admirably suited for molding, feel firm as early as 10 days postoperatively. With the use of cancellous bone grafts, fixation of a small joint, such as the wrist, may become manifest, clinically, as early as 4 weeks following arthrodesis (without metallic fixation), while fusion of the spine or larger peripheral joints appears, radiographically, to be consolidating well by the twelfth postoperative week.

Until a bone graft, whether it is cortical or cancellous, becomes fully reconstituted by new bone of adequate strength, it may fracture or collapse, a complication which is observed even when the grafted part has been well protected (Fig 2). This is a particular hazard where the graft is massive and has been used across the sclerotized fragment ends of an ununited fracture or to bridge a gap defect, and thus contacts little or no viable osseous tissue in its central portion (Fig 2b). This "weak period" may occur later than the terminal second or the third month usually referred to (8, 15, 21). The writer has observed a case in which a massive cortical graft, employed to bridge a gap defect of the ulna in the presence of an intact radius, had fractured 18 months postoperatively, although there had been no injury or postoperative infection, and part had been protected by a splint for 1 year (Fig 2a).

When cortical fragments unite across a defect which has been filled with cancellous bone, the transplanted bone appears homogeneous and retains its original features for a long time (Figs 3 and 4). Until such an area differentiates into cortex and medulla, it is structurally weak and may give way. How long does this differentiation of cancellous bone take? The writer has observed the "ground glass" roentgenographic appearance of a cancellous graft retained for as long as 1 year. Abbott and his coworkers (3) studied the histologic specimens removed from 8 iliac grafts as late as 3 years following transplantation, and they observed complete differentiation in a tibia 1½ years postoperatively, and in an opponens thumb-strut 2 years following surgery. On the other hand, differentiation of a cortical bone graft in a bed of cancellous bone (for example, at the ends of long bones and in the spine) is also prolonged and, by roentgenographic stand-

ards, this may never fully occur. Such cortical struts, when massive and dense, may not become replaced by, but rather become incorporated within, new bone formation.

These findings form the basis for conclusions such as Abbott and his coworkers have arrived at. If an ununited fracture or incomplete osseous defect occurs at the end of the shaft of a long bone where spongy bone normally predominates, the type of graft employed should be predominantly cancellous. With adequate fixation and approximation of the fragments, these grafts will become rapidly and intimately incorporated within, and assume the features of, the host bone. At or near the center of a long bone where cortical bone predominates and where strength is required throughout a longer period of revascularization and revitalization, cortical grafts are preferred.

Cancellous chip grafts or sliver grafts, which become rapidly incorporated when employed where spongy bone normally predominates, are not advisable alone in the repair of long bone defects at or near the center of the shaft. However, in this area, a massive iliac graft with its one or two cortical surfaces will serve admirably when sufficient cortical bone is not available, or in order to spare one lower extremity when the opposite one is the site of operation. Such a graft is almost as rigid as a cortical graft of like dimensions, and it has the advantage of rapid incorporation by virtue of its predominant cancellous component. It has the disadvantage of limited length because of the normal curvature of the wing of the ilium, and of variable thickness (Fig 1, a and c). The writer no longer favors the use of iliac grafts alone in the repair of a complete gap defect in the shaft of a long bone, but agrees that the dual cortical graft, supplemented with cancellous strips, is a more effective mechanical procedure (5) and is fraught with less likelihood of failure (6). Where possible, the defect in these cases would be diminished by shortening the extremity. The dual type cortical graft operation (7) tends to reconstruct the cortical walls and medullary cavity of the shaft. Cancellous grafts placed along the sides of or encircling the cortical grafts, line the latter with a type of bone which is more readily revitalized and which serves to reenforce the

major grafts, in turn hastening their revitalization and replacement by new bone. When the condition of the soft tissues will not permit the introduction of so much bone in one stage, the reinforcing cancellous strips could be inserted at a second stage preferably preceding or during the resorptive phase of incorporation of the major graft.

There are sound arguments for and against the use of plate fixation at the time of the bone graft operation. Luckey and Adams believe that a metal plate encourages resorption of the graft by removing the effects of functional stress and strain which are necessary for the development and growth of the graft once it has become united in its bed. It is this local factor which has encouraged the use in some foreign clinics of the intramedullary nail as a method of internal fixation in the treatment of pseudarthrosis (44). Gilson and Loadman, on the other hand, suggest that the metal plate may prevent failure by taking away some of the strain from the bone graft. The writer now believes that metallic plate fixation is indicated specifically in the repair of osseous defects in certain anatomical areas, such as in the upper half of the femur and humerus where the lever action of the extremity may prove vicious (Fig. 3a, b, and c). The effectiveness of the internal fixation secured initially by metallic screw fixation of a large bone graft, becomes endangered during the resorptive phase of incorporation of that graft. Adequate support may be afforded in these cases by external fixation when the fracture site is within or distal to the lower part of the femur or humerus, especially in the presence of an intact bone adjacent the fracture site (for example, the tibia or a forearm bone), and particularly where there has been minimal soft tissue dissection during surgery (Fig. 3a, b, and c). Indeed, in these latter cases no internal fixation whatever may be required (20) (Fig. 4d). Where, however, reduction is difficult to maintain the soft tissues will not hold the graft and internal fixation of the graft is necessary.

#### COMPARISON OF RED AND YELLOW MARROW CANCELLOUS BONE AS DONOR AND HOST

Clinically cancellous bone containing red marrow, such as bone from a rib, the ilium or

the greater trochanter, appears to be better graft material than spongy bone containing yellow marrow, as found in the ends of a long bone such as the tibia (30). This is fortunate since both iliac wings offer an enormous amount of bone for transplantation the removal of which need result in no disability (23, 24). Abbott and his coworkers (3) may be correct in attributing this difference between the osteogenic properties of both types of cancellous bone to the inhibitory effect of fat on the formation of new vascular tufts and new bone.

The experiments of Huggins and associates (25, 26, 27) are enlightening as to the distribution of red and yellow marrow. These authors demonstrated in rats that the occurrence of increased hemopoiesis, vascularity, and protein framework of marrow, was directly related to elevation in body temperature. Yellow marrow was found in those bony components furthest removed from the trunk—for example, in the tail and the extremities. Also transplantation of these peripheral segments into the body wall or peritoneal cavity caused the transformation of marrow from yellow to red. In their experimental animals, actual intramedullary temperature measurements increased from the periphery of the extremities to the trunk. These findings are consistent with those in the human skeleton, where the cancellous bone of the osseous components of the trunk (for example, the sternum, ribs, vertebrae, pelvic bones, and the bony components of the shoulder and hip joints) contain red marrow, and the cancellous bone in the extremities (for example, the tarsal and carpal bones, and at the ends of long bones) contain yellow marrow predominantly.

What pertains to bone as grafting material also applies to bone as host material. Spongy bone is a more receptive host tissue than cortical bone, both types of host bone are more receptive to cancellous than to cortical bone grafts, and, finally, a cancellous bed containing red marrow may be even more receptive than a bed of yellow marrow spongy bone.

#### THE BEHAVIOR OF BONE GRAFTS IN THE PRESENCE OF INFECTION

As recently as 1934 Dickson cautioned against the use of a bone graft in the presence of

of infection, even if low grade. Experience in the late war has shown that a bone graft may survive a complicating postoperative infection. For example, Luckey and Adams observed latent infection in 22 of 228 cases, yet union occurred in 17 of this infected group. In the writer's series of 91 bone graft operations (23), successful union occurred in 6 of 11 infected cases. Indeed, the use of chemotherapeutic and antibiotic agents has encouraged some surgeons to recommend the filling of draining, obviously infected, bone defects with cancellous bone chips, simultaneously with any necessary soft tissue repair (1, 10, 18, 40). Others are agreed, however, that it is less hazardous to use such grafts a suitable time following saucerization and temporary split skin coverage (28, 31, 41, 42).

In the reconstructive bone surgery of previously compound fractures, especially those which have been frankly infected, there is a hazard of recurring infection, during which the survival of transplanted tissue, particularly bone, becomes jeopardized. Cancellous bone appears more capable of withstanding infection than cortical bone, perhaps because of its greater permeability and more rapid revitalization (1, 18, 23). If infection occurs and is mild and if surgical intervention can be withheld or minimized, portion or all of graft may survive, and operation may still succeed.

The incidence of recurrent infection in these cases appears to be related to the "waiting period" between the time of wound healing following the original compounding and the time of reconstructive surgery. A period of 3 months or even less has been accepted by many as a safe interval prior to definitive surgery. Farrow, analyzing the incidence of 11.5 per cent infections in 156 bone graft operations for 137 cases with ununited fractures and 19 cases with limited union, 80 per cent of which had been compound, observed that the incidence of infection diminished rapidly as the "waiting period" was prolonged. This incidence was 40 per cent in 15 cases with a waiting period of 1 to 3 months, 20.5 per cent in 39 cases with a waiting period of 3 to 6 months, and no infection in 18 cases with a waiting period of 6 to 8 months. Lambert and the writer (23), adhering to a 6 month waiting in-

terval, reported an incidence of recurrent infection in 12.1 per cent of their 91 bone graft operations. In view of these and other reports, a "waiting period" of 8 months or even longer appears advisable at the present time if the danger of relighting a latent infection is to be reduced to a minimum.

Further light has been shed regarding these recurrent infections by Lambert and the writer (23), who obtained positive wound cultures at the time of reconstructive surgery in 9 of 18 cases with ununited fractures of long bones, 6 months or longer after all wound healing. In all of these cases, chemotherapeutic and antibiotic agents had been utilized liberally at the time of injury, during wound healing, and in preparation for the reconstructive operation. Indeed, in 1 case healing had been present for 9 months and in another for 1 year. Eight of these 9 cases had been compound fractures and 1 case was a simple fracture which had been reoperated upon. In view of the inability, at this time, to determine accurately the presence of living bacteria prior to or during surgery, and to protect fully against this potential hazard, these authors have concluded that there will continue to be an irreducible minimum incidence of postoperative infection following reconstructive surgery of compound fractures. If a bone graft operation is to be performed and there is danger of relighting a latent infection, cancellous bone is preferred to cortical bone, since this type of bone appears more capable of surviving this complication.

#### CONCLUSIONS

1. Cancellous bone should be used as graft material to bridge or fill an osseous defect at the end of a long bone, where spongy bone normally predominates. At or near the center of a long bone, where cortical bone predominates and where strength is required throughout a longer period of revascularization and replacement by new bone, cortical bone grafts are preferred. There will be greater assurance of union in these latter cases if cancellous grafts are used to supplement the major cortical graft. Although the fracture fragments at or near the midshaft of a long bone, will unite when bridged with cancellous bone, it will take as long as 2 years for this transplanted bone

to assume the architectural features of the host bone, and during this entire period of transformation there is danger of its collapse or refracture. Cortical bone, on the other hand, when transplanted to a cancellous bed may never fully lose its original structural features.

2 Transplanted cancellous or cortical bone undergoes a phase of resorption during graft incorporation, and while this "weak period" has been noted usually at the end of the second and during the third months, it has been observed to occur as late as 18 months postoperatively. It is during this phase that refracture of the bone graft may occur.

3 The technique of the bone graft operation, i.e., whether dual-type, onlay, inlay, intramedullary, etc., and whether or not internal fixation is to be employed, will depend entirely on the circumstances analyzed in each case. In the presence of large osseous defects with nonunion, the dual-type of graft appears to be most effective mechanically and is fraught with less likelihood of failure.

4 Cancellous bone containing red marrow appears to have greater osteogenic properties than cancellous bone in which yellow marrow predominates. The iliac wings are the source for an enormous quantity of red marrow spongy bone, and a massive graft from this region has rigidity and strength.

5 If bone is to be transplanted and there is danger of relighting a latent infection, cancellous bone is preferred to cortical bone, because of its greater ability to survive this complication. Despite the use of chemotherapy and antibiotic agents, recurrent infection has been observed as late as 1 year following wound healing in a compound fracture.

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# THE MEDICAL TREATMENT OF ENDOMETRIOSIS AND THE SIGNIFICANCE OF ENDOMETRIOSIS

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THE medical treatment of endometriosis has not as yet been proved to be of great importance. There can be no doubt that progression of the disease can be held in abeyance and its activity checked by medical treatment but the cure of such a lesion seems out of the realm of possibility. Miller of Hartford and Hirst of Philadelphia have presented experiences of considerable value in the use of testosterone. This hormone stopped the advance of the disease probably by inhibiting the activity of the pituitary gland as far as follicle stimulating hormone and luteinizing hormone are concerned, so that ovulation and luteinization and therefore an active, normal, ovarian-uterine cycle did not occur. It is also possible that the hormone may directly counteract the effect of estrin upon the proliferating cells of the endometrium. Miller reports that his case was made more easily operable but endometriosis was still present. It is unlikely that a pathologic state in which the lesion is often in an end-phase and which in many instances has taken years to develop would vanish following the use of any hormone. This hormone to be effective would of necessity have to be given over a period of years, for our experience on observing an adenomyoma of the rectovaginal septum following castration showed that 3 years elapsed before the lesion became white and puckered. Karnaky, judging from his personal communications with me, is very active in his advocacy of stilbestrol in the treatment of endometriosis. He states that the lesions vanish, that pain ceases, and that fertility results in many instances. He uses large doses of stilbestrol and has worked out a definite program for treatment. It is fair to say that the hormonal approach should be given every opportunity and its advocates should be encouraged to persist in their attempt to find a

satisfactory treatment. However from the very nature of the lesion, that it is endometrium which is active but misplaced, any medical treatment to cure an endometrioma must cause inhibition of the hormones that activate it. Inasmuch as medical methods of treatment are in the experimental stage, it is not possible to advise their use at the present time.

Another form of medical or perhaps better called nonsurgical treatment is the use of radiation, either radium or roentgen therapy. This method of treatment is definitely curative and yet it is not recommended unless as a secondary treatment following a surgical excision that has failed, or in a lesion so extensive that surgery is considered too dangerous to carry out. Inasmuch as endometriosis is so frequent in the age group in which sexual activity is important it is unwise to use a form of treatment that causes the menopause to develop with its ensuing effect on sexual desire and satisfaction. It must not be forgotten that castration, whether surgical or following radiation, may cause serious changes in the metabolism of bone. About 20 years after the normal menopause, osteoporosis frequently occurs and it is reasonable to expect that 20 years after castration at the age of 30, that is at 50 years of age, real bone changes may occur. Unquestionably castration has an effect upon bone, skin, and hair, and for young people this method of treatment should be avoided if possible. Radiation is an easy, simple, and safe method of treatment but this type of therapy in youth is not being used so frequently as it has been, even in the group of patients who have small fibroids with bleeding or metropathia haemorrhagica. Radiation therapy can be used and it will be a most satisfactory method in a number of cases but its after effects are not desirable.

For these reasons this author is not satisfied with the use of medical treatment in patients with endometriosis. It surely will have its

TABLE I.—TWO SERIES OF CASES TAKEN FROM PRIVATE AND WARD PATIENTS 8 YEARS APART

	Consecutive cases	Endometriosis microscopically		Endometriosis grossly		Endometriosis microscopically or grossly	
		No	Per cent	No	Per cent	No	Per cent
Private Cases (1st series)	400	112	28	32	8	144	36
(2nd series)	400	12	3.0	18	4.5	140	35
M G H cases (1st series)	400	21	5	11	3	32	8
(2nd series)	400	23	5.75	10	2.5	31	7.75

uses, and perfection of these methods of treatment will give the surgeon or gynecologist another arrow for his bow in the cure of a usually simple but sometimes very complicated lesion. We should encourage experimental trials but not advocate their use until further satisfactory reports have been published.

#### THE IMPORTANCE OF ENDOMETRIOSIS

The peculiar phenomenon (8) of endometriosis, which the author believes is a result of abnormal physiology and not a true disease or tumor, has certain effects upon young women that are far from desirable. Its ability to cause pain—both intermenstrual and during menstruation—is well known. The dysmenorrhea is usually of no serious consequence and its relief by the methods suggested recently by Dr. Counseller is obvious and not dangerous. Its advance however into the bladder, the bowel, or around the ureter is of serious consequence and its growth must be checked or the lesion removed. The cure of such lesions in these days of modern surgery is not too much to expect. However, its true importance is its effect upon the problem of reproduction. From previous studies of ward patients versus private patients it seems that the successful and educated stratum of society is most affected and this should be very important to us. We, as physicians, are in that stratum—intelligent, trained, educated, and socially minded—the so-called upper middle class as contrasted with the unsuccessful, impecunious and less educated group. This must not be misconstrued as an attempt to place us in the

snobbish society group, but we are college men, university graduates, and are supposed to be intelligent and intellectual. Apparently it is our group of society, that marries late and limits the size of its families, which is most affected by endometriosis. It is our duty to reproduce ourselves, for according to many investigators only an occasional man or woman of large intellectual stature springs from the uneducated and supposedly not so intelligent class. It is from us, the really educated, that most of the superior minds develop. If this is so, and undoubtedly it is, it would appear that we should do our share of reproducing ourselves and not leave it to the other group. It has been shown that endometriosis is much more frequent in private than in ward patients (Table I) and therefore with the recognition of these facts and with our superior intelligence it would appear that the thinkers or more intelligent group should be interested in this problem. The importance of endometriosis is in its accompanying infertility among those who by their training and education attempt to plan their marriages on the basis of security from financial worries, and their child-bearing not upon biologic laws but the rules set down by the society in which they live. To these people conformity with the "Joneses" is more important than the production of the best children of the nation. Carrel in his famous book *Man the Unknown* states in confirmation of this brief discussion that "Eugenics is indispensable for the perpetuation of the strong. A great race must propagate its best elements. However, in the most highly civilized nations reproduction is decreasing and yields inferior products. Women voluntarily deteriorate through alcohol and tobacco. They subject themselves to dangerous dietary regimens in order to obtain a conventional slenderness of their figure. Besides, they refuse to bear children. Such a defection is due to their education, to the progress of feminism, to the growth of short-sighted selfishness. It also comes from economic conditions, nervous unbalance, instability of marriage, and fear of the burden imposed upon parents by the weakness or precocious corruption of children. The women belonging to the oldest stock, whose children would, in all probability, be of good quality,

and who are in a position to bring them up intelligently, are almost sterile. It is the newcomers, peasants and proletarians from primitive European countries, who beget large families. But their offspring are far from having the value of those who came from the first settlers of North America. There is no hope for an increase in the birth rate before a revolution takes place in the habits of thinking and living, and a new ideal rises above the horizon." Such a philosophy falls in with the facts of the studies carried out and reported previously. Private patients, and it is presumed that they are of more superior intelligence in most instances than ward patients, do not marry early enough and do not have sufficient numbers of children who can be brought up into healthy and strong sons and daughters. Carrel suggests that "The only way to obviate the disastrous predominance of the weak is to develop the strong."

#### THE SIGNIFICANCE OF ENDOMETRIOSIS

As a gynecologist interested in the problem of endometriosis and long aware that it is much too frequent, and interested and somewhat alarmed at the possible injury to us by the apparent frequency of late marriage and infrequent child-bearing, I have made repetitions of my thesis since its first presentation in 1938 in an editorial in *SURGERY, GYNECOLOGY AND OBSTETRICS* (9). A paragraph from Edwin Lawrence Godkin's *Problems of a Modern Democracy* quoted in a *Book-of-the-Month Club News* helps me to feel that repetition can be salutary. This paragraph states "No one ever talks freely about anything without contributing something, let it be ever so little, to the unseen forces which carry the race on to its final destiny. Even if he does not make a positive impression he counteracts or modifies some other impression, or sets in motion some train of ideas in some one else, which helps to change the face of the world. One of the functions of an educated man is to talk, and of course he should try to talk wisely." This paragraph bolsters me in my repetition and perhaps it is a good excuse for repeating what has been written before.

In 1798 Malthus was distressed about the increasing population in the British Isles and

his worry was based upon the theory that population increased by multiplication whereas the basic food supply increased only by addition. He apparently was in favor of marital continence, avoidance of marriage, pestilence, and war to keep the population within normal limits. It so happened that his worry was not necessary at that time for shortly after his essays were published the concentration of population in cities due to the industrial revolution was followed by a decrease in birth rate, although due to newer methods of hygiene and sanitation an increase occurred in the length of life. According to Vance, whose article "Malthus and the Principle of Population" I am using freely, contraception began to be used in France about this time with the result that the birth rate of that country dropped rapidly and kept the population stable in spite of the increasing length of life. There were just as many marriages in France but not so many children. This was the beginning of an attempt to control the birth rate and if it had been used everywhere plus the advent of hygiene and the subsequent increase in length of life the Malthusian idea might have been borne out. There is no doubt that something had to happen to save the world from overpopulation. Malthus thought that each married couple should have 6 children but modern demographers, or those interested in the study of population in relation to vital statistics and social statistics, believe that 3 children per family are sufficient. Six children per family if all lived, and in these days most would live, would quickly overpopulate the countries where hygiene, sanitation, and the like are part of modern civilization. Something needed to be done about the population, and contraception, late marriage, and infrequent child-bearing were aided by two very great wars. Ireland is an example of the working of the Malthusian theory for here the population is kept at 4,500,000 and overpopulation is avoided by late marriage, by the entrance of many sons into priesthood and of daughters into the sisterhood, and by the largest percentage of unmarried and therefore unproductive women in the world. Birth control is not used in this Catholic country but stabilization of the population has been achieved.



TABLE II

	Per married couple reportage
All colleges women, class of 1922	1 66
Harvard, class of 1922	1 83
All colleges, men, class of 1922	1 85
Mills College, California (women), class of 1923	1 88
Princeton, class of 1921	1 90
Occidental, California (women), class of 1923	1 94
Private patients (J V M)	1 94
Massachusetts General Hospital doctors	2 70
Massachusetts General Hospital outpatients	3 31
*Women with not over 4 years' schooling	4 33

\*This is very high for even including the unmarried they had produced

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It is interesting to note what patients in the private practice of a gynecologist do about increasing the population. The last 200 patients were questioned as to whether or not they used contraception and the results show that over 90 per cent use contraceptive methods of one sort or another. In my private practice 200 married couples, who at this time were over 38 years of age, had produced 389 children or 1 94 per couple. Further information showed that in the Gynecologic Out Patient Clinic of the Massachusetts General Hospital 196 successive patients had 650 children or 3 3 children per married couple, a little less than twice the number produced by private patient couples. Dr Clarence Gamble (1,3) of the Population Reference Bureau discloses that married college women graduated in 1923 had but 1 66 children in 1948 and that married college men had 1 85 children. The graduates of Princeton and Harvard, 25 years out of college, fathered but 1 90 and 1 83 children respectively, while the total number of women with not more than 4 years' schooling averaged 4 33 children. This must mean, therefore, that in our intelligent and successful class of society the deliberate avoidance of large families is the rule. Thus we are enthusiastic Malthusianists and our group is gradually becoming smaller while the less educated group becomes larger. It must be admitted here that 100 unselected doctors of the staff of the Massachusetts General Hospital, with their usual intelligence and farsightedness, have been an exception to these figures for these married couples who have reached 38 years of age have had 2 7 children per couple, a very satisfactory accomplishment (Table II).

Unquestionably limitation is important to society but the mistake is the use of birth control in patients who have married late and in patients who have produced but 1 child. It is the feeling of this writer, and this has often been repeated, that our children should marry young and they should have their families when young. After this has been accomplished they can then practice prevention of impregnation. I am definitely against giving contraceptive advice to patients who are young and can afford to have children. I am against giving it to newly married women over 25 for it is my belief that these are the patients who by not using their reproductive organs and by allowing their menstrual cycles to continue uninterrupted for 12 to 14 years, develop endometriosis with its important bearing upon fertility. An ovary that is adherent or a tube that is adherent, a complication of endometriosis, certainly is a definite deterrent to conception. Again to be repetitious (7) it is my feeling that we as parents should give financial aid, if we can, to our children and encourage them to have babies. The modern young married couple gets along on very little. These children of ours are the type that are important to the world. It is not large families of the poor, the unhealthy, the weak, and the unintelligent that the world needs, but families of the healthy, strong babies of our children. With a slight amount of help we can prevent the sad occurrence of our children seeking advice and help for a sterility problem that may be insoluble.

That this philosophy can lead to the ridiculous is obvious. I have a letter from a surgeon in Worcester, Massachusetts which is so apropos that I would like to quote a paragraph. The doctor writes after reading a similar article to this one in the *Annals of Surgery* for May, 1948 "I warn you I read it with a shudder and will delete all references to parents helping their children financially so that they may marry young. My case history and a little mathematics are sufficient to precipitate a psychosis at the very thought. I even though I was one of those poor benighted souls who put in a long period of training and did not marry until I was 32, my score at the box office at present is 7 children. My wife is only

43 If, in order to prevent endometriosis, I encourage the early marriage of my children with the responsibility in the background of education in private schools, colleges, and universities, I may have to borrow some money from you. If the larger physical growth of the present generation of children is paralleled by a corresponding increase in fertility, and they can ring the bell at 8 children each, I soon would have an extension of the endometriosis program to apply to 56 children!" This is a delightful commentary from a very wise and friendly surgeon, and how correct he is! But I hope all his sons will be older and established and marry young wives, as he did, and then they will be able to care for them even as the doctor has. Not all young men want to marry out of their own age group and this is the problem that is before us. Not only do I think that we should help our children financially but that industry might be able to give more wages to the young married man so that he can have children when young and healthy.

The Malthusian theory is working out among us but war and pestilence are not our methods for we prefer the use of contraceptive methods which are satisfactory in their place, which is not with the young married couple until they have produced their offspring.

A look at Table I showing the incidence of endometriosis in the private and ward patients should convince each of us of the seriousness of the problem of endometriosis and should warn all of us that our young are too precious to be sacrificed in these difficult economic days. Malthus was correct and we must pay attention to his ideas but let us not carry them out too rigorously in our educated and supposedly intelligent group!

The importance of endometriosis is its aspects and relation to infertility, and its significance is that we as parents, recognizing the facts, can help to increase the most necessary class in society and aid the world in becoming a healthier and better place.

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# SURGICAL PROCEDURES INVOLVED IN THE TREATMENT OF ENDOMETRIOSIS

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THE surgical treatment of endometriosis is both of a radical and of a conservative nature. However, before presenting to you the ideas of my colleagues and me concerning some of the surgical procedures required in the successful management of this interesting entity, let me repeat what I have so often said, "There is no pelvic operative procedure which at some time is not required for endometriosis or made more difficult by its presence. Few conditions demand more surgical skill and judgment to secure the best way out of an unfortunate situation for the patient."

It seems to us that extreme caution must be used in making a decision that a patient suspected of having endometriosis has now reached the point at which she requires surgical treatment for relief. This is a simple matter if one is dealing with large chocolate cysts of endometrial origin or if there are associated pelvic pathologic conditions which of themselves need surgical treatment. I refer especially to those younger patients who complain of dysmenorrhea and who may have some slight fixation or immobilization of one adnexa or tender and tense uterosacral ligaments. One of the chief symptoms of the younger patient is menstrual pain, uncontrollable and of an increasing character. Usually in a few years there will be superimposed on this some type of menstrual disturbance and in the young married patient, there is the question of sterility. If therefore, the pelvic findings are not remarkable and definite on pelvic examination, one should be quite hesitant in advising surgical treatment and, what is more, should be quite cautious in evaluating the results which may be obtained if the patient accepts surgical treatment. However, it is an entirely different matter when the pelvic findings are definitely

those associated with extensive endometriosis or if this is associated with other pelvic lesions such as fibromyomas, ovarian cysts, hydro salpinx, and so forth.

This word of caution is injected here to try to prevent, or at least to defer, early surgical intervention in some of these young women because we have noted that there is such a variation in the threshold for pain among them, and that clinicians so frequently will make a diagnosis of endometriosis on the basis of menstrual pain alone. Certainly, by no means is endometriosis responsible for all the pelvic pain ascribed to it. There are, however, definite physical findings which are familiar to the trained gynecologist and which denote only endometriosis. These should be entirely familiar to anyone who attempts to treat surgically such an important pathologic entity in women, which is so intimately associated with their pelvic comfort, their marital relations, and their reproductive capabilities. A discussion of the physical findings in this disease is not to be incorporated here.

As a basis for discussion of the surgical procedures a series of 852 patients in whom operation was performed from 1940 through 1945 will be used. Also, I shall refer in addition to some of the difficulties inherent in performing the common pelvic operative procedures in the presence of endometriosis.

It is particularly interesting that in this group of patients only 6.2 per cent were less than 30 years of age, while 81.7 per cent were from 30 through 49 years of age (Table I). This, I believe, is the correct trend and is indicative of our efforts to allow the younger patient to carry on with her disability providing it is not too incapacitating. If she marries, it is to be hoped that she will have children before it becomes necessary to intervene surgically, because there is increasing evidence that surgical intervention on the uterus in patients who have a few endometrial implants does in-

TABLE I.—AGE INCIDENCE

Age, years	Number	Per cent
10-19	2	0.2
20-29	51	6.0
30-39	311	36.5
40-49	385	45.2
50-59	99	11.6
60-69	4	0.5
Total	852	100
Mean age		41.3 years
Youngest		19 years
Oldest		69 years

fluence a secondary sterility. Patients who undergo operation after 40 years of age usually have other associated pelvic lesions in addition to the endometriosis.

It does seem that the pelvic structures and peritoneum of some women are different from those of others in that they do not tolerate manual manipulation or any surgical trauma. Each of you has seen the excessive contraction which occurs in the uterus of some patients when it is handled at operation and the vascular flush which also is easily induced in the peritoneum of the cul-de-sac and broad ligaments if they are subjected to the slightest trauma. These structures actually behave in the same manner as the cornea when it is touched or irritated.

Since endometriosis seems to be definitely increasing, every precaution should be taken at least on our part to prevent its occurrence. Nonsurgical intervention in the female pelvis except for acute emergency conditions may be quite helpful, since the incidence of endometrial lesions seems to be definitely increased by previous surgical procedures. In this series of 852 patients studied, 369 (43.3 per cent) had undergone previous pelvic and abdominal surgical procedures. However, only 7.0 per cent had undergone abdominal surgical procedures on structures other than the pelvic organs. Surgical procedures involving the uterus itself or its adnexa had been performed in 27.6 per cent of the cases, and dilatation and curettage and perineal surgery had been done in 8.7 per cent (Table II). Whether this is a definite factor in the causation, of extreme

TABLE II.—PREVIOUS SURGICAL TREATMENT

	Number	Per cent
Previous surgical treatment total cases	369	43.3
Surgery of uterus or adnexa	235	27.6
Dilatation and curettage, perineal surgery	74	8.7
Other abdominal surgery	60	7.0
No previous surgery	483	56.7
Total	852	100

surgical significance, cannot be said for certain but it can be said, I believe, without question that there is considerable variation in the degree of sensitivity of the pelvic organs among women.

Whenever surgical treatment becomes indicated for endometriosis, it is on account of menstrual pain, menstrual dysfunction, sterility, associated pathologic lesions of the pelvic organs or a combination of two or more of these factors. The extent of the surgical treatment required will depend entirely on the extent of the endometrial process.

We all know that endometriosis is functioning endometrium or endometrium-like lesions in an ectopic position. Its activity is synchronized with that of the normal endometrium, so that to secure a surgical cure the ovaries, which control the activity of the endometrium, must be removed or the endometrial lesions must be excised.

The longer that surgical intervention can be postponed, the better it will be for the patient, because it is not possible to estimate before operation how extensive the procedure is going to be. If the patient is less than 35 years of age, perhaps one can perform a conservative operation and maintain both the menstrual and reproductive functions, a result which is highly desirable. However, maybe at operation it is obvious that this cannot be done without the possibility of early return of the same symptoms and difficulties. For this reason it is mandatory that the surgeon be given permission to do a radical removal of all pelvic organs if in his judgment this appears to be advisable at the time of pelvic exploration. Most young women who thoroughly understand these facts and who understand how this pelvic situation functions will not submit to surgical treatment under these circumstances.

TABLE III — PRESENT SURGICAL TREATMENT

Type of Lesion	Cases	Per cent	With presacral neurectomy	
			Number	Per cent
Partial hysterectomy	42	81		
Conservative total*	110	100	10	9.1
Total hysterectomy	1	0.1		
Colporrhomy	2	3.7	5	18.5
Salpingectomy, oophorectomy	51	60	3	5.9
Local excision	2	1	2	7.4
Excisional hysterectomy	1	0.4		

\*Operations concerning menstrual function  
 71 per cent of total cases  
 Per cent of cases with listed treatment

unless they are indeed having serious disability and desire relief above everything else.

There is a situation which seems contradictory to what I have just said, and I believe that it should be briefly stated here. Occasionally you will encounter a patient whose ovaries are quite free of endometrial lesions, but it is impossible to excise completely all the implants on the broad ligaments and peritoneum of the cul-de-sac. My colleagues and I hesitate to perform castration in this type of case, but we usually perform a subtotal hysterectomy since we have found that, if the patient does not menstruate, the remaining implants stay relatively quiescent even though the ovaries are still functioning. I cannot give a good reason for this behavior except to say that it resembles some malignant implants or metastatic growths which remain quite inactive for several months or years after removal of the parent growth. Hysterectomy in a young woman must be considered radical treatment but not as radical as though bilateral castration were done also.

We feel that it is vital to the patient's welfare to conserve ovarian tissue and prolong ovarian function as long as it is possible, because some of the effects of sudden cessation of ovarian function are about as detrimental and as difficult to manage as the original disease itself. Some of these conditions briefly are atrophy and increased sensitivity of the vaginal mucosa, loss of muscle tone, and other evidences of early senility. However, fortunately in some instances in which it is neces-

sary to perform castration the effects are not as severe as is common in castration for other reasons. Many of these patients will have few if any symptoms. This phenomenon is explained in part by the fact that the gradual destruction of ovarian tissue by the endometriosis has progressed, at the time of operation to such an extent that the patient has been bordering on menopause for some time. Therefore in this condition patients who are in the age group of 35 years or older will begin to have evidence of ovarian dysfunction and menstrual disturbances.

If the foregoing statements and observations are correct and they are applied in the selection of patients for surgical treatment, it will be noted that a greater number of the patients will be treated by more radical means and that surgical treatment will be delayed until the middle or later part of the thirties. Our studies in this group of patients show that 74 (87.1 per cent) were treated by radical surgical measures which, generally speaking, means a complete removal of all pelvic organs except in the case of those patients who have diffuse lesions in which the ovaries are uninvolved (Table III).

Conservative operations, which were, of course, directed at relief of pain and preservation of menstrual and reproductive functions, were performed in 110 patients (12.9 per cent of the total cases). Of these, 10 (9.1 per cent) underwent presacral neurectomy in addition. This was combined with excision of the accessible implants in 2 patients, excision of one adnexa in 3 patients, and the removal of one ovary in 3 patients. Owing to careful selection of patients the results of presacral neurectomy have been excellent.

If a presacral neurectomy is to be done as one of the conservative measures, it should be limited to those situations in which the lesions are confined mainly to the uterus, uterovaginal ligaments, and vesical tissues. If the lesions are on the parietal peritoneum or intestine they are not affected by this procedure. Furthermore, it is not a procedure to be undertaken hastily, and it must be carefully executed, especially in securing the branch which passes downward along the left common iliac vein, if one is to avoid severe hemorrhage.

It must be remembered too, that this nerve can regenerate completely within 3 to 5 years and have all the sensitivity restored

Menstrual abnormality in endometriosis is rather high and is one of the symptoms which the patient is most anxious to have corrected. In this series 688 patients (81 per cent) complained of some type of abnormality. Some of these abnormalities were not due to any gross pathologic change in the ovaries but were attributed to ovarian-pituitary and thyroid imbalance or dysfunction. However, in 496 patients (58 per cent) there was menorrhagia or metrorrhagia which could be directly attributed to endometrial or other lesions of the ovaries and uterus. From this, one can assume that about 58 per cent of the patients at least will require surgical intervention for adnexal or uterine lesions which most likely are producing the menstrual disturbances.

The dysmenorrhea which these patients complain about is variable and, as previously referred to, must be carefully selected if the surgical intervention is primarily for the relief of pain. Patients may have extensive lesions without much pain, as was the case in 145 patients (17 per cent). Many of these lesions are in conjunction with large fibroids and for some reason are relatively painless. This same situation obtains in cases of large endometrial chocolate cysts, in which all ovarian tissue is about destroyed from pressure of the old blood. In these situations also there is not much pain. On the other hand, one or two small implants properly situated on the uterosacral ligaments can produce severe dysmenorrhea and, if one is to be conservative in one's surgical approach, it is most difficult to know which lesions are producing the pain.

The question of fertility in these patients is most interesting and in many it is the chief symptom which brings them to the gynecologist. What part the endometriosis plays in this is certainly problematical. It is true, however, that 30 to 50 per cent will have a primary sterility problem. In this group of patients 737 were married and in 215 (29.2 per cent) of them there were no pregnancies recorded (Table IV).

It is of interest that in some of these patients infertility develops after 1 or more pregnan-

TABLE IV—FERTILITY OF 737 MARRIED PATIENTS\*

	Cases	Per cent
Total	737	100.0
No pregnancy	215	29.2
Pregnancy, all cases	506	68.6
One live birth	162	22.0
Two or more live births	290	39.3
Miscarriage only	54	7.3
No information	16	2.2

\*215 patients unmarried not included.

cies. For example, only 32 per cent of those becoming pregnant had fewer than 2 live births and 57 per cent became infertile after the delivery of 2 or more children. The reason for this certainly needs careful study and consideration, for it does appear that if one of these patients does become pregnant it may have something to do with subsequent infertility. It is known that 100 per cent of patients who have diffuse uterine adenomyosis (internal endometriosis) have had children, so that perhaps it may be the trauma which causes the endometrial cells to invade the myometrium. When this situation ensues, dysmenorrhea becomes progressively more severe, the uterus becomes usually somewhat enlarged and the patient becomes sterile or aborts when pregnancy occurs. The cure in these cases is hysterectomy.

A word of caution should be expressed concerning the results of conservative operations in an attempt to correct the sterility. Our records show that not more than 10 per cent of those who have been treated surgically will later become pregnant. Therefore, the chances of future pregnancy occurring are probably just as great if the patients are left alone.

The difficulties which surgeons have in doing any pelvic operations where endometriosis predominates are explained on a sound and correct pathologic basis. The endometrium and its stroma cells are among the most rapidly growing and repairing tissues in the body. The stroma cells and the surrounding tissue which they stimulate form dense fibrous adhesions. The tarry material which is periodically spilled into the pelvis contains blood, tissue debris, and glycogen. It is far more ir-

ritating and causes denser and tougher fibrous adhesions than does the inflammatory reaction from specific infections or fecal fistulas. Also the endometrial cells invade the muscular walls of the intestine and the peritoneum overlying the ureters, bladder, and uterus, a fact which accounts for the inability of the surgeon to separate the intestine by any means other than sharp dissection. This fact clearly explains why there is a rather high incidence of fecal fistulas subsequent to surgical intervention for endometriosis.

Given a case of extensive endometriosis with chocolate cysts and uterine fibroids which requires removal of all pelvic organs for a cure, the operation is generally a very difficult procedure and, unless meticulous care is used, complications such as vesicovaginal fistula, ureteral injuries, intestinal fistulas and obstruction will occur. The type of hysterectomy should be a supracervical one because in this disease the paracervical tissues are involved in the endometrial process which has resulted in formation of considerable scar tissue with fixation of the cervix and the lower ends of the ureters. The ureters in this region become fixed to the peritoneum and covered, and if one elects to do a total hysterectomy these structures do not drop away in the usual manner. Injury of a ureter usually takes place about 1 inch (2.5 cm.) above the ureterovesical juncture. One of the most common injuries to the ureter is interference with its blood supply so that a portion of the ureteral wall sloughs out and a ureteral fistula then develops.

There are three other complicating lesions of endometriosis which become surgical problems so that their management must be included in this discussion. The first of these is endometrioma of the urinary bladder. The symptoms are hematuria as well as other symptoms of vesical irritation at the menstrual period.

Cystoscopic examination and a biopsy will reveal the nature of the lesion usually, although not every time. Occasionally the pathologic diagnosis of an inflammatory lesion is made a result which leaves one to wonder if the lesion is a malignant one associated with a metastatic implantation. Repeated biopsies

should settle the issue. This is important since the management of these two lesions is entirely different and the prognosis is profoundly different.

An endometrioma, such as of the bladder is an instance of one benign tissue invading a normal tissue. Complete surgical excision cures the patient. However to perform a complete excision is best done when the endometrioma is congested with blood. At this time its extensions can be more easily identified. Many of these endometriomas of the bladder are solitary lesions so that no other surgical treatment on the pelvic organs is required.

Another type of endometrioma which may cause more serious trouble is an endometrioma of the sigmoid. Fortunately, these lesions are not all obstructive and do not all require resection of the bowel. The sigmoid is usually involved in extensive pelvic endometriosis but, if the bowel is not obstructed, the lesion on the bowel will regress with complete removal of the ovarian tissue. But if partial or complete obstruction has already begun then castration alone is not sufficient and one must proceed with colostomy, segmental resection and anastomosis.

Finally, there are some implantation endometriomas other than those in abdominal scars or in the umbilicus which are more difficult to attack surgically. These are the implants which develop in the suture line of the vaginal vault subsequent to vaginal hysterectomy, those that occur in the scar of a repaired perineum and those beneath the bladder where a cystocele had been repaired. These lesions become very troublesome and produce marital disturbance to such a degree that excision of the lesions are necessary. Since these lesions do occur, they cause a simple dilatation and curettage to assume considerable importance if the patient is to undergo vaginal hysterectomy or vaginal repair or if both are to be carried out.

To summarize the surgical treatment of endometriosis briefly, one must conclude that it is much better from every point of view to delay surgical intervention in the disease as long as possible unless it is obvious that one is dealing with a malignant lesion or the uterine

and adnexa which in themselves require surgical treatment. Conservative operations for the relief of dysmenorrhea and menstrual disturbances and the correction of infertility should be undertaken only after careful consideration and a full discussion with the patient, her parents, or her husband, as the case may be. Radical surgical treatment is the most effective means and the end result will be a greater number of satisfied and cured patients.

Surgical procedures in the pelvis for endometriosis are always more difficult than the usual ones, because of the dense fibrous adhesions which it produces. Injury of the intestines, ureters, and bladder is to be avoided by the surgeon having a more complete acquaintance with the nature of endometriosis, and always keeping in mind that this is a specific example of one benign tissue invading another. Complete cure is effected by local excision of solitary lesions or castration in diffuse types.



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# THE RADICAL MASTOIDECTOMY

## Anatomical Considerations in Surgical Technique

J BROWN FARRIOR, M D , F A C S , Tampa, Florida

THE present day renaissance in otological surgery is, at a superficial glance, associated only with the endaural incision and the fenestration operation, technical procedures aided by the electrically driven burr and magnification. More careful study of the developmental period of this renaissance will reveal the evolution of sound clinical anatomical knowledge of the temporal bone, accurate to the finest microscopic detail. Attention to this anatomical detail is essential in all otological surgery.

According to Boies, the objective in the radical mastoidectomy is to remove the disease and, thus, the danger to life and to preserve as much hearing as possible. However, the patient will measure the results in terms of a dry ear.

The success of the radical mastoidectomy, as measured by a cured patient with a dry ear with maximum hearing, is dependent upon the minutely accurate surgical technique in the everturation of the disease and upon the meticulous postoperative care of the cavity. Toward this goal, I want to stress two anatomical considerations in the dissection of the middle ear, to outline the procedure of the radical mastoidectomy, and to advocate the primary skin graft as an aid in facilitating the accurate healing of the mastoid and middle ear cavities.

### ANATOMICAL CONSIDERATIONS

Among the many potential minute imperfections in the radical mastoidectomy, which may result in persistent suppuration, are residual foci of infection in the epitympanum, the hypotympanum, and the tympanum proper, including the eustachian tube orifice. In my opinion, the most frequent causes for this persistent suppuration are first, residual disease foci in the hypotympanum and, second, inac-

curate or officious surgery of the tympanic orifice of the eustachian tube. At the onset of this presentation, I want to describe the anatomy of the hypotympanum and the eustachian tube orifice.

*Hypotympanum* Anatomically, the hypotympanum is bounded externally by the rim of the annulus tympanicus and the infra-annular mass of bone which constitutes the floor of the external auditory canal. As illustrated in Figure 1, this infra-annular mass contains no important structures anterior to the facial nerve. The height of this external wall will vary with the depth and the cellular development of the hypotympanum. In the radical mastoidectomy, this infra-annular mass must be lowered to the level of the depth of the hypotympanum or there will result a hypotympanic pocket. Further, this infra-annular mass must be removed to complete the accurate dissection of the medial wall of the hypotympanum. On the medial wall of the hypotympanum (Fig. 2) are the jugular bulb posteriorly and the carotid artery anteriorly. Together, these structures form a V, in which rests the promontory of the cochlea.

The pneumatization of the hypotympanic cells is highly developed in the anthropoid apes and is rudimentary in man. Inferiorly, the hypotympanic cells are superficial and are easily evertuated after the removal of the infra-annular mass. Posteriorly, the hypotympanic cells may extend medial to the facial nerve and, as pointed out by Almour, are usually responsible for the retrofacial and infralabyrinthine cellular development. Medially, the hypotympanic cells may extend through the V formed by the carotid artery and jugular bulb to pneumatize the petrous apex. Anteriorly, the hypotympanic cells are continuous with the peritubal cells. In the radical mastoidectomy, these potential routes of cellular development must be explored, even though the mastoid, itself, is sclerotic.

From the Department of Otolaryngology, Tampa Municipal Hospital, Tampa, Florida.

Presented before the Clinical Congress, American College of Surgeons, Los Angeles, California, October 18 to 22, 1945.

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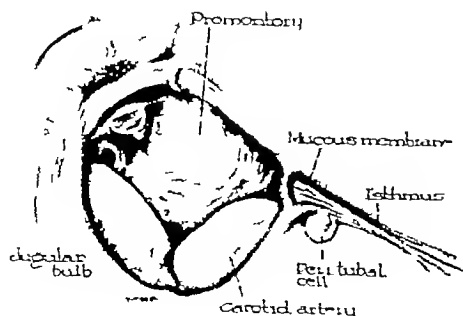


Fig 2 All accessible disease is removed from the hypotympanum and tympanic orifice of the eustachian tube. Within the eustachian tube, there will invariably remain mucous membrane granulations, and peritubal cells which will discharge into the nasopharynx if the isthmus is patent.

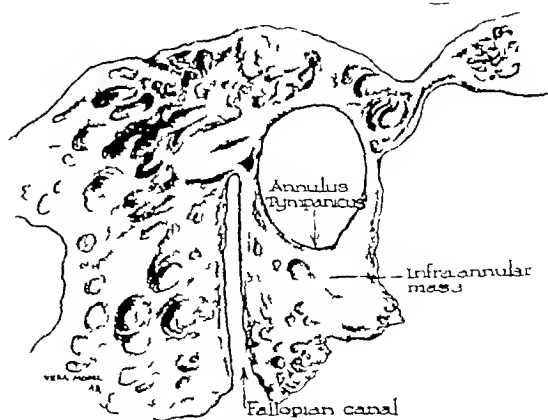


Fig 1 A sagittal section through the annulus tympanicus reveals the dense area of cancellous bone which forms the floor of the external auditory canal. This "infraannular mass" is the external boundary of the hypotympanum and must be lowered to the level of the depth of the hypotympanum to prevent a pocketing of hypotympanic discharge.

#### OPERATIVE PROCEDURE

The mastoid cortex is exposed through the incision of the operator's choice. It may be postauricular or endaural. The endaural approach is now generally preferred because of its simplicity, the direct avenue of approach to the antrum and middle ear, the minimal bleeding, the perfect orientation, the minimal trauma to the soft parts, the improved exposure of the tympanum, the absence of trauma to the cartilages, the free postoperative drain-

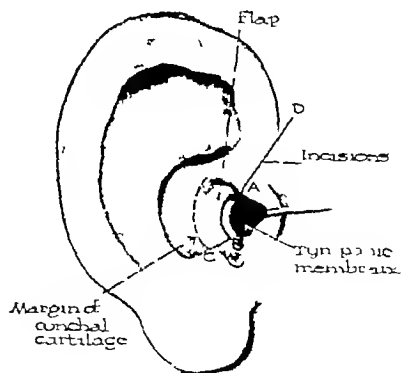


Fig 3 The endaural incision (as illustrated A, B, C, -A, D) preserves the skin of the canal, prevents stenosis of the canal, protects the margin of the conchal cartilage and aids in epithelization. The dotted line indicates the margin of the conchal cartilage, it is not an incision.

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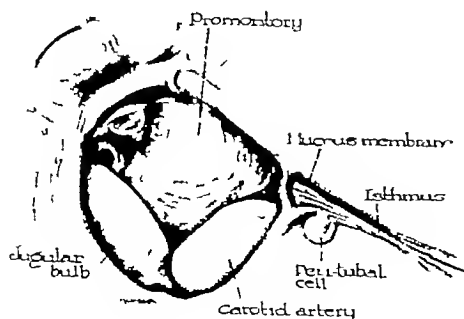


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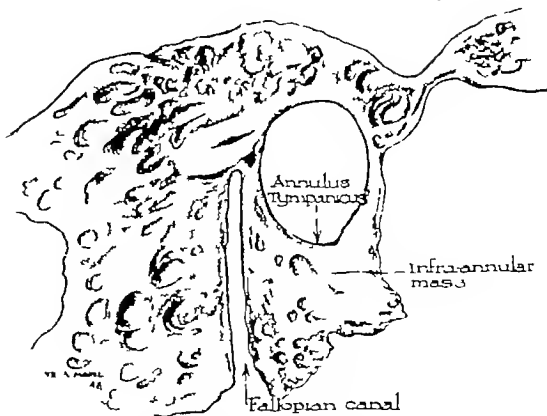


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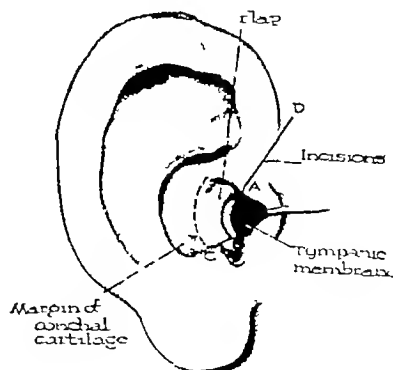


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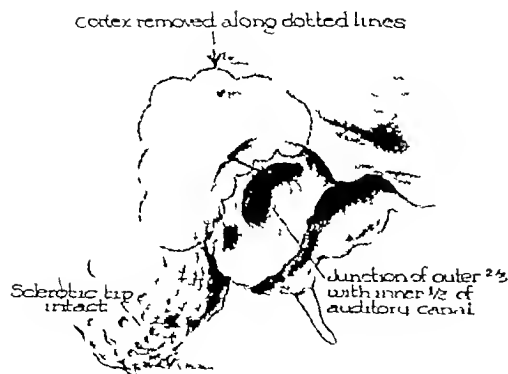


Fig 4 Direct approach to mastoid antrum, with simultaneous removal of cortex of outer two thirds of posterior superior bony walls of external auditory canal and neighboring mastoid cortex, performed with burrs or with gouge

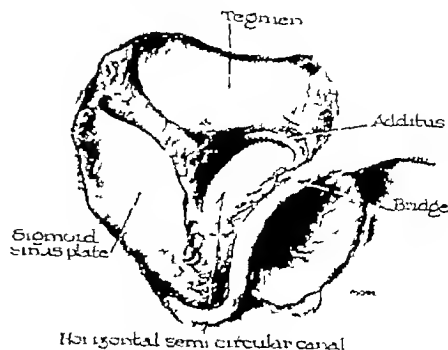


Fig 5 Demonstrates the internal landmarks of the sclerotic mastoid cavity, with the cortex removed. Note the relative superior position of the mastoid antrum to the external auditory canal

age, the ease of postoperative dressing, and the reduced period of hospitalization

Hoople, Lathrop, Tolan, and others have modified the Shambaugh (11) incision, preserving the skin of the canal and removing the subcutaneous mass of tissue and periosteum. I prefer this modified incision, believing that the preservation of the flap aids in preventing stenosis of the external auditory canal and facilitates the epithelization of the cavity.

The incision is begun at 12 o'clock, deep in the external auditory canal. At the same depth in the canal, the incision is carried from 12 o'clock around the posterior rim of the canal to 7 o'clock (right ear, 5 o'clock in left ear). The incision is then downward and outward to the rim of the cymba concha. The second incision begins at the original point, 12 o'clock, and is carried vertically upward through the periosteum to the rim of the temporal muscle and then superficial to the temporal muscle, between the helix and the tragus, as in the Lempert (7) incision. The skin and periosteum are then elevated from the cortex of the outer one-third of the bony wall of the external auditory canal and the mastoid. The pedicle, thus created, is grasped at its inner extremity with an Allis forceps and the epithelium elevated from the subcutaneous tissue. The subcutaneous tissue, excised along the margin of the conchal cartilage and the inferior border of the temporal muscle, is discarded. The epithelium preserved as a flap covers the rim of the conchal cartilage and pre-

vents stenosis of the auditory canal. This incision is little more than the endaural modification of the classic Koerner flap.

The inner one-third of the cutaneous lining of the external auditory canal is then reflected from the bony wall, the notch of Rivinus and the posterosuperior limit of the annulus tympanicus (as with the fenestration flap). In this way, the surgeon is immediately oriented as to the depth of the epitympanum, the annulus, and, thereby, the depth of the facial nerve.

*The mastoidectomy.* Regardless of the incision used, the mastoidectomy begins with the direct approach to the mastoid antrum. The cortex of the posterosuperior bony canal wall and the adjacent mastoid are removed simultaneously to gain direct access into the mastoid antrum (Fig 4). This bone may be removed with the electrically driven burr, as utilized by Lempert (6), or with the gouge and mallet. With this direct approach into the mastoid antrum (Fig 5), the operator is always oriented in relation to important internal landmarks, the rim of the annulus tympanicus identifies the depth of the vertical course of the facial nerve, and, immediately upon entering the antrum, the operator can identify the external surface of the horizontal semicircular canal. Thus oriented, the operator evertes all disease in the mastoid. The cortex is removed from the mastoid tip only to the extent which is necessary to uncover any tip cells or to bring the level of the inferior surface of the antrum down to the level of the

inferior surface of the external auditory canal Trautman's angle is explored, and all disease external to the superior semicircular canal removed. A sclerotic mastoid tip is not disturbed. In the usual chronic disease of the ear, this exteriorization and exploration of the antrum and periantral region constitute the limit of the mastoidectomy. If the medial surface of the antrum is found to be lined with the matrix of a cholesteatoma, this squamous epithelium is not disturbed.

This direct approach into the mastoid antrum discards the long taught technique of performing a simple mastoidectomy before beginning the removal of the bony wall of the auditory canal. It thereby minimizes the danger of injury to the sigmoid sinus. Further, with the immediate identification of the horizontal canal and antrum, the inexperienced operator is less likely to create a false antrum below the canal or transect the vertical course of the facial nerve. Figure 5, the drawing of specimen 2, illustrates the high position of the mastoid antrum relative to the auditory canal.

**Tympanectomy** The dissection of the tympanic cavity is divided into the dissection of the epitympanum, dissection of the hypotympanum, and the dissection of the tympanum proper, including the eustachian tube orifice. The dissection of the epitympanum is begun with the removal of its external wall. This simultaneous removal of the external wall of the epitympanum and thinning of the bridge will bring into view the incus and the head of the malleus. The incus or its remnants are removed at the earliest convenience. The external wall of the epitympanum is removed well anteriorly to exteriorize the anterior cul-de-sac of the epitympanum completely. The entire expanse of the bridge (the inner superior wall of the external auditory canal over the notch of Rivinus) is thus brought into view. The thinned arch of the bridge is removed with the Lempert rongeur (Fig 6), the initial bite being taken well anteriorly to avoid injury to the facial nerve. The posterior buttress of the bridge (Stacke's spine) is left in position until the final stages of the operation to protect the footplate of the stapes and the facial nerve. The anterior buttress of the bridge and the remaining external wall of the

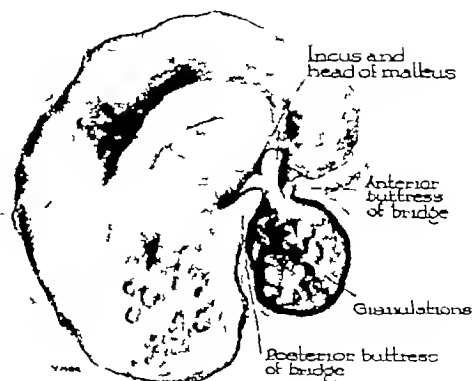


Fig 6 The epitympanic dissection begins with the removal of the external wall of the attic and the narrowing of the bridge. Here, the arch of the bridge has been removed. The anterior buttress of the bridge is next removed to permit the epitympanic dissection. The posterior buttress of the bridge is left in position until the final stages of the operation to protect the peristapedial area.

attic is now removed anteriorly to the plane of the anterior limit of the anterior wall of the external auditory canal (Fig 7). The malleus or its remnants are removed. The medial wall of the epitympanum is explored from behind, forward. With the face of a small mastoid curet directed medially, the mucous membrane is dissected off the ampulla of the horizontal semicircular canal, and this dissection is carried downward and forward off the ampulla to identify the cochleariform process of the tensor tympani muscle. From this point, the dissection is then carried downward and backward, and the entire intratympanic course of the facial nerve delineated (Fig 7). The nerve, so identified, may be avoided. With the intratympanic course of the facial nerve identified, all remaining disease in the epitympanum is exenterated.

**Dissection of the hypotympanum** Dissection of the hypotympanum requires an additional incision, the removal of the annulus and the infra-annular mass, and the exenteration of the hypotympanic disease. With an angulated canal knife, an incision is made through the skin and periosteum, 5 millimeters external and parallel to the annulus tympanicus, in a manner similar to the Lempert (8) incision for the tympanosympathectomy. This 5 millimeters of epithelium and the remaining fibro-



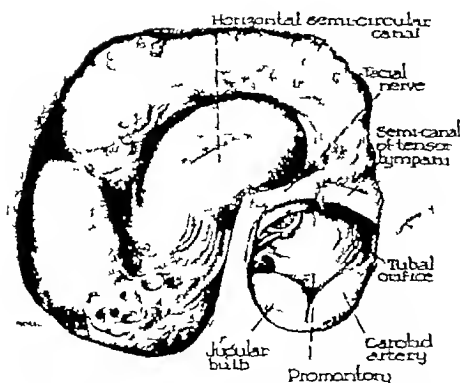


Fig 7 The completed radical mastoidectomy reveals the exenteration of all disease in the tympanic and mastoid cavity, with delineation of all the internal landmarks of the middle ear and mastoid

cartilaginous ring of the annulus tympanicus are then dissected free to permit direct visualization of the annulus. The remaining inner cutaneous lining of the auditory canal, the free fibrocartilaginous ring of the annulus, the remnants of the tympanic membrane, and the free excess of granulations are then removed from the tympanic cavity. Before the detailed dissection is continued, a pledget of epinephrine is placed in the tympanic cavity to secure hemostasis, this procedure may be repeated from time to time to permit accurate visualization. When a dry field has been obtained, the inferior portion of the annulus tympanicus and the underlying infra-annular mass of bone (Fig 1) are removed to the level of the floor of the hypotympanum with the large polishing burr. The polishing burr is preferred, as it is easily controlled and is less likely to engage any fragments of tissue. The burr should rotate in an anterior direction (clockwise in the right ear and counterclockwise in the left ear) to avoid running in the direction of the stapes. With the hypotympanum thus exteriorized, the mucous membrane and granulation tissue is dissected from below, upward, off the medial wall of the hypotympanum, delineating the jugular bulb posteriorly and the carotid artery anteriorly (Fig 2). The potential routes of cellular extension are explored, and infection removed. The end result is a wide open hypotympanum with all accessible disease removed.

*Dissection of the tympanic cavity and eustachian tube* The dissection of the tympanum proper is begun with the removal of infected tissue from the promontory. This is carried forward to exenterate the disease in the eustachian tube orifice and, finally, posteriorly to the peristapedial area.

The exenteration of the tympanic disease is begun at the cochleariform process. As the dissection is carried anterior to the cochleariform process, the mucous membrane and granulation tissue are elevated from the external and inferior surfaces of the semicircular of the tensor tympani muscle (Fig 7). The dissection is carried downward, off the anterior surface of the promontory and then anteriorly, well into the orifice of the eustachian tube. Then, as the dissection is continued upward from the hypotympanum, the mucous membrane, granulations, and the tympanic plexus are elevated from the promontory of the cochlea and, again, the dissection carried well forward into the orifice of the eustachian tube. The resultant aggregation of tissue in the orifice of the eustachian tube is grasped with the aural biting forceps and avulsed from the depth of the tubal orifice. All accessible disease is then removed from the eustachian tube orifice with a small mastoid curet and aural biting forceps. The dissection is carried well into the eustachian tube, however, no attempt is made to produce a stenosis at the isthmus. Nor is an unaffected tensor tympani muscle ever disturbed.

Throughout the operation, the peristapedial area has been protected by a relatively high facial ridge and by the posterior buttress of the bridge (Stacke's spine). The facial ridge (posterior bony wall of the external auditory canal) is now lowered to the external surface of the horizontal semicircular canal (Fig 7). In the performance of this maneuver of lowering the facial ridge, the burr should rotate in a posterior direction (counterclockwise in the right ear, clockwise in the left ear) so that the burr will never run into the middle ear to produce irreparable damage. The lowering of the facial ridge will thin the posterior buttress of the bridge from without, inward, to the point of spontaneous fracture. The final removal of the posterior buttress exposes the peristapedial

area Infected granulation tissue around the stapes and the oval window is removed, the dissection always being from posteriorly, anteriorly, in the long axis of the footplate of the stapes to obtain maximum utilization of the fixing or guy-wire effect of the stapedius muscle (Fig 7) Any infected granulation tissue is removed from area of round window

This minute dissection of the peristapedial area is carried out only when this area is involved with infected granulation tissue If the peristapedial area is lined with a relatively healthy mucous membrane or with the lining matrix of a cholesteatoma, this thin epithelium is always preserved The preservation of such epithelium will result in minimum postoperative scarring in the peristapedial area and maximum postoperative mobility of the footplate of the stapes As Meltzer and Baron have pointed out, the preservation of such epithelium will result in maximal postoperative preservation of hearing

*Summary of radical mastoid technique* The end result of the tympanomastoid dissection should be a perfectly dry cavity with no remaining granulation tissue Posteriorly, the mastoid antrum and air cells have been explored and all disease exenterated The cortex of the mastoid tip has been lowered to the level of the floor of the external auditory canal or to the inferior limit of the residual mastoid tip cells The sclerotic portion of the mastoid tip has not been disturbed Superiorly, the overhanging mastoid cortex has been removed to the level of the tegmen of the middle cranial fossa Anteriorly, the external wall of the attic and the bridge have been removed to the anterior limit of the anterior cul-de-sac of the epitympanum Inferiorly, the floor of the bony wall of the external auditory canal (the infra-annular mass) is lowered to the depth of the hypotympanic cells Medially, the facial ridge (the posterior bony wall of the external auditory canal) has been lowered to the level of the external surface of the horizontal semicircular canal With the tympanic cavity thus exteriorized, all granulation tissue and disease have been removed from the tympanic cavity and eustachian tube orifice The exteriorized mastoid cavity and middle ear will then receive a primary skin graft

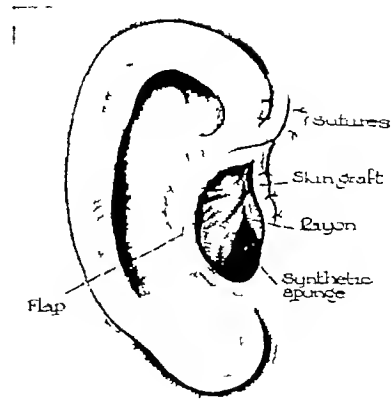


Fig 8 The entire radical mastoid cavity has been lined with the primary skin graft. The skin flap is turned over the margin of the conchal cartilage The upper two-thirds of the vertical incision is closed with two vertical mattress sutures The skin graft is sutured to the anterior margin of the lower one third of the vertical incision The skin graft and rayon are held in position with synthetic sponge packing

#### PRIMARY SKIN GRAFT

The meticulous postoperative care of the radical mastoidectomy is as essential to a good result as is the accurate and thorough exenteration of disease The goal of this postoperative care is to secure a healed radical mastoid cavity which resembles in shape the postoperative bony cavity and is covered with the thinnest possible epithelium, particularly in the region of the oval and round windows The primary skin graft is an aid in attaining this goal, through more rapid healing, reducing the possibility of annoying granulation tissue and stenosis of the cavity, and, in reducing the postoperative cicatrization in the peristapedial area

The skin graft is taken prior to the mastoidectomy to avoid contamination of the donor site and the necessity of a second sterile operative setup During mastoidectomy, the skin is preserved in normal saline and, at completion of the mastoidectomy, strips of skin are cut in a pattern to dress the operative cavity

*Instruments* The instruments for obtaining a good otological skin graft consist of the Weck razor and an appropriately shaped skin traction block The Weck razor is preferred to any other type of dermatome or skin graft knife because of the sharp, expendable blades Skin traction blocks are notched to the width of the

blade to provide an elevated flat donor site with depression of the adjacent skin

*Technique* After being surgically prepared, the donor site is thoroughly greased with sterile vaseline. The right skin traction block is held in fixed position by the assistant, the left skin traction block is held in the operator's left hand with the blade flat against the donor site. The operator follows the progress of the left skin traction block with gentle to and fro movements, adjusting the thickness of the skin to his individual preference. Eliminating all cumbersome equipment, this simple technique provides a thoroughly adequate otological skin graft.

*Application* When the mastoidectomy is nearing completion, the surgical nurse spreads the skin on wet surgical rayon, with the cut surface up. The skin and the rayon are then cut to a pattern to fit the mastoid cavity. The rayon backing makes the skin more manageable. It is my practice to cut three strips (A, B, and C) to be applied to the cavity. Section A covers the medial wall of the tympanum, the hypotympanum, and the denuded auditory canal. Section B covers the facial ridge, the medial wall of the antrum, and the sigmoid sinus plate. Section C covers the epitympanum, the tegmen, the temporal muscle, and the lower one-third of the vertical incision. As each section is placed over its individual area, it is anchored in position with a small pledget of synthetic sponge and the long free end of the rayon is brought out of the auditory canal to provide further fixation. The thinnest available portion of the skin is selected to line the medial wall of the tympanum. Its free border is placed adjacent to, but never over, the oval and round window. This free border of skin provides an island from which the thinnest possible layer of epithelium can grow to cover the oval and round windows. The incision is closed as illustrated in Figure 8.

*Postoperative care* The synthetic sponge and rayon are removed at the end of the first postoperative week. The cavity may then be treated as the surgeon desires, I prefer repacking at weekly intervals for 3 weeks. One-half inch gauze, soaked in furacin, is used for packing. The bacteriostatic action of the furacin will usually permit the packing to remain in

position for 7 days. The epithelial debris may be wiped away at the end of the second, third, and fourth postoperative weeks. If the cavity has been well lined with skin, epithelization will be nearly complete at the end of the fourth postoperative week. Thereafter, one may adopt dusting powder, gentian violet, or drops until healing is complete.

#### COMMENT

The success of the radical mastoidectomy is dependent upon the minutely accurate enteration of the tympanic and mastoid disease and upon meticulous postoperative care of the radical mastoid cavity. The completed radical mastoidectomy should consist of the exteriorization of all pockets of infection and the enteration of all accessible disease. The postoperative care of the radical mastoidectomy is greatly facilitated by the primary skin graft.

#### SUMMARY

1 Sound anatomical knowledge has been the basis for the present renaissance in otological surgery.

2 The minute anatomy of the hypotympanum, the eustachian tube and tympanic cavity have been reviewed in reference to the radical mastoidectomy.

3 The technique of the radical mastoidectomy has been outlined.

4 The primary skin graft is advocated to facilitate complete postoperative healing of the radical mastoid cavity.

5 The technique of skin grafting is outlined.

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# THE SUCTION SOCKET FOR ABOVE-KNEE AMPUTEES

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THE suction socket prosthesis for above-knee amputation eliminates pelvic band and shoulder harness. The special construction and fitting cause it to be held on to the stump by a moderate amount of suction. The authors have had an opportunity to observe the fitting and use of more than 60 suction socket prostheses during the training and experimental programs of The Committee on Artificial Limbs of the National Research Council and Veterans Administration, plus observations on private patients.

Observations indicate that the suction socket compared to the conventional leg is less cumbersome, allows a greater range of mobility, feels more like an integral part of the patient, and offers less interference with clothing.

In 1863 Parmelee of New York obtained the first known patent on the suction socket. Subsequent patents were issued to Beacock and Sparham of Ontario, Canada, in 1885, to Toles of Stockton, California, in 1911, and to Underwood of Birmingham, England, in 1926.

Following the first World War, several groups in England employed the suction socket with variable results. However, use of the suction socket in England has been dormant for a number of years but has been revived recently. In Germany the suction socket was made and used to some extent following World War I, but it was not popularized until a satisfactory valve was devised in 1932. Since that time, and especially during the recent war, it has been used for many above-knee amputations.

The Surgeon General of the United States Army sent a commission to Europe in 1946 to study the various aspects of amputations and prostheses. The recommendations of this

commission<sup>1</sup> were acted upon by the Advisory Commission on Artificial Limbs of the National Research Council, which instituted in this country a program, in collaboration with the Veterans Administration, to investigate the use and development of the suction socket.

A national suction socket training program for training of surgeons and limb fitters was implemented by the Committee on Artificial Limbs of the National Research Council and the Veterans Administration. The initial school was held at the University of California, Berkeley, California, November 19, 20, 21, 1947, under the direction of Professor Howard D. Eberhard and Doctor Verne T. Inman. Subsequently, schools were held at various centers throughout the country under the auspices of the Veterans Administration and the Orthopedic Appliance and Limb Manufacturers Association. Completion of the specified work offered in these schools resulted in the certification by the Veterans Administration and the Orthopedic Appliance and Limb Manufacturers Association of surgeons as qualified under the Veterans Administration Experimental Suction Socket Program, and certification of limb fitters for the manufacturing and fitting of suction sockets under the same program.

The Veterans Administration and various certified limb fitters are now conducting a continuing experimental suction socket program. Under it carefully selected and supervised patients at several centers have been, and are being, furnished suction sockets. These patients are studied and followed carefully.

<sup>1</sup>The Commission was composed of the following:  
Colonel Leonard T. Peterson, MC, Chief of Amputation and Prostheses Unit, Surgeon General's Office.  
Doctor Paul E. Klopsteg, Chairman, Committee on Prosthetic Devices, National Research Council.  
Lt. Colonel Rufus Alldredge, MC, Chief of Amputation Section, England General Hospital, Atlantic City, New Jersey.  
Mr. Edmond M. Wagner, Executive Assistant, Committee on Prosthetic Devices, National Research Council.  
Lt. Colonel Robert J. F. Lewis, Ordnance, Amputation and Prostheses Unit, Surgeon General's Office.  
S/Sgt. John Paul Gavell, Recorder.

From the Orthopaedic Service, U. S. Veterans Hospital (Wadsworth General Hospital), Los Angeles, California, and U. S. Veterans Administration Regional Office, Prosthetic Division, Los Angeles, California.

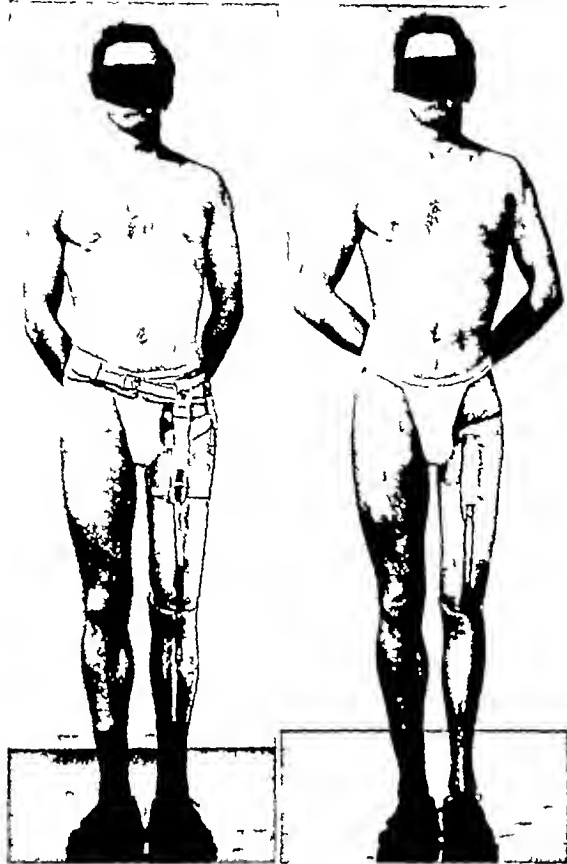


Fig 1 a, left Conventional type prosthesis with pelvic band b, Same patient with suction socket prosthesis

As a result of this program, some alterations of the suction socket have already been found advisable and others are being studied

The characteristic features of the suction socket are

1 Pelvic bands and shoulder harness are eliminated (Fig 1)

2 The muscles of the stump control all movements

3 The socket is held on by a moderate negative pressure, which requires an accurate and snug fit, but without undue pressure

4 Stump socks are eliminated

5 Body weight is taken mainly on the ischial tuberosity. Some side bearing appears to be advantageous. In a few instances partial end bearing is tolerated

6 The socket is applied by using a thin sock on the stump. This is pulled off and out through the valve opening at the distal end

which pulls the stump into the socket. Body weight is then applied and the valve is screwed in, and the socket thus sealed

Instruction in proper walking, muscle control, and posture are important to eliminate or reduce limp, unsightly gait, and lordosis

The indication for a suction socket leg is a good thigh stump. The minimal length of stump is considered to be  $4\frac{1}{2}$  to 5 inches measured from the adductor tubercle to bone end. Shorter stumps require a pelvic band or shoulder strap

The main contraindications are

1 Large scars which are either painful or adherent over a prominent end. Extensive scars which are located at upper end of socket may cause loss of suction. These conditions however can be corrected surgically

2 Osteomyelitis, unless it has been definitely arrested

3 Large tender bony spurs. These, however, can be eliminated surgically

4 Extensive skin disease. A dermatologist, however, can correct many of these conditions

5 Capillary fragility and purpura conditions, characterized by persons who bruise easily have been considered as contraindications but recently patients have been fitted successfully

6 Unco-operative or mentally deficient patients

Peripheral vascular disease has been considered a contraindication, but a few cases of Buerger's disease in younger individuals have been successfully fitted

Bilateral above-knee amputees have been fitted satisfactorily with suction sockets, although one in the authors' series has not been successful as the patient is unable to put on the prostheses without aid

The construction of the socket is from pre cut patterns. Willow wood is considered to be the most adaptable material for making the socket, as it can be reshaped easily to changing size of the stump. The socket can be made smaller by the addition of a liner or enlarged by cutting out. Plastic material should not be used for the initial construction, but may be used later when the person becomes expert with the suction socket and the stump has stabilized in size

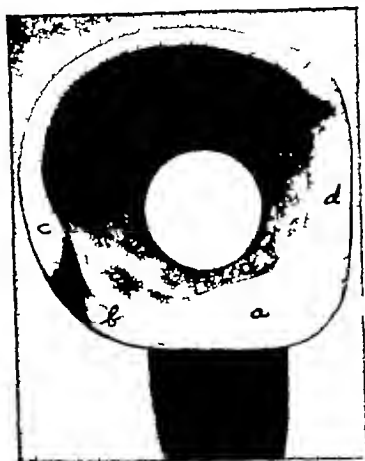


Fig 2 Top view of suction socket prosthesis, a, ischial seat, b, gluteal channel, c, protuberance behind trochanter, d, adductor channel, e, valve opening

The following points of construction are emphasized (Figs 2 and 3)

1 Medially a channel is cut out for the adductor muscles. The height is determined by individual variations and comfort, being approximately the same as the ischial seat.

2 Anteriorly, the fit is snug but not tight enough to cause compression on the femoral vessels. If too high it causes pressure in sitting. The upper and inner portion of the socket is often slightly undercut approximately  $\frac{1}{2}$  inch below the top with a long taper in order to hold suction.

3 Laterally, the socket is made higher, almost to the tip of the trochanter. If too high it tends to obstruct abduction. A protuberance is left immediately in back of the trochanter which is of great benefit in assisting with rotation and stability.

4 Posteriorly, a cut-out is made for the gluteus maximus. The ischial seat is of utmost importance and specific details, such as height, size, shape, and incline, must be carefully individualized.

5 One or 2 inches of free space in the socket at the end of the stump is desirable to allow for installation of the valve.

6 A screw-type automatic expulsion valve, allowing a small exchange of air, is now generally used. It is placed at the distal end of the socket and preferably not in contact with the skin. It should be in an acces-



Fig 3 Side view of suction socket prosthesis, a, ischial seat, b, gluteal channel, c, protuberance behind trochanter, d, adductor channel, e, valve opening

sible place for the patient to remove the thin sock in pulling the stump into the socket, as well as for manual control of the valve. A negative pressure of  $1\frac{1}{2}$  pounds per square inch during the swing phase of walking and  $\frac{1}{2}$  pound of positive pressure during the stance phase are considered sufficient. Greater pressures are in general undesirable and can be regulated by valve corrections.

7 Several different types of finish have been used but in general cellulose acetate has been most satisfactory.

Mistakes in construction which must be avoided are:

1 An ischial seat which is either too high or too deep, or prolonged too far medially causing adductor constriction and pressure on ramus. An ischial seat having too much undercut causing stretching of skin over its sharp border and pressure on sitting.

2 The gluteal channel cut too narrow causing undue pressure.

3 Too tight a fit, anteriorly, causing pressure on femoral vessels with subsequent edema of stump, and interference with flexion.

4 A socket cut too high or narrow medially causing adductor pressure.

5 A socket cut too high laterally limiting abduction

6 Too much vacuum, or negative pressure  
Complications, if present, generally arise because of improper selection of cases and inadequate attention to details of construction. Pressure spots can generally be relieved by minor reshaping. Edema, which is not an uncommon complication, is usually due to either too much negative pressure or excessive pressure over the femoral vessels anteriorly or an extremely tight fit of the stump. Either can, as a rule, be corrected easily. Excessive perspiration may occur. A small amount of silica gel placed in the bottom of the socket usually will control this.

Ischial irritation has been the most troublesome feature of the suction socket. Careful fitting and reshaping as well as perseverance on the part of the patient are necessary to overcome this.

It has been noted that during the early stages of wearing a suction socket shrinkage of the stump is apt to occur. This is frequently followed by hypertrophy. One wearer has

increased his stump circumference  $5\frac{1}{2}$  inches, and is wearing his seventh socket. Hypertrophy apparently occurs in the muscular tissues from their active use in control of the prosthesis.

Success of the suction socket depends largely on the whole-hearted co-operation of the surgeon, patient, and limb fitter, with frequent consultations during fitting, and as needed whenever difficulties arise.

#### SUMMARY AND CONCLUSIONS

The suction socket prosthesis has by accumulated evidence, both in this country and abroad, proved to be most satisfactory in the majority of selected cases of above-knee amputation. The most important features are the following:

- 1 Elimination of pelvic bands and shoulder harness
- 2 Easier control of prosthesis and greater ranges of motion
- 3 A feeling that the prosthesis is an integral part of the wearer
- 4 Less interference with clothing

# THE EFFECT OF MODERATE DEGREES OF DICUMAROL-INDUCED HYPOPROTHROMBINEMIA ON EXPERIMENTAL INTRAVASCULAR THROMBOSIS

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THE drug dicumarol is being used extensively in attempts to prevent or inhibit intravascular thrombosis. Surgeons have employed it as a prophylactic measure against postoperative thrombosis and embolism, as a therapeutic agent in established deep phlebitis of the lower extremities and more rarely as an adjunct in certain operations on blood vessels. Internists have been particularly interested in its possible effect on the incidence of thromboembolic complications in acute myocardial infarction.

There is no doubt that dicumarol exerts a powerful effect on the coagulation mechanism if it is given in sufficient quantities to produce a marked depression of the prothrombin level. In an early experimental study, Dale and Jaques demonstrated a reduced incidence of thrombosis in the traumatized veins of dicumarolized dogs. However, it is little wonder that clotting was inhibited because so much dicumarol was administered (10 mgm per kilogram) that the prothrombin time was above 100 seconds at the time of the test in all of the animals, and it frequently exceeded 200 seconds, indicating prothrombin percentages well below 1 per cent.

In like manner, in the study of Richards and Cortell, extreme degrees of hypoprothrombinemia were produced in a small series of dogs. The prothrombin times of their 4 dogs varied from 171 to 491 seconds, the injection of monolate solution into veins produced less thrombosis than in the controls, but all of the animals subsequently died of hemorrhage.

Thill, Stafford, Spooner and, Meyer produced experimental thrombosis by injecting 0.25 cubic centimeter of monolate solution into the radial veins of dogs. Fifteen animals were given a single dose of dicumarol, 5 milligrams per kilogram and 2 days later, the sclerosing solution was injected. At this time, the prothrombin time varied from 5 to 46.5 seconds (median 18.5 seconds). About a week later, the veins were removed for histologic study. Only 2 veins (6.6 per cent) showed definite thrombosis as compared with an incidence of 50 per cent thrombosis in the controls. No excessive bleeding was encountered at the operation and no postoperative hemorrhage was noted. Hence, they were able to conclude that a definite reduction in the incidence of thrombus formation was noted in dogs previously treated with dicumarol in a dosage equivalent to a therapeutic and safe quantity commonly administered to human beings. Their data could be assumed to provide at least a partial answer to the question which is posed by the title to this communication.

Kieswetter and Shumacker carried out a study of the comparative efficacy of heparin and dicumarol in the prevention of experimental arterial and venous thrombosis. The arteries were traumatized by a deliberately careless suture of incisions into the vessels, the veins were injected with sodium morrhuate. In their control group of 9 animals, thrombosis was present in 92.9 per cent of the femoral arteries, 66.7 per cent of the carotid arteries, and 85.2 per cent of the veins. With heparin administration, they reduced these percentages to 6.7 per cent, 9.5 per cent, and 56.3 per cent respectively. In 10 animals treated with dicumarol before and after operation (prothrombin levels kept below 30 per

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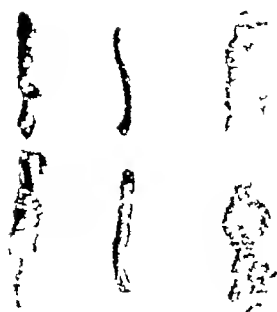


Fig 1 Veins removed from 2 animals 2 days after trauma. The radial veins (on left) are thrombosed, the long saphenous veins (middle) are thrombosed, and the short saphenous veins (right) are free of thrombosis, although it is obvious that the intima has been damaged

cent of normal), thrombosis occurred in 50 per cent of the femoral arteries, 15.8 per cent of the carotid arteries and 41.4 per cent of the veins

This inhibition of thrombosis had its price in the form of hemorrhagic complications, however. Of 35 animals treated with heparin, 25 or 71.4 per cent had subcutaneous hemorrhage, there were 19 large hematomas. Nine animals (25 per cent) actually died of hemorrhage. Of 25 dogs treated with dicumarol, 11 or 44 per cent bled subcutaneously. There were 5 large hematomas and 3 deaths from hemorrhage. It is doubtful if a clinical surgeon would be willing to contend with such a complication and mortality rate in order to obtain the possible beneficial anticoagulant effect of either drug.

Most of those who have recommended the use of dicumarol clinically have indicated that they are satisfied with very conservative doses of the drug, so that hemorrhagic complications are minimized. Peters, Guyther, and Brambel tried to keep the prothrombin level in their 50 cases of coronary occlusion between 35 and 50 per cent of normal. Glueck, Strauss, Pearson, and McGuire preferred a level between 20 and 30 per cent. The American Heart Association is carrying out a controlled clinical study of the use of dicumarol in acute myocardial infarction. The instructions to co-operating clinics state that the administration of dicumarol should be discontinued if the prothrombin time goes to

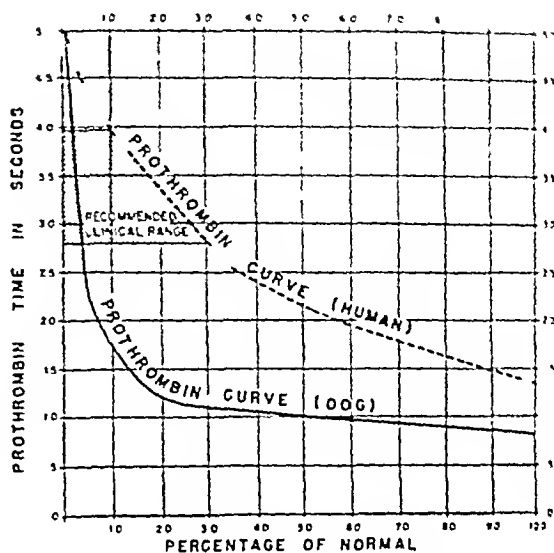


Fig 2 Empiric curves used to convert Quick prothrombin time values to percentage values

35 seconds. This would represent about 20 per cent of normal. Preliminary reports from this study (exhibit at American Medical Association, 1948) indicate that the drug has a valuable effect in preventing thromboembolic complications. However, in this connection it must be mentioned that at least one clinician (2) prefers that his patients with acute coronary occlusion have a normal prothrombin level, and he administers vitamin K therapy to this end.

The present study was undertaken to study the effect on experimental intravascular thrombosis if dicumarol is administered so as to produce an effect comparable to that commonly sought in human cases, i.e., so that the prothrombin level is in the range of 10 to 30 per cent of normal.

It was elected to use traumatized veins as the experimental lesion to produce thrombosis. The technique was identical with that used by Murray, Jaques Perrett, and Best in their investigation of the effect of heparin. The dogs were anesthetized with intravenous nembutal. A surgical incision was made parallel to but a short distance away from, the vein to be tested. A round curved needle bearing a heavy silk thread was passed into the lumen of the vein for a distance of 2½ centimeter and then out again. The length of vessel con-

TABLE I—RESULTS IN GROUP I

Dog No	Daily* prothrombin times in seconds			Daily prothrombin percentages			Daily coagulation times in minutes			Thrombosis in veins			Hematomas
										Radial	Long saph	Short saph	
40	10 5	10	14	40	50	14	9	8	7	+	+	+	0
41	12	17 5	17 5	19	4 5	4 5	9 5	7 5	9 5	+	+	+	0
43	9 5	25	17	75	3	5	9 5	14	7 5	+	—	—	0
44	11	10 5	9 5	25	40	75	4 5	9	7 5	+	+	+	0
46	15	9 5	7 5	6 5	75	100	5 5	3 5	9 5	+	+	—	0
49	12	9 5	10	19	75	50	9	3 5	6 5	+	+	+	0
52	12 5	8 5	8 5	18	100	100	9	9 5	6	—	+	+	0
53	12	13	8 5	19	15	100	5 5	8 5	9 5	+	+	+	0
55	9 5	9	8	75	82	100	6 5	4 5	8	—	+	—	0
36	12	26 5	12 5	19	3	15	10	12	8	—	+	—	0
Total 10 dogs 30 veins							Total thrombosis			7	9	6	0

Total 22 (70%)

\*Day of trauma and next 2 days

TABLE II—RESULTS IN GROUP II

Dog No	Daily prothrombin times in seconds			Daily prothrombin percentages			Daily coagulation times in minutes			Thrombosis in veins			Hematomas
										Radial	Long saph	Short saph	
6	22	29	24	5	3 5	4	10	12	8	+	+	+	0
8	23 5	12 5	18	3	19	4 5	13	15	22	+	+	+	0
11	27	24	32	4	4	3	18	24	18	+	+	—	+
31	25	41	23	3	2	3	14 5	18	18 5	+	—	+	+
32	21	21	15	3	3	6 5	14 5	14	5	+	+	—	+
33	23	21 5	23 5	3	3	3	10	9	12 5	—	+	+	0
35	19	16 5	22 5	4	5 5	3	3	13 5	9 5	+	+	—	0
36	16 5	18	10	5 5	4 5	50	5	11 5	10 5	—	+	—	0
38	16	25 5	11	6	3	25	14	10 5	13 5	—	+	—	0
50	16 5	14 5	8 5	5 5	5 5	100	9	8	7	+	+	+	0
Total 10 dogs 30 veins							Total thrombosis			7	9	5	3 (30%)

Total 21 (70%)

taining the suture was then crushed with an artery forceps in three planes. Reasonably uniform trauma to the intima was assumed since the same clamp was used throughout the study and it was always clamped to the first notch. After the crushing, the silk was withdrawn from the vein. Bleeding from the holes made by the needle was negligible. Two days later, the incisions were opened and the veins were inspected for evidence of thrombosis. Patency was determined by cutting across the vein proximal to the crushed area, after which the entire segment was resected and opened (Fig 1).

Six veins on each animal were used. These were the radial, long, and short saphenous veins on the two sides. For the control series, the three veins on the animals' right were traumatized. This series comprised 41 animals or a total of 123 veins. The radial vein was found to be thrombosed 29 times, the long saphenous 37 times, and the short saphenous 31 times. Thus, 97 out of 123 veins were thrombosed, an incidence of 78.8 per cent.

Numerous determinations of prothrombin levels as well as coagulation times were carried out before and during dicumarol administra-

TABLE III—RESULTS IN GROUP III

Dog No	Daily prothrombin times in seconds			Daily prothrombin percentages			Daily coagulation times in minutes			Thrombosis in veins			Hematomas
										Radial	Long saph	Short saph	
7	36.5	47	19	2.5	1.5	4	28	29	18	+	—	+	2
99	32	44	27	3	2	4	22	33	32	—	+	—	1
12	30	38	47	2.5	2.5	2	14.5	16.5	20	—	—	—	1
13	32	45	22	3	2	5	20.5	22.5	17	—	—	—	1
14	38	39	39	2.5	2.5	2.5	16	11	22.5	—	—	—	1
15*	38	95	—	2.5	0.5	—	22	24	—	—	—	—	1
16	32	38	28	2.5	2.5	3	16.5	16	19	—	—	—	1
25	36	37	18.5	2.5	1.5	9.5	12	14	12	—	—	+	2
26*	32	79	—	3	0.5	—	15	20	—	—	—	—	1
27	33	40	61	3	2	1	∞	19	25	—	—	—	2
Total 10 dogs 30 veins							Total thrombosis			1	1	2	13 (100%)

Total 4 (13.3%)

\*Animal expired of hemorrhage.

TABLE IV—RESULTS IN GROUP IV

Dog No	Daily prothrombin times in seconds			Daily prothrombin percentages			Daily coagulation times in minutes			Thrombosis in veins			Hematomas
										Radial	Long saph.	Short saph	
1	69	104	80	<1	<1	<1	7	12	19	—	—	—	3
2	110	174	169	<1	<1	<1	8	23	40	—	—	—	3
3	144	105	80	<1	<1	<1	13	13	25	—	—	—	3
4	105	115	72	<1	<1	<1	13	11	14	—	—	—	3
5	77	100	38	<1	<1	2.5	24	40	12	—	+	—	1
10*	50	110	—	1.5	<1	—	29	—	—	—	+	—	3
Total 6 dogs 18 veins							Total thrombosis			0	2	0	16 (100%)

Total 2 (11.1%)

\*Animal expired of hemorrhage.

tion The prothrombin method was that of Quick, using a commercial preparation of thromboplastin. For the conversion of time values to percentage values, empiric curves were constructed from the prothrombin time values obtained from testing known dilutions of dog plasma (Fig. 2). Several batches of thromboplastin gave normal prothrombin time values varying from 7.5 seconds to 10.5 seconds. The same thromboplastins gave values on human plasma varying from 13 seconds to 17 seconds. The coagulation time of the blood was determined by a modification of the Lee and White method. Several cubic centimeters of blood were placed in 3 Wassermann tubes. One of the tubes was inverted at 30 second intervals until the clot retained its position in the bottom of the tube, after

which the second tube and, finally, the third tube were inverted until clotting was seen to take place.

Following the control study, dicumarol was administered by mouth (mixed in meat) until the desired prothrombin level was obtained, after which the three veins on the animal's left were traumatized and examined 2 days later. An effort was made to keep the prothrombin level stable during the experimental period by feeding small maintenance doses of dicumarol.

A protocol of a typical animal experiment follows.

*Protocol.* Dog No. 8. Weight 12 kilograms. November 24, 1947. Prothrombin time 9.5 seconds (60 per cent). Coagulation time, 5 minutes. Radial, long and short saphenous veins on right traumatized.

November 26 Prothrombin time 9 seconds (80 per cent) Coagulation time 9 minutes Investigation of previously traumatized veins revealed thrombosis of the radial and short saphenous veins, patency of the long saphenous vein

November 28 Dicumarol 50 milligrams

November 29 Dicumarol 25 milligrams

November 30 Dicumarol 12.5 milligrams

December 1 Prothrombin time 23.5 seconds (3 per cent) Coagulation time 13 minutes Three veins on left traumatized Dicumarol 12.5 milligrams

December 2 Prothrombin time 12.5 seconds (19 per cent) Coagulation time 15 minutes

December 3 Prothrombin time 18 seconds (4.5 per cent) Coagulation time 22 minutes Examination of traumatized veins on left showed thrombosis in all three No ecchymosis nor hematoma present Animal discarded

The experiment was completed on 36 dicumarolized dogs. These animals could be divided into four groups. Group I (10 animals) with veins traumatized when the prothrombin time was in the range of 9 to 15 seconds (57 per cent down to 6.5 per cent), Group II (10 animals) with the veins traumatized when the prothrombin time was between 16 and 28 seconds (from 6 per cent down to 3 per cent), Group III (10 animals) with a prothrombin time range of 28 to 39 seconds (3 per cent down to 2 per cent) and Group IV (6 animals), with prothrombin times above 40 seconds (percentage under 2 per cent). The significant data with regard to these four groups are shown in the corresponding tables (Tables I-IV). For purposes of brevity, the prothrombin values and the coagulation times are indicated for the 3 significant days of the experiment, namely, the day of trauma to veins, the intervening day, and the day of examination of veins for thrombosis.

#### COMMENT

In Table I, it will be noted that in this group of animals, a minimal dicumarol effect was produced. Nevertheless, in 7 of the 10 animals, the prothrombin percentage was below 30 on the day the veins were traumatized. Sometimes the prothrombin level was higher on the following days, sometimes it was lower. The coagulation times were within normal limits. Seventy per cent of the veins were thrombosed, only slightly below the 78.8 per cent found in the controls.

TABLE V—SUMMARY OF RESULTS

Group No	Prothrombin time range seconds	Prothrombin percentage range per cent	Number of veins	Per cent thrombosis	Per cent animals with hematoma
Controls	7.5-9	100	123	78.8	0
I	9-15	6-75	30	70	0
II	16-28	3-6	30	70	30
III	28-39	2-3	30	13.3	100 (2 fatal)
IV	Over 40	<2	18	11.1	100 (1 fatal)

The animals in Group II were dicumarolized to a degree commonly thought to be well within the therapeutic range (prothrombin percentages between 3 and 6 per cent). All of the animals showed one or more coagulation times slightly above normal. Hematomas were present in 3 of the animals. Nevertheless, the incidence of thrombosis was still high (70 per cent).

In the third group of animals (Table III) we find that the desired therapeutic effect of dicumarol has been obtained, since thrombosis occurred in only 4 out of 30 veins (13.3 per cent). However, to produce this effect, it was necessary to depress the prothrombin to a level below 3 per cent of normal. The coagulation time was frequently 3 to 5 times the normal value. Hematomas were present in all of the animals, and 2 died of hemorrhage during the experiment. Similar results are seen in the fourth group (Table IV) in which there were extremely low prothrombin levels (under 2 per cent).

A tabular summary of the results which were obtained in the control group and in the four groups which were treated in Table V may be seen.

#### CONCLUSIONS

Under the conditions of this experiment, moderate degrees of dicumarol-induced hypoprothrombinemia did not significantly reduce the incidence of thrombosis. At prothrombin levels below 3 per cent, it was found that there was marked inhibition of thrombosis and also an important increase in hemorrhagic complications.

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# PAPILLOMA OF LACTEAL DUCT

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THE purpose of this paper is to present study and follow-up data on 87 cases of intraductal or intracystic papilloma seen at Scott and White Hospital during the period 1921 to 1946, inclusive. Follow-up reports by questionnaire method have been obtained for 77 (88.5 per cent) of these cases. Of those patients seen prior to 1943, representing a 5 year survival group, 84.0 per cent have responded to our inquiry.

The condition of papilloma of lacteal duct refers to a tumor, rarely more than 2 to 3 centimeters in diameter and often microscopic in size, located most often within the central zone of the breast. It is essentially a complex papillary mass projecting into the distended lumen of the duct. The papillary mass is made up of branching, quite vascular stromal bands coated by normal duct epithelium and usually attached at only one point to the wall of the duct. Often there is found an associated widespread hyperplasia of ductal epithelium.

In the present series, study of the case histories, in each case, with the recorded pre-operative examination and opinion of the surgeon has given a unique opportunity to realize a practical point not emphasized hitherto in the literature, that is, that the papilloma is very often not the tumor which is felt at time of examination. As a rule, if a tumor is palpated, upon removal it is found to be an area of cystic mastitis, whereas, the intraductal papilloma or papillomas are often microscopic in size and are discovered only on careful study of the surgical specimen. Five exceptions to this rule were noted in this series. In these exceptional cases the papilloma was 1 to 2 centimeters in size, but a blood-filled cystic space had formed around it, causing the entire mass to be clinically palpable and surgically accessible.

Since bleeding at the nipple gives a clue to the probability of finding the chief disease

process in one or more ducts, we have found that a modification of the usual methods of examination in the laboratory will give a much higher rate of positive findings. Instead of simply searching for the tumor by multiple cross sections of the breast, the examination follows the pattern of anatomical distribution of lacteal ducts in radiating fashion from the nipple. The breast is placed skin surface down and after the nipple is located as the center, many cuts down to skin level are made in the breast from the nipple to the periphery so that the entire duct system is exposed. Usually the involved duct or ducts will be prominent because of brown or bloody fluid present and quick but careful dissection will usually show the tumor in the duct. Quick frozen section can be made from the area with diagnosis resting upon a sound foundation of fact. The whole process takes only a few minutes longer than the older cross section method, is based upon anatomical distribution of the lacteal ducts, yields a much higher percentage of positive findings, and demonstrates the widespread distribution of disease. In our experience lacteal papilloma occurs chiefly in the area identified by the brown or bloody fluid along the path of involved ducts although other areas including the nipple itself must be carefully searched. The pathologist is always faced with the problem of how much papillary hyperplasia constitutes a papilloma and he must decide that for each case, for, in breasts of the type under consideration, papillary hyperplasia is very common. In most cases the differential diagnosis between the benign and malignant form of this is quite difficult. In line with the current accent on cytological study of fluids and smears we believe that detailed study of cells involved will help greatly. The work of Jackson and his associates is of great value in this field but we prefer excision biopsy. It is unusual to fail to find the pathological process if the radial dissection method is carried out.

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Diagnosis of this lesion rests squarely on microscopic evidence, however, certain clinical procedures are of definite aid. In addition to a careful history and inspection and palpation of the suspected area it is agreed that an attempt to express secretion from the nipple should be made. If this is successful, a slide should be prepared and submitted to the pathologist for examination as to presence of red blood cells and, rarely, of tumor cells. Transillumination of the lesion is generally considered a help in diagnosis for the blood-filled space which may surround the papilloma is opaque to light. Hicken recommended use of skiodan viscous as a contrast medium injected into the lacteal ducts to elicit the filling defect produced by these tumors. In regard to management of this lesion, it is emphasized by most observers that in the presence of cardinal symptoms of intraductal papilloma, either tumor or bleeding from the nipple, or both, surgery is required. Especially is this true since in approximately 50 per cent of cases of bleeding nipple a malignant lesion is revealed on exploration. The difference of opinion rests with the extent of the indicated surgery when an entirely benign lesion is encountered.

In separate reports based on series of 52 and 55 cases, respectively, Wakeley and Campbell urge simply local or wedge excision unless the lesion is multiple at time of surgery. Gray and Wood of the Mayo Clinic contended that bloody discharge is a serious sign and preferably merits simple mastectomy. However, no follow-up data are included in their study. Hicken emphasizes the work of Cheatle and Cutler, Adair, and others who have made serial sections of removed mammary glands. They had found papillomas to be multiple in a high percentage of cases, encountering as many as 150 separate and distinct papillomas scattered in one breast. Papillomas have been stated to be multiple in 15 to 37 per cent in 3 previously reported series. Here, 21.7 per cent were multiple, and in 2 (2.3 per cent) instances were bilateral. Also, Stowers, Hicken, and others have pointed out the coexistence of papilloma with papillary carcinoma, and the resultant necessity for assurance that all the discrete entities in the particular breast be eradicated. Our series contains 3 cases of this

latter category which will be mentioned in the follow-up study.

Briefly, arguments for a conservative local excision resolve themselves into (1) cosmetic and psychologic, (2) absence of demonstrated pathologic changes in the remaining breast tissue, and (3) lack of proof that the patient's risk is thus increased. Main arguments for simple mastectomy are (1) the 15 per cent "recurrence" rate following local excision, (2) the possibility of overlooked multiple papillomas with later malignant changes, and (3) overlooked papillary carcinoma in another portion of the same breast.

#### CLINICAL FEATURES

The clinical features noted in lacteal papilloma are summarized in the following paragraphs. These data conform closely to those in series reported by Geschickter and Grant and Wood.

Of the total of 87 histologically proved cases of intraductal papilloma, 81 patients (93 per cent) were married and 6 single at the time of admission. A family history of cancer was mentioned by 21 patients. One or more pregnancies were noted for 57 patients. The average age was 44 years, ranging between 26 and 67 years.

Twenty patients had records of previous breast surgery, more often on the opposite breast, and this was of varied type, including incision for "abscess," excision of lipomas or areas of cystic mastitis. The left breast was involved in 40 cases, the right in 36, and there was involvement of both breasts in 11 cases. The chief complaint upon admission concerned the breast in 81 cases. Since most patients had been referred, it is believed that this latter figure is probably abnormally high as compared to that which might be expected in routine office practice. Since these tumors are small and painless, in the absence of discharge examination of the nipple area as a matter of routine becomes of importance for diagnosis.

Duration of symptoms was variable, averaging 10 months but ranging from 1 month in 14 cases to 20 years in 1 case, and long time discharge, sometimes bloody in type, was not uncommon. Although all observers agree that sanguineous nipple discharge merits ex-

TABLE I

Surgery	No. of cases Local excision	No. of cases Simple mastectomy
Discharge alone	5	21
Tumor alone	23	15
Tumor and discharge	11	11
Pain or tenderness	(15)	(13)
Retraction of nipple	( 2)	( 3)
Total	39	47

Note Another patient, the 87th of the series had radical mastectomy performed for extensive associated cystic mastitis of borderline histologic malignancy. She is in good health 12 years following surgery.

ploration, it bears re-emphasis that the finding is purely a symptom and, in roughly 50 per cent of cases, a benign lesion will be encountered.

All patients in this series had findings of either nipple discharge, tumor, or both (Table I). As pointed out earlier, the tumor palpated was usually not the intraductal papilloma but more often was an area of cystic disease. It is apparent upon dividing the cases into two groups depending on type of surgery performed that the tendency here at Scott and White Hospital during this period has been for the operator to remove the local tumor and, when the frozen section is reported benign, to close the wound. Conversely, when bloody discharge is a symptom, a simple mastectomy is more likely to be undertaken. This latter judgment is supported by the work of both Lepper and associates and Adair who independently have performed multiple serial sections of these specimens and remark the difficulty of finding the microscopic multiple tumors even by this careful technique.

Ten cases bearing the clinical diagnosis of probable intraductal papilloma were also studied. In 9 cases the chief complaint was of nipple discharge and in the tenth, a small tumor within the nipple. Eight of these patients were followed. Four refused surgery and report good health after 2,  $3\frac{1}{2}$ , 2, and 4 years respectively. One of these patients mentions persistence of brownish nipple discharge. Three patients accepted simple mastectomy, but no papilloma was found in the excised tissue. These patients reported no additional trouble in 4,  $4\frac{1}{2}$ , and 5 years respectively. One patient accepted surgery

TABLE II

	No. cases Local excision	No. cases Simple mastectomy
Not followed	5	5
Well 2-3 years	20	25
Well 5 years	14	17
Recurrence	2	0
Subsequent surgery	3	0
Per cent followed—88.5		

elsewhere, a papillary carcinoma was found, and a radical mastectomy performed. She reports herself in good health 7 years after surgery.

#### FOLLOW-UP STUDY

Table II summarizes our experience here as obtained by follow-up questionnaires, letters from referring doctors, and data from the Bureau of Vital Statistics, Department of Health, State of Texas.

In the 42 cases of unilateral or bilateral simple mastectomy for proved histologic intraductal papilloma which were followed, the patients were found to have absolutely no further trouble, to have remained in good health generally, and to have had no subsequent operations. This is in accord with Geschickter's report on 39 of 46 similar cases. No instances of supervening cancer were noted.

It might be mentioned that the 3 cases in the files here of grade 1 papillary carcinoma in association with intraductal papilloma with simple mastectomy performed were followed also. One patient is a 7 year survival in apparent good health, another is a 14 year survival for whom recently a radical procedure on the same breast was performed elsewhere for large local recurrences without evidence of distant metastases. The third patient has been followed less than 2 years and her health is reported excellent. Three additional patients had radical mastectomy performed for coexisting carcinoma grades 2 or 3. Follow-up on 2 of these patients revealed 1 survival for 2 years, and 1 death after 3 years ascribed to cancer of the breast with metastasis. Whether the foregoing 6 cases represent instances of malignant transformation of an intraductal papilloma remains conjecture.



The 34 cases followed sequential to local or wedge excision of the lesion tell a slightly different story. Further trouble is indicated by 4 of these patients. One reports another small lump near her incision. Another patient has had subsequent bilateral simple mastectomy here for breast tumors. Pathologic report was cystic mastitis in one breast and papilloma in the other. A third patient has had simple mastectomy performed upon the same breast. The fourth patient has had 6 operations on the breasts in the course of 15 years, with papillomas found in 2 instances. Although this represents only 11.7 per cent who have reported further trouble, it compares with Geschickter's reported data in which 8 of 110 (7.3 per cent) patients for whom local excision was performed were operated upon later for "recurrent" papilloma. This is especially interesting, for Geschickter advocates merely local excision for single benign papilloma. It is our opinion from these data rather than simple mastectomy is the procedure of choice for attempted cure of this condition as papillomas may be multiple, may be present in more than one duct, and, contrary to some authorities, may become malignant. There is evidence in our series that additional operations have been necessitated. There is no evidence from this study that local excision of the lesion has resulted in development of a later cancer, but the possibility of malignant change in overlooked multiple papillomas is certainly conceivable. Again, in Geschickter's group, 3 of 54 such patients, followed for more than 5 years, had developed mammary cancer. Hart, who reported upon the only comparable series in the literature with follow-up study, found strikingly similar results. Of 66 patients followed with 95 benign intraductal papillomas (69.5 per cent), none developed cancer but 9 patients were reoperated upon for another papilloma and 6 were reoperated upon for a bloody nipple discharge. Clinically, when there is a

small discrete, mobile tumor at or near the areola, pressure upon which produces secretion at the nipple, a papilloma is probably present and perhaps a local excision is contemplated. However, from our study we believe that even in this type of case the patient should be told that such a tumor 1 time out of 5 (15 to 30 per cent) is multiple and reoperation may be necessary unless simple mastectomy is done at the outset.

#### SUMMARY

A follow-up study of 77 patients, or 88 per cent of 87 cases of microscopically proven intraductal papilloma seen at Scott and White Hospital in the period 1921 through 1946, has been presented. Clinical features and principles of surgical management have been discussed. Subsequent trouble in the same breast was reported in 11.7 per cent of 34 cases in which segmental excision of the lesion was carried out. In the 42 cases followed in which simple mastectomy was performed no further trouble developed. No patients in this series are known to have developed cancer of the breast sequential to operation.

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# CARCINOMA OF THE THYROID GLAND

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THERE is great variation in the incidence and other characteristics of this disease, as indicated by the reports of different investigators from various parts of the country. This variation in incidence suggests that carcinoma of the thyroid gland is a geographical disease. In our report 4 years ago we noted an incidence of cancer equal to 17.1 per cent in nontoxic nodular goiter (Table I). This appeared to be an unusually high incidence of carcinoma in goiter, but since previous investigators had not broken down their series into nontoxic and toxic nodular goiter, but usually gave one figure for all types of thyroid glands encountered in the surgical pathology laboratory, there was relatively little previous data with which to compare ours. Thinking that our series, which was relatively small, might have reflected a high incidence through coincidence, we have continued the study and analyzed the cases observed in our clinic during the 3½ year period since the original publication. Of the 93 patients operated upon for nontoxic nodular goiter, between 1944 and 1948, 17.2 per cent had carcinoma. The incidence in the two periods has remained remarkably identical. Altogether in the 11½ year period since 1936, up to January 1, 1948, 17.15 per cent of the 285 nontoxic nodular goiters removed in the operating room were carcinoma. Of still more significance was the fact that of the solitary nodules which comprised about one-half of the group 24.4 per cent were carcinoma in contrast to only 9.8 per cent for the multinodular types of nontoxic nodular goiter (Table II). The incidence of carcinoma in both types of nodular goiter (toxic and nontoxic) rose from 7.2 per cent in the first series to 11.3 per cent in the latter series (1944 to 1948), but this increase should be ignored because it is ex-

plained by the relatively smaller number of toxic nodular goiters observed in the latter period.

The data in Table II reveal only 1 case of carcinoma in 517 cases of toxic diffuse goiter operated upon in the 11½ year period. This constitutes an incidence of 0.2 per cent, agreeing with the experience of others. For example, Ward encountered only 1 carcinoma in 1900 patients with toxic diffuse goiter. In 378 specimens of toxic nodular goiter removed at operation in the 11½ year period, we encountered carcinoma of the thyroid in only 4 patients. It is obvious, therefore, that presentation of figures on incidence of carcinoma on all thyroid specimens combined, as removed from the operating-room, are entirely misleading, and do not give the correct emphasis on incidence, particularly as related to types of goiter. In other words, if a toxic diffuse goiter is present, one can almost dismiss completely the possibility of carcinoma, particularly if the toxicity is of more than a mild type.

Since our initial report showing a breakdown of incidence of carcinoma in various types of goiter, other investigators have computed the incidence in each group, e.g. Crile reported a 10.9 per cent incidence of carcinoma in 274 specimens of nontoxic nodular goiter, which is considerably less than our figures. However, the incidence of carcinoma in the solitary type of nontoxic nodular goiter was almost identical to that in our series, being 24.5 per cent and 24.4 per cent respectively.

Crile has very appropriately called attention to the fact that patients who are hospitalized and operated upon for nontoxic nodular goiter have in reality been screened, particularly by the patient and the internist, and has emphasized that the incidence as reported from hospitals is not a true incidence in all patients with nontoxic nodular goiter. We agree with him on this point, but its importance appears to be minimized to a certain extent by the comparison of our statistics in

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TABLE I—INCIDENCE OF CARCINOMA IN NODULAR GOITER (INCLUDING TOXIC, NONTOXIC AND CARCINOMA) ILLINOIS RESEARCH HOSPITAL 1936-1948

Type of goiter	1936-1944		1944-1948		1936-1948	
	No cases	Per cent carcinoma	No cases	Per cent carcinoma	No cases	Per cent carcinoma
Toxic nodular	330	1.2	48	0	378	1.0
Solitary	71	0.0	17	0	88	0.0
Multinodular	259	1.6	31	0	290	1.4
Nontoxic nodular	102	17.1	93	17.2	285	17.15
Solitary	92	24.0	51	25.5	143	24.4
Multinodular	100	11.0	42	7.1	142	9.8
Total	522	7.2	141	11.3	663	8.0

1936 to 1944 to those of 1944 to 1948. Following 1944, when we noted such a high incidence of carcinoma in nontoxic nodular goiter (particularly of the solitary type), we recommended thyroidectomy in every patient with such a lesion, with practically no exceptions. Patients accepted our advice and had a thyroidectomy performed. Even though we operated upon all these patients with solitary nodules, our incidence of carcinoma in nontoxic nodular goiter remained the same.

The supposition that goiter, including carcinoma of the thyroid gland, is a geographic disease is supported by figures from different parts of the country. For example, Rogers and associates noted that in 544,918 patients admitted to the Boston City Hospital, the Massachusetts General Hospital, and the Johns Hopkins Hospital over a period of several years, only 0.59 per cent were admitted for goiter. In 68,573 admissions to the Illinois Research Hospital during an 11½ year period, there was an incidence of 1.7 per cent goiter, which is roughly three times that of the Atlantic seaboard. After all, there is nothing new in these data since it is well known that goiter is more common in goiter belts, and figures in nongoiter belts cannot be compared to those in goiter belts. It is even more fallacious to attempt to determine the incidence of carcinoma in goiter from autopsy statistics, as has been suggested by Vanderlaan. He reports that in 18,668 autopsies performed at the Boston City Hospital over a period of 50

TABLE II—INCIDENCE OF CARCINOMA IN VARIOUS TYPES OF GOITER (INCLUDING CARCINOMA) ILLINOIS RESEARCH HOSPITAL 1936-1948

Type of goiter	No cases goiter	No cases carcinoma	Per cent carcinoma
Toxic diffuse	517	1	0.2
Toxic nodular	378	4	1.0
Nontoxic nodular	285	49	17.15
Solitary	143	35	24.4
Multinodular	142	14	9.8
Total	1180	54	4.6

years, there were only 5 cases of carcinoma, and implies that this might be interpreted as data on incidence. We are convinced that autopsy figures are worthless in attempting to determine incidence of carcinoma and quote figures from the Illinois Research Hospital to support this statement. For example, during the second period (1944 to 1948) of our study, there were 675 autopsies at Illinois Research Hospital. Only 2 were for carcinoma of the thyroid. During this same interval 16 patients with carcinoma were encountered in the operating room and their condition diagnosed as such by the Department of Pathology. The astounding feature is that of the 16 patients followed in this series, we know that 11 are already dead. However, autopsies were not performed upon any of these 11 patients in our hospital, the 2 autopsies which were made during this 1944 to 1948 period belonged to the 1936 to 1944 series. It must be realized that patients with certain diseases are not referred to the hospital to die. Since these patients were able to receive all possible care as ambulatory patients, we did not refer them to the hospital when the disease became terminal, largely because the insufficient number of hospital beds available are reserved for patients for whom we hope to obtain better results than those indicated in terminal carcinoma of the thyroid. Any suggestion that our pathologists are more liberal with the diagnosis of hyperplastic lesions than others can certainly be refuted emphatically by the fact that 11 of the 16 patients with carcinoma in this latter series (1944 to 1948) are already dead, and 2 of the 5 known to be living have metastases. We know that all those who died had metas-

# COLE ET AL CARCINOMA OF THYROID GLAND

TABLE III — CHARACTERISTICS OF VARIOUS TYPES OF NODULAR GOITER

Illinois Research Hospital  
1936-1948

Type of lesion	Total No	Average	Sex per cent F	Race per cent Col	Duration mass years	No solitary
Toxic nodular goiter (benign)	378	43.5	88.9	9.4	9.9	84 (22.4%)
Nontoxic nodular goiter (benign)	285	42.4	90.1	18.0	10.2	108 (37.9%)
Carcinoma of thyroid	54	48.0	67.0	13.0	6.1	35 (64.9%)
Total	717					

tases Although we cannot prove that the cause of death in every instance was carcinoma, yet the fact that all had demonstrable metastases should dispel any doubt regarding accuracy of the diagnosis

Carcinoma of the thyroid is much more apt to develop in men with nodular nontoxic goiter than in women, for example, of 663 patients with nodular nontoxic and nodular toxic goiter as observed at the Illinois Research Hospital from 1936 to 1948, only 10 per cent were males contrasted to an incidence of 33.3 per cent males in 54 cases of carcinoma encountered during that same period (Table III). This indicates that the probability of development of carcinoma is about three times as great in men as in women, a point which Ward has emphasized for years. This figure is quite similar to that reported by other investigators in this field. Ward has noted further that in his entire series covering 20 years, the incidence of carcinoma in men with nodular goiter is 12 per cent, but in recent years this percentage has risen to 16.6 per cent. Our incidence of carcinoma in men with nodular goiter (toxic and nontoxic) is 17.5 per cent and likewise has shown an increase in the past few years. In our series of 54 patients with carcinoma of the thyroid the average age was 48 years, which is identical to the average as reported by Lahey, Hare, and Warren (13, 14). In fact, all investigators have reported that the average age of a patient with carcinoma of the thyroid is much lower than the average age of patients with other types of carcinoma because it is so common in young people. For example, in 62 children 14 years of age or under with nodular goiter, Kennedy

TABLE IV — INCIDENCE OF CARCINOMA IN NODULAR GOITER AS OBTAINED FROM NUMEROUS REPORTS IN THE LITERATURE

Author	No patients with nodular goiter (toxic and nontoxic)	Per cent carcinoma in nodular goiter (toxic and nontoxic)	No patients with nodular nontoxic goiter	Per cent carcinoma in nodular nontoxic goiter	Per cent carcinoma in solitary nontoxic nodular goiter
Brenner and McKnight Charlotte N C 1940	2324	4			
Horn and associates Philadelphia Pa 1947	1135	6.3	637	9.8	
Crile Cleveland Ohio 1948	537	5.6	274	10.9	24.5
Ward San Francisco 1947	3539	4.8			15.6
Cole and associates Chicago 1948	663	8.0	285	17.1	24.4

encountered carcinoma in 12 cases, representing an incidence of 19.3 per cent. This series alone emphasizes the seriousness of goiter in young people. Ward noted an incidence even higher, namely 40 per cent in 10 children under 15 years of age with nodular goiter. The percentage of colored people in our series of carcinoma of the thyroid was 13 per cent, which is identical to the percentage of colored patients in our group of nodular goiter, toxic and nontoxic.

The average duration of the mass in our patients with carcinoma was 6.1 years (Table III). In our patients with toxic nodular (benign) goiter the average duration of the mass was 9.9 years, as compared to 10.2 years for nontoxic nodular (benign) goiter. The 6.1 year history of a mass in the neck in patients with carcinoma appears to be fairly good evidence that carcinoma develops in pre-existing nodules or adenomas. In fact, almost all investigators in this field agree that most carcinomas of the thyroid have onset in benign nodules or adenomas, frequently of the fetal adenoma type.

## RELATIONSHIP TO HYPERTHYROIDISM

Carcinoma is extremely uncommon in toxic diffuse goiter. For example, in 517 cases of toxic diffuse goiter operated upon during the

TABLE V — PATHOLOGIC TYPES IN 54 CASES OF THYROID CARCINOMA OBSERVED IN ILLINOIS RESEARCH HOSPITAL 1936-1948

Type	Number	Per cent
1 Papillary adenocarcinoma	15	27.7
2 Alveolar adenocarcinoma	11	20.4
3 Hürthle cell adenocarcinoma	7	12.9
4 Small cell diffuse carcinoma (carcinoma simplex)	4	7.5
5 Giant cell carcinoma	1	1.9
6 Fibrosarcoma	1	1.9
7 Carcinoma, type undetermined*	15	27.7
Total	54	100.0

\*If Shields Warren's classification were used many of these would be classed as malignant adenoma.

past 11½ years, we encountered only 1 carcinoma. Ward encountered 1 case of carcinoma in 1900 cases of toxic diffuse goiter. Carcinoma is more common in toxic nodular goiter, but in general is so uncommon in toxic goiter that presentation of a figure on incidence of carcinoma *for all types of goiter are in reality misleading*, since the incidence is so many times more common in nontoxic nodular goiter. We encountered 4 patients with carcinoma in 378 patients having thyroidectomy for toxic nodular goiter. All together, hyperthyroidism was associated with carcinoma of the thyroid in 9 per cent of our series, but in general was quite mild in type.

There is considerable variation in figures presented by other workers. The highest incidence is that reported by Pemberton and Lovelace (17, 18), namely 33.5 per cent. However, this figure is far above most of the other figures in the literature. Horn and associates noted that thyrotoxicosis was present in 9 per cent of 71 cases of carcinoma studied by them. McSwain and Diveley encountered definite hyperthyroidism in 10 per cent of 22 cases of carcinoma and doubtful hyperthyroidism in an additional 10 per cent.

There is controversy as to the origin of the thyrotoxicosis when it occurs with carcinoma. However, after a study of 396 patients with carcinoma of the thyroid, Friedell arrived at the conclusion that the carcinomatous area itself does not have the function of hyperthyroidism. We agree with this conclusion, but are aware of a few instances in which the metas-

tases appeared to have produced hyperthyroidism.

#### PATHOLOGY

It is not our intention in this paper to discuss the details of pathology of carcinoma. As previously stated, most authorities working on this subject are of the opinion that carcinoma of the thyroid has its origin in benign nodules or adenomas in a large percentage of cases. A classification of Shields Warren includes malignant adenomas as one of the types observed, although some pathologists prefer to place these tumors in other categories. Table V reveals the types of tumors encountered in our series. Twenty-seven per cent are shown as lesions which some pathologists might classify as malignant adenomas. It is important that this group, which is classified by some authors as malignant adenomas, is slow to metastasize as are also the papillary carcinomas. In our series 27.7 per cent were papillary carcinomas. In other series the incidence of this type of tumor is higher. In 517 cases of carcinoma of the thyroid Pemberton (17, 18) reports 30 per cent as being papillary carcinoma, 38 per cent as carcinoma in adenoma, and 30.4 per cent as diffuse adenocarcinoma.

There is considerable difference of opinion as to the incidence of malignancy in lateral aberrant thyroids. After analyzing 34 cases of lateral aberrant thyroid nodules, Lahey (12) reports that 35 per cent were carcinoma. Crile noted that "in nearly half the cases of lateral aberrant thyroid disease, the lobe of the thyroid on the affected side contained a tumor histologically identical with the lateral cervical nodes." King and Pemberton (11) considered all such nodules as metastases from the homologous lobe of the thyroid. After a study of 112 cases, Black has concluded that lateral aberrant thyroids are metastases from primary lesions in the thyroid and are practically always of the papillary adenocarcinoma type.

#### DIAGNOSIS

Unfortunately, there are no early symptoms of carcinoma of the thyroid except rapid increase in the growth of the nodule in the neck. The remainder of the symptoms as noted below are in reality late symptoms. The

first complaint noted after increase in the size of the mass in the neck is apt to be a feeling of pressure in the neck, particularly when the patient moves his head in certain directions. Hoarseness is fairly common and is indicative of pressure on one of the laryngeal nerves or invasion of the larynx or trachea itself. Persistent cough with excessive mucus is not uncommon. Difficulty in breathing and swallowing are later symptoms and usually indicate invasive growth of the tumor compressing the trachea or larynx, or esophagus respectively. Along with difficulty in breathing, stridor is occasionally noted, particularly while the patient is asleep.

Soley and associates have called attention to the fact that pressure symptoms are by no means pathognomonic of cancer of the thyroid. For example, in 72 of 81 patients with nonmalignant nodular goiter, pressure symptoms of one type or another were present. This incidence is remarkably similar to the incidence of pressure symptoms in carcinoma of the thyroid, insofar as 12 of 15 patients with carcinoma had one or more types of pressure symptoms.

Examination of the mass is helpful but by no means will make a positive diagnosis, since the consistency of the different types of tumors varies. Obviously, any indurated tumor mass must be considered as potentially malignant, although thyroiditis is about as common and must be ruled out. Of more value than consistency of the tumor is the presence of metastatic nodules in the neck.

Considering the manifestations described, it is obvious that it will be very difficult to make a preoperative diagnosis in a high percentage of cases, as is borne out by actual experience. For example, McSwain and Diveley report that in 27 per cent of their series of carcinoma of the thyroid, the diagnosis was not suspected preoperatively. In the series reported by Pemberton (17, 18), carcinoma was unsuspected in 60 per cent. In our report (2) 4 years ago, our figure on preoperative diagnosis actually was less than reported above. However, since that time we have made much greater effort to differentiate benign from malignant lesions of the thyroid, but have been able to make a correct preoperative diagnosis

in no more than 75 per cent of cases, even then we had to have the assistance of preoperative biopsy to attain this figure.

However, Crile reports an accuracy of 90 per cent preoperative diagnosis of carcinoma of the thyroid, although he admits that it may not be possible to maintain a percentage accuracy as high as this.

#### TREATMENT

Since it appears that carcinoma of the thyroid frequently develops within benign nodules, the removal of nontoxic nodular goiter becomes an important method of therapy in the treatment of carcinoma of the thyroid although it is obviously prophylactic. Practically all the authorities reporting on the incidence of carcinoma have arrived at the conclusion that all nodular goiter of the solitary type should be removed. The authors agree with this conclusion. Hinton and Lord made a study of the incidence of carcinoma in 184 patients with clinically benign nodular goiter (toxic and nontoxic) finding that 7.6 per cent were carcinoma. In 75 patients with clinically benign lesions of the breast, carcinoma was encountered in 6.7 per cent of the group. They, therefore, conclude that there is actually more reason for removing an apparently benign nodule in the thyroid than an apparently benign nodule in the breast. They emphasize that practically all physicians advise removal of all nodules in the breast even though they appear benign. After this study they conclude that "all nontoxic nodular goiter should be removed because of the high incidence of unsuspected cancer, a rate which exceeds that of cancer of the breast in the clinically benign appearing group." Practically all surgeons now agree that even though a nontoxic nodule in the thyroid appears quite definitely to be benign, it *must not be removed by simple enucleation*, but that a subtotal thyroidectomy of the affected lobe should be done, because early carcinoma is so frequently found in the nodule.

Opinions differ somewhat as to the actual type of treatment, although it is agreed that surgery and irradiation therapy (including radon seeds) are extremely valuable. The authors favor radical dissection of the neck in all cases of carcinoma of the thyroid except

TABII VI—FIVE YEAR SURVIVAL RATES IN CARCINOMA OF THE THYROID AS REPORTED BY NUMEROUS OBSERVERS IN THE LITERATURE

Author	No. patients followed 5 years	Per cent 5 year survival
Pemberton Rochester Minn 1918	421	61
Horn and associates Philadelphia Pa 1917	42	55
Cole and associates Chicago Ill 1918	36	39
Portmann Cleveland Ohio 1910	110	15.5
DeQuervain Switzerland 1915	105	17.5
Dargent Lyon France 1911	115	0.6
Watson and Pool New York 1910	167	7.5

those in which a small carcinoma is found within the thyroid tissue in the surgical pathology room. By radical dissection of the neck we mean excision of the sternomastoid muscle, internal and external jugular, the ribbon muscles, and all areolar and lymphatic tissue on the affected side. Details of the operation may be found in the publications of Lahey (13, 14), and Watson and Pool. Some surgeons (Crile) are not convinced that radical resection adds a great deal to the ultimate results. Black is of the opinion that radical dissection is not necessary in the malignant lateral aberrant thyroid.

Radium and x-ray treatment are quite effective in certain types of lesions particularly the papillary adenocarcinoma. Either or both of these types of therapy should be utilized in every patient with carcinoma of the thyroid revealing metastases, regardless as to whether or not radical resection has been performed.

When radioactive iodine was introduced as a method of treating carcinoma of the thyroid, great hope was held out for good results, since it was known that the thyroid gland picked up iodine from the blood stream. However, reports from numerous workers have not been very encouraging. For example, Marinelli re-

ports that in 19 cases of carcinoma of the thyroid only 11 took up radioactive iodine. Rawson reports that in 12 patients with carcinoma only 5 took up iodine, whereas all benign tumors of the thyroid did. In 8 cases the metastatic nodules took up radioactive iodine but not in quantities as great as did normal tissue. They concluded that this function which was present in normal thyroid to a great extent, was actually lost when carcinoma developed. Ward reports that in 10 patients of the California series, treated with radioactive iodine, there was no measurable pick-up of radioactive iodine in 7. From the reports mentioned, it is rather obvious that radioactive iodine will contribute very little to the treatment of carcinoma of the thyroid except in the occasional case.

#### RESULTS

The operative mortality following thyroidectomy for carcinoma of the thyroid will be somewhat higher than thyroidectomy for benign lesions of the thyroid, but will vary depending largely upon the percentage of radical neck dissections. Pemberton reports an operative mortality rate of 18 per cent. Portmann noted a mortality rate of 8.5 per cent, although many of these patients are drawn from records many years ago. We had 1 operative death in 36 patients upon whom we did a thyroidectomy or thyroidectomy with radical neck dissection, constituting a mortality rate of 2.7 per cent. Seven of these 36 patients had radical neck dissections without operative fatality.

In general it is agreed that the best results will be obtained in papillary carcinoma, Hürthle cell carcinoma, and malignant adenoma, perhaps in the order named. After studying their series of cases, McSwain and Diveley concluded that the duration of the mass in the neck had no bearing on prognosis. Dailey emphasizes that the presence of distant metastases should not be considered too seriously in issuing a pessimistic prognosis. For example, he noted that 10 of 90 patients studied by him had remote metastases for 3 to 17 years. All investigators studying the problem of carcinoma of the thyroid have known of patients with metastases in bone or other organs.

which have been present for years without much evidence of spread

There is an enormous variation in the 5 year survival rates reported by various authors. For example, in 421 patients followed for 5 years at the Mayo Clinic, Pemberton (17, 18) reports 61 per cent 5 year survivals (Table VI). On the contrary, Watson and Pool reported only 7.8 per cent 5 year survivals in 167 patients, and Dargent reported only 9.6 per cent in 135 patients. De Quervain reported a slightly higher rate of 17.5 per cent in 108 cases followed 5 years or more. Our series of patients, observed 5 years or longer, is quite small. Of 36 patients having complete follow-up, 38 per cent survived 5 years or longer. The survival rate for our late series will probably be less than this, since in 11 of the 16 cases followed (3 months to 5 years) death has already occurred.

It is difficult to explain the wide variation in 5 year survival rates as reported above. It is assumed that certain observers may be more lenient in allowing doubtful cases to be classified as carcinoma, however, the authors are not at all convinced that this is the sole explanation. We are convinced that coincidence and geographic location are probably of greater importance in this variation of figures, largely because the incidence of papillary carcinoma (particularly of the lateral aberrant type) and other relatively slow growing tumors will show great variation geographically. It is quite obvious that in the 16 patients, followed closely during the past 4 years, we have been dealing with a very vicious type of tumor, since 11 are already dead.

As in other types of malignant tumors, the relative curability is dependent upon how extensively invasion has taken place when treatment is instituted. For example, Ward found that in patients whose disease was diagnosed before operation, the 5 year survival rate was 20 per cent, whereas in those patients whose condition was diagnosed only after examination of the specimen in the surgical pathology room it was 80 per cent.

#### SUMMARY

During the past 11½ years we have encountered 54 patients with carcinoma of the

thyroid in 663 patients having thyroidectomy for nodular goiter, constituting an incidence of 8 per cent. The incidence of carcinoma in toxic nodular goiter was only 1 per cent, contrasted to 17.15 per cent in nontoxic nodular goiter.

In a study made by us (2) 4 years ago the incidence of cancer in nontoxic nodular goiter was 17.1 per cent. Since this appeared unusually high, we have analyzed the data during the past 4 years and found it to be almost identical, namely 17.2 per cent. Of the solitary nodules, which comprised half of the group of nontoxic nodular goiters, 24 per cent were cancer, in contrast to only 9.8 per cent for the multinodular type of nontoxic nodular goiter. Statistics on cancer including all types of goiter are entirely misleading because the incidence is so low in toxic goiter. The incidence of cancer in our series of 517 patients with toxic diffuse goiter was only 0.2 per cent.

Goiter, including cancer of the thyroid, is a geographical disease. The ratio of goiter to all admissions in our hospital is three times greater than in hospitals along the Atlantic seaboard. It is worse than worthless (i.e. entirely misleading) to attempt to determine the incidence of cancer in goiter from autopsy statistics. Our study of patients encountered in our clinic during the past 4 years reveals the fact that 11 of the 16 patients with carcinoma of the thyroid are already dead from their cancer, yet none of these 16 was autopsied in our hospital. One or two died in other hospitals, the rest died at home.

The danger of cancer in goiter is about three times greater in men than in women. The average age of patients with carcinoma of the thyroid is much lower than the average age of patients with other types of cancer because it is so common in young people. Most carcinomas have onset in benign nodules or adenomas as indicated by the fact that the average duration of the mass in our combined series was 6.1 years.

The preoperative diagnosis in early cases is extremely difficult. During the past 4 years when we have been extremely careful in the diagnostic study of our cases we have been able to make a correct diagnosis in no more than 75 per cent of patients with carcinoma,



even then we had the advantage of a biopsy in a few cases. Rapid increase in the growth of the nodule, a feeling of pressure, hoarseness, persistent cough, difficulty in breathing, and an indurated tumor mass are of help in making this diagnosis. The first symptom is the earliest, the remainder are usually indications of metastases or invasion outside the gland.

When a cancer of the thyroid has invaded the capsule or metastasized to cervical lymph nodes, it should be treated by radical neck dissection and radiation therapy, sometimes including radon seeds. Reports of other investigators indicate that radioactive iodine will be of only slight help in controlling this disease.

The 5 year survival rate as reported by numerous authors varies greatly (from 61 to 78 per cent in 7 reports reviewed by us) due in part to the different criteria used in making the microscopic diagnosis, and in part to geographical locations. In our series it was 38 per cent, but in our late cases, the figure will probably be lower since 11 of 16 patients observed during the past 4 years are already dead.

The incidence of cancer in the solitary type of nontoxic nodular goiter is so high in our locality that we advise removal of all solitary nodules, but perform subtotal hemithyroidectomy rather than enucleation because early cancer will be found unexpectedly in a surprisingly large number. During the past 4 years we have advised and removed practically all solitary nodules encountered in patients in our clinic, but in spite of this the ratio or per cent of cancer has not decreased over

that encountered in our initial series reported 4 years ago.

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# PREOPERATIVE EVALUATION OF LIVER FUNCTION IN PATIENTS WITH CIRRHOSIS OF THE LIVER

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THE great strides that have been made in the protective and supportive measures for the treatment of the impaired liver have enabled the surgeon of today in most instances to undertake and carry out successfully long and tedious operative procedures. These advances bring into focus the importance of accurate preoperative evaluation of the extent of liver damage and its functional capacity in a given case.

An analysis of 44 cases of disease of the liver (42 of cirrhosis) in which the operation of portacaval anastomosis was performed affords some opportunity of correlating the preoperative evaluation of the status of the liver with its postoperative behavior.

It became apparent early in the series that no single liver test employed by us afforded consistently adequate information upon which to predict the behavior of the liver postoperatively in a given case. On the other hand, there was the occasional patient whose postoperative progress was better than could be anticipated on the basis of several preoperative liver tests.

This is best illustrated by citing the case of an 18 year old girl who gave a 5 year history of progressive, unremitting, painless jaundice. Hepatosplenomegaly was known to have existed for 2 years prior to her admission to the Presbyterian Hospital. A dietary medical regimen for cirrhosis of the liver was without effect in this case. Over the years there had been a progressive severity of the jaundice with decline in the serum albumin. A liver chemistry survey 6 months prior to admission revealed a 2+ cephalin flocculation reaction, serum albumin was 3.2 per cent, globulin 4.4 per cent, and cholesterol esters less than 50 per cent of the total. On admission, the cephalin flocculation was 4+, thymol turbidity, 4+, serum albumin, 3 per cent, globulin,

2.9 per cent, serum phosphatase, 3.9 Bodansky units per cent, bromsulfalein retention 45 minutes after injection was 37 per cent, the galactose removal constant was 50 per cent of normal (2.1), the prothrombin time was 60 per cent of normal and the serum bilirubin 3.6 milligrams per cent.

The spleen was markedly enlarged. A venous hum could be heard below the xyphoid process. All concurred that this patient was a bad operative risk. Nevertheless she tolerated the operation of splenectomy and anastomosis of the splenic vein to the renal vein surprisingly well. Postoperatively, as evidence of further depressed liver function, she developed edema and ascites on the third day. There was anorexia and lassitude but the patient took a high protein diet courageously, and following a paracentesis on the sixth postoperative day there was no further recurrence of the ascites. By the seventh postoperative day the serum bilirubin had dropped 30 per cent below its preoperative level. At the end of 3 weeks the serum albumin had risen to 3.4 per cent.

At the time of discharge on the thirty-ninth postoperative day, the patient was free of jaundice for the first time in 5 years. The total serum proteins had risen to 8.3 per cent (albumin 4.8 per cent, globulin 3.5 per cent). The cholesterol esters had risen from a preoperative figure of less than 50 per cent to 66 per cent of the total cholesterol. There had been improvement in the bromsulfalein and galactose tolerance liver function tests. The thymol turbidity test had become reduced from 4+ to 2+ and the cephalin flocculation test, which before operation had been consistently strongly positive, had returned to normal.

This case has been cited in some detail to illustrate two additional points namely (1) Results of tests designed to indicate liver damage and/or impairment of function do not

TABLE I

No patal o	Preoperative liver chemistry	Postoperative course
1 171	Cephalin flocculation 4+ serum albumin 2.9% globulin 3.7% serum bilirubin 2.7 mgm % serum phosphatase 0.5 BU % bromsulfalein retention 1/2 hr 70%	Anorexia weakness temporary recurrence of ascites
2 996	Cephalin flocculation 3+ serum albumin 3.3% globulin 5.2% serum phosphatase 10.7 BU % serum bilirubin 1.0 mgm % hippuric acid excretion 0.8 gm bromsulfalein retention 1/2 hr 42%	Ascites reappeared requiring one paracentesis Wound disrupted
3 1765	Cephalin flocculation, 3+ serum albumin 3.5% globulin 2.9% serum phosphatase 6.1 BU % serum bilirubin 1.3 mgm % bromsulfalein retention 45 min after injection 23% prothrombin time 50% of normal	Ascites reappeared transiently
4 2015	Cephalin flocculation 4+, thy mol turbidity 4+ serum albumin 3% globulin 2.0% serum bilirubin 3.6 mgm % serum phosphatase 3.0 BU % galactose removal constant, 2.1 bromsulfalein retention 45 min 37% prothrombin time 60% of normal	Ascites occurred on 3rd postoperative day requiring 1 paracentesis
5 1905	Cephalin flocculation, negative serum albumin 2.9% globulin 2.3% serum phosphatase 3 BU % bromsulfalein retention 1/2 hr, 35%	Ascites recurred and persisted for several months finally disappearing as the serum proteins rose
6 7310	Cephalin flocculation negative serum albumin 3% globulin 2.3% serum bilirubin 2.5 mgm % serum phosphatase 4.6 BU % bromsulfalein retention 1/2 hr after injection 40%	Ascites reappeared but proved transitory. Became more jaundiced for a week postoperatively
7 3972	Cephalin flocculation, negative serum albumin 2.3% globulin 1.3% serum phosphatase 10.2 BU % hippuric acid excretion, 0.6 gm bromsulfalein retention 1/2 hr 40%	Anorexia weakness Recurrence of ascites requiring 1 paracentesis on 8th postoperative day

rays correlate well with the pathologist's interpretation of disease on the basis of microscopic examination of fixed and stained sections taken from a biopsy specimen of the liver. (2) Discrepancies occur between the surgeon's report on the gross examination of the liver and the pathologist's report on the microscopic examination of a biopsy specimen. The pathologist's report on the biopsy specimen of this girl's liver was as follows: "fatty infiltration, more marked in the peripheral areas. No cellular infiltration and but little fibrosis." The facts of the matter are that the pathologist did not see enough evidence upon which to base the diagnosis of cirrhosis and the biopsy specimen was classified as "undiagnosed condition of the liver."

The surgeon's observations at operation are decidedly in keeping with the long clinical history, the physical findings, and the laboratory studies in this case. The right lobe of the liver was contracted and its surface studded with irregular sized nodules. The consistency was abnormally firm. The left lobe was enlarged but otherwise appeared normal on gross examination. A portal pressure reading taken from the splenic vein revealed the presence of portal hypertension.

The cephalin flocculation reaction is interpreted by many to indicate active liver cell injury in cases of cirrhosis of the liver. Hanger and Patek's observations are of interest.<sup>1</sup> These authors correlated the cephalin flocculation and the clinical course of 40 patients having cirrhosis of the liver. The cephalin flocculation reactions were consistently strongly positive (3+ to 4+) in 17 per cent of the 40 cases. Twelve of the 17 patients died and 4 additional had a clinical course that was classified as unfavorable or stationary, in only 1 case was the clinical course favorable. In 12 of the 40 patients the cephalin flocculation reaction was progressively diminishing. Thus group had a decidedly more favorable clinical course. Only 3 patients died, the remaining 9 having a favorable clinical course. Finally, there were 11 of the 40 who had a persistently weak or negative flocculation reaction. Three patients died in this group and 8 had a favorable clinical course.

In our series of 44 patients having disease of the liver in which the portacaval anastomosis operation was performed there were 10 postoperative deaths. It is of interest to note that the cephalin flocculation reaction was strongly positive (3+ to 4+) in 8 of the 10 cases. In 1 case, the test was not recorded as having been done and in 1 case the test was weakly positive.

It must be remembered, however, that in the group of postoperative deaths, the liver played no role in the cause of death in at least 3 of the 10 deaths. Furthermore, one must keep in mind that whereas the cephalin flocculation reaction is important it can present but one part of the total picture in the preoperative evaluation of the status of the

<sup>1</sup>HANGER, FRANKLIN M. and PATEK, ARTHUR J. Jr. *Am J Med Sc.* 1941 202 48-57.

liver. This is well illustrated by the fact that 11 of the 20 patients with strongly positive cephalin flocculation reactions did withstand the portacaval shunt procedure successfully.

To obtain an over-all perspective of the relative values of the different liver tests employed in terms of the postoperative behavior of the liver, it is well perhaps to illustrate with cases. I have selected 7 patients whose postoperative course for a short while was punctuated by unmistakable evidence of further depression of liver function even though they had survived the portacaval shunt procedure.

Table I shows the preoperative liver studies and the postoperative comments on the 7 cases. In respect to the latter it is to be noted that ascites appeared postoperatively in all 7 cases. Ascites occurring during the postoperative course in a patient whose portal hypertension has been relieved through the establishment of a portacaval shunt is interpreted by us to mean unmistakable clinical evidence of severe depression of liver function.

One is impressed by one fact in comparing the array of liver studies in the different cases, namely, the importance of no single test to the exclusion of others. The best example of this is the cephalin flocculation reaction which is strongly positive in 4 cases and totally negative in 3. I am inclined to believe, however, that the type of cirrhosis is a factor in this particular discrepancy. The 3 instances of negative flocculation tests were in cases of Laennec's cirrhosis, whereas, in our opinion, in 3 of the 4 cases of strongly positive cephalin flocculation reactions, the cirrhosis was of the posthepatitis variety.

Any positive advantage of the negative cephalin flocculation reaction in Cases 5, 6, and 7, would seem to be well offset by extreme-

ly low albumin percentages and the marked impairment on the part of the liver to excrete bromsulfalein. The serum bilirubin is noted to be elevated in 5 of the 7 cases.

By all odds the patient in Case 4 has the worst over-all picture and, with the exception of 1 patient (Case 5), she had the stormiest postoperative course.

The most consistent findings throughout the series of 7 cases is the marked inability of the liver to excrete bromsulfalein and make albumin. The quickest postoperative deaths from liver failure in our experience occurred in 2 patients each of whom preoperatively had a serum albumin level of 2.4 per cent. One patient was in coma and died on the second postoperative day with a blood nonprotein nitrogen of 136 milligrams per cent. The other patient died in coma on the fourth day with a blood urea of 74 milligrams per cent. One of the patients had a severe unremitting jaundice and the other had a bromsulfalein retention of 40 per cent  $\frac{1}{2}$  hour after injection.

#### CONCLUSIONS

Our experience would indicate that patients with cirrhosis, who have serum albumin levels of 3 per cent or under with bromsulfalein retention in excess of 35 per cent  $\frac{1}{2}$  hour after injection, are in general not good operative risks. Careful study of individual cases, however, will reveal, even in this group, a wide margin of risk. Particularly is this true in posthepatitis cases. It is remarkable how many of these patients can be brought through a shunt procedure safely if care is exercised in the selection of the time to operate, the preoperative preparation, and the postoperative handling.

# THE EFFECT OF REDUCED BLOOD FLOW TO THE LIVER IN RENAL HYPERTENSION

LOYAL DAVIS, M D, F A C S, CARLOS TANTURI, M D, and  
JOSEPH TARKINGTON, M D, Chicago, Illinois

THE modern theories concerning the causative factors of vascular hypertension and of their interrelationships may be stated as follows

(A) Renin, a protein-like substance, is formed in excessive amounts by an "ischemic" "anoxemic" renal parenchyma. Hypertensinogen, the precursor of hypertensin, is an alpha-globulin substance formed in the liver and has a specificity for reacting with renin, produced in the kidney, to form hypertensin, the vasopressor substance

(B) The existence of a hitherto undescribed homeostatic system for the regulation of the peripheral circulation has been disclosed in recent studies (3) "This system is made up of two components, one of hepatic (V D M), the other of renal origin (V E M). Evidence of the presence of such a circulatory homeostatic system, its mode and sites of origin, and the manner in which it regulates the behavior of the peripheral vascular bed, was first derived from studies on experimental hemorrhagic and traumatic shock. Subsequent studies have shown this homeostatic system to be likewise involved in the syndrome of experimental renal hypertension." The most probable mechanism responsible for the formation of these vasotropic factors during the shock syndrome is, as was pointed out, the reduced oxygen tension resulting from the reduction in blood flow to the liver and skeletal muscle (V D M), and the kidney (V E M)

Since it has been demonstrated that the plasma level of hypertensinogen is maintained by its production in the liver, and since a decrease in hypertensinogen is described only in some cases of experimental acute liver insufficiency (2), we have attempted to produce low grade hepatic pathology to inhibit the

formation of hypertensinogen, and thereby relieve an experimentally produced hypertension. On the other hand, reducing the blood flow to the liver should increase the formation of the vasodepressor factor considered to play a role in the homeostatic system involved in the syndrome of experimental renal hypertension

To date, we have produced renal hypertension in 5 dogs by the Goldblatt and Grollman methods and subsequently have partially occluded their hepatic arteries and portal veins to cause a relative anoxemia of the liver parenchyma. Goldblatt clamps were used to maintain a uniform and consistent caliber of the vessels. We have found a substantial reduction in the systolic blood pressure of each of the 5 animals following the reduction of the blood flow to the liver. Three of these experiments are summarized in Table I. The renal hypertension was induced by clamping the renal arteries with Goldblatt clamps, or by compressing one kidney and removing the other in a two stage operation according to the method of Grollman. In our experience, the Goldblatt procedure produces an earlier rise and a better sustained hypertension in dogs than does the Grollman technique

A Goldblatt clamp was placed on the portal vein at the entrance of the vessel into the liver above the splenic vein. The lumen of the clamp, when it is completely open and in place, is enough to reduce about one-half to two-thirds of the portal flow without producing symptoms in the animal. Another Goldblatt clamp was placed on the common hepatic artery after infiltration of the periarterial tissue with procaine solution. The hepatic plexus which surrounds the artery was carefully stripped off, this procedure avoided the vasoconstriction produced by manipulating the artery and leaves the caliber of the vessel normal. This step is essential in order to place

TABLE I—SUMMARY OF 3 EXPERIMENTS

Dog	Renal surgery	Blood pressure	Partial occlusion of portal vein and hepatic artery	Blood pressure	Course
9	5-13-48 Bilateral Goldblatt clamps	6-8-48 180 mm Hg	6-8-48 Prothrombin concentration 7-16-48 96% 7-23-48 90% 7-23-48 70% 9-24-48 80% 11-10-48 90%	6-17-48 150 mm Hg 6-19-48 130 mm Hg	Portacaval shunt, 12-3-48 Biopsy of liver 12-3-48 Blood pressure 138 mm Hg
15	7-16-48 Bilateral Goldblatt clamps Prothrombin concentration preoperatively 100%	7-27-48 175 mm Hg Prothrombin concentration 7-23-48 110%	7-30-48 Hepatic artery clamp adjusted 9-1-48 Prothrombin concentration 7-30-48 80%	8-11-48 190 mm Hg 8-23-48 150 mm Hg 8-31-48 170 mm Hg 9-3-48 150 mm Hg Prothrombin concentration 11-10-48 90%	Blood pressure has remained at 150 mm Hg for 120 days
18	Grollman method 8-4-48 Left kidney compressed by figure of 8 ligature 8-20-48 Right kidney removed	8-31-48 180 mm Hg	9-9-48 Prothrombin concentration 9-22-48 100%	9-14-48 140 mm Hg 10-12-48 80 mm Hg 11-9-48 120 mm Hg Prothrombin concentration 10-18-48 90% 11-10-48 80%	Blood pressure has remained at 120 mm Hg for 111 days Portacaval shunt 12-29-48

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After the operation the dogs showed no symptoms of illness. They remained alert and ate normally although most of them lost weight. A portal hypertension developed at the end of 2 to 3 months evidenced by dilatation of the veins in the abdominal wall. The liver showed a bright yellow color with a distinct lobular pattern. Fluid was not present in the peritoneal cavity. Histological studies of the liver will be reported upon elsewhere. Prothrombin determinations of the plasma were made periodically to detect any degree of liver injury produced by the reduced liver circulation. Variations between the normal limits always were found although some may be considered as low normal. One dog showed a reduction of 50 per cent.

In 2 dogs 130 and 111 days after the operation, a portacaval anastomosis was performed to relieve the portal hypertension and to observe the effect on the arterial blood pressure of diverting the apparently increased blood volume of the splanchnic area. To date no change in the arterial blood pressure has been

observed 30 and 20 days after this operation (Table I).

Work is in progress to investigate whether reduction of the hepatic or portal circulation is more important. Preliminary results show that by ligating the branches of the hepatic artery that enter the liver, a steady decline of systolic blood pressure is obtained in hypertensive dogs (Goldblatt type).<sup>1</sup> Experiments are also under way to determine if the surgical procedure of reducing the blood flow to the liver interferes with the production of hypertensinogen or increases the formation of the vasodepressor substance of Shorr, Zweifach, Furchgott, and Balz (V D M).

<sup>1</sup>Ligation of the liver branches of the hepatic artery in the normal dog have long been known to result in death within 24 to 36 hours. If penicillin is given immediately following the ligation the dogs live. This latter experiment has been carried out in our laboratory for the past 6 months. Markowitz, Rappaport and Scott (3) learned the same fact independently and have reported their result.

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SEPTEMBER, 1949

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### THE RH FACTOR

THE discovery of this constituent of human blood by Landsteiner and Wiener in 1940 and the further studies carried out by Wiener and his associates, by Levine and his coworkers, by Edith Potter, by Diamond, and by Hill and Haberman, of this country, have aided in the clarification of previously unexplainable transfusion reactions and in solving the mystery of hemolytic disease of the newborn (commonly called erythroblastosis fetalis). Noteworthy contributions to this subject have also been made by Coombs, Race, Taylor, Fisher and Mourant, of England, and by Chown, of Canada.

The Rh factor is really a complex, composed of the subgroups Rh<sub>0</sub>, Rh', and Rh". Eighty-five per cent of Caucasians possess the Rh<sub>0</sub> factor along with one or both the others, about 3½ per cent possess only one factor, and about 13 per cent lack all 3 factors. The latter are the true Rh negative persons, though this term is universally applied to those lacking the Rh<sub>0</sub> factor. In other races

98 per cent or more possess the Rh factor, and it has been suggested that those who do not probably have an admixture of white blood.

The Rh factor acts as an antigen and may stimulate the production of antibodies if introduced into the blood of an Rh negative individual. This may be accomplished by blood transfusion or by pregnancy produced in an Rh negative woman by an Rh positive man. Here the red blood cells evidently pass from fetus to mother through microscopic lesions in the placenta, probably seeping through all during the pregnancy. Some contend, however, that this transfer occurs most often during labor. At any rate, it appears that in pregnancy the process of antibody formation is a gradual one, so that in the first pregnancy they cannot be detected. Once the antibodies are formed, they may cross the placental barrier from mother to child in a subsequent pregnancy and attack the red cells carrying the Rh factor, thus producing hemolytic disease. Three types can be differentiated clinically, the hydropic (mortality, nearly 100 per cent), the icteric (40 to 50 per cent fatal), and the anemic (with a risk of 15 to 20 per cent). The infant may die in the uterus days or weeks before delivery, may die shortly after birth, or may survive, especially when promptly and properly treated. Once sensitization of a woman is established, it persists throughout life, and if she has lost a child from hemolytic disease, all subsequent Rh positive children borne by her will suffer the same fate. However, this mother-to-child antibody transfer does not always occur, or it may be so slight as to be of no consequence. Furthermore, about 50 per cent of such women are not capable of sensitization.

These antibodies may be of the type that cause agglutination of the red cells in saline, or they may be of the "blocking" or "incomplete" variety which prevent or "block" the agglutinating property of the first type because of their greater affinity for the combining units on the red cells. They agglutinate Rh positive cells in a protein medium. They result from more prolonged immunization, and may ultimately replace the simple antibodies, hence their presence, especially if found alone and in high titer, establishes a more serious (but by no means is this infallible) prognosis for the present, or any future infant. If one or both antibodies are found persisting in the maternal blood months or years after delivery, the outlook in a future pregnancy is especially somber.

Of the 15 per 100 females who are Rh negative, some are not in the childbearing age, some are not married, and a few are married to Rh negative men. Hence only about 9 per cent of all pregnancies occur in Rh negative women married to Rh positive men, and, as noted above, many of these women are not susceptible of sensitization. Furthermore, about 58 per cent of Rh positive men are heterozygous for the Rh factor, hence that percentage of their children should be Rh negative. Thus, only in about 1 to 350 (some say 1 to 500) deliveries will the child be affected in varying degree with hemolytic disease of the newborn. This will not occur in the first term pregnancy unless the mother has been sensitized by blood transfusion or by a pregnancy which has progressed to 4 or 5 months or more before abortion occurred. The disease is most often noted in the second or third and subsequent pregnancies, rarely not until the fifth or sixth. In 569 consecutive patients in our private practice, our group found 98, or 17.3 per cent, of the women to be Rh negative. Of these, the potentiality of Rh

sensitization was present in 43. In 24 women it did not develop, in 10 it was found, 8 were still undelivered and in 1 the outcome was not known. Of the 10 women, 6 lost a total of 8 babies. Thus, 1.05 per cent of these 569 women lost their babies from hemolytic disease. This is much higher than the ratio usually given.

Three Hr factors, the reciprocals of the corresponding Rh factors, have been found. Of these, only the Hr' is capable of producing antibodies, and that very rarely. Davenport of New Orleans, in thousands of studies, has found only 1 such case, a quadron at the Charity Hospital.

As stated, once sensitization is established, it is permanent. The recent work with the haptens by Carter offers great promise of combatting this, but much remains to be done. At present, 15 to 30 liters of blood must be processed to secure enough haptens to desensitize one patient. Phillipot has suggested the use of methionine, 5 grams daily, throughout pregnancy for its protective influence on the fetal liver, the organ chiefly affected. This may be of value, but definite conclusions cannot be drawn from the few cases so far reported.

As far as transfusion is concerned, the clinical implication is clear. Rh typing should be routine, and no Rh negative person, male or female, should receive Rh positive blood. If this has been done, either in the days before the Rh factor was known, or in case of great urgency, that patient should under no circumstances be transfused again with Rh positive blood. The risk of a fatal reaction would be too great.

In obstetrical practice the Rh type of every pregnant woman should be determined early. If she is Rh negative and has had a transfusion, the Rh type of the transfused blood should be ascertained if possible. Also, the Rh

status of her husband and of other children (if any) should be determined. If she is a multigravida, or if she is a primigravida with a history of transfusion, tests for antibodies should be done at monthly intervals after the fifth month, and if present, titers should be noted. In such a case the prognosis for the child should be guarded, especially if the titer is rising, a rising titer of blocking antibodies is considered particularly grave. We cannot be too dogmatic, however, for we have all had the experience of delivering perfectly normal Rh negative babies under such conditions.

The termination of pregnancy 3 or 4 weeks before term by cesarean section or by induction of labor has not given satisfactory results in our hands, or in the experience of others. The babies are either severely damaged already, or they are in good condition. In either instance, the hazard of prematurity is an added risk.

After delivery, the Rh type of the baby and a study of its blood should be performed at once. If the baby is Rh positive, and is jaundiced or anemic with an abnormally high percentage of erythroblasts, transfusion with Rh negative blood should be performed at once. The same is true if the baby is Rh negative, and the clinical picture is that of hemolytic disease. In such a case, the true Rh type may be masked by the presence of antibodies, or the trouble may be caused by another type of sensitization. If the baby appears normal, it should be very closely observed clinically, and with hourly blood studies, and transfused as soon as any abnormal developments are noted. We prefer the replacement transfusion, using the umbilical vein if done soon after birth, the femoral if done later. The long plastic catheters of Diamond are employed, injecting 30 cubic centimeters at a time, then withdrawing 30 cubic centimeters, injecting and withdrawing again, and continuing this

until 350 to 500 cubic centimeters of blood have been used. We consider this preferable to the use of repeated small transfusions, however, these have been used successfully in many cases.

It is important to discuss the situation frankly with the parents. One should not be overly optimistic or unduly pessimistic. As yet we do not know enough to be dogmatic in our statements.

E L KING

## ACUTE FULMINATING CHOLECYSTITIS

NOT many decades have passed since the surgeon, faced with the problem of acute fulminating cholecystitis, thought only of the establishment of a vent to the outside world through which the distended gall bladder could empty. It was quite likely that, on account of inadequate anesthesia and other factors, an all-important stone in the cystic duct, or a large one impacted in the ampulla, might be left in place, and that the fistula of the cholecystostomy would fail to close. Over the years general advances in surgery, and a better understanding of the nature of acute cholecystitis, have led to the general acceptance of prompt cholecystectomy as the procedure of choice in the average case. Twenty years ago it was the custom to let acutely inflamed gall bladders "cool off," and to wait a few days after the patient's temperature reached normal before proceeding with surgery. In many instances the process advanced to perforation instead of subsiding. In addition, it was found that operation was likely to be technically much easier early in the acute phase than it would be ten days later. Endless arguments ensued between surgeons who advocated "immediate" operation and those who considered this unwise. Much of the difference of opinion was

due to the loose use of terms and misunderstanding as to just what "early" or "immediate" meant, in relation to the onset of the attack, or to the patient's admission to the hospital

Acute cholecystitis is a dramatic disease and the appearance of the gall bladder at operation may be alarming indeed, with the huge thick red viscus often extending well down into the right lower quadrant or well out toward the flank. Fortunately, the pathology is usually not as ominous as it looks. Real empyema is the exception rather than the rule. Stones are almost invariably present, and distention of the gall bladder follows obstruction. The vascular factor then becomes important, with interference with the cystic vein and then the artery. The bacterial factor may be relatively in the background for some time. The omentum is a great shield against free perforation but perforation occurs often enough to present a real hazard. For some unknown reason acute cholecystitis seems to be commoner in males. The more treacherous and rapidly progressing type is apt to be encountered in the older age groups.

There seems not the slightest doubt that the swing of the pendulum to prompt cholecystectomy in these patients represents real progress and a very fortunate trend. However, those who are teaching young surgeons have the responsibility of pointing out repeat-

edly that there is still a definite place for cholecystostomy in the management of certain cases. Removal of an acutely inflamed gall bladder may be surprisingly simple and easy. On the other hand, engorgement, distortion, or friability may preclude the careful and complete demonstration of structures that is so essential to performance of a safe cholecystectomy.

Just as it is wise in occasional cases of appendicitis with abscess merely to establish drainage and to leave the removal of the appendix to a future date, so is it wise in certain cases of fulminating cholecystitis to limit the surgery to a careful cholecystostomy. One should never be ashamed when confessing this conservative decision to the patient or the family. If great care is taken to empty the gall bladder completely and external bile drainage appears promptly a most encouraging proportion of these patients remain well indefinitely after cholecystostomy.

If one is reasonably sure, at operation, that cholecystectomy can be safely accomplished it is surely the procedure of choice. In all other instances (probably 15 to 20 per cent) cholecystostomy should be resorted to. The decision must be made promptly and not *after* getting into serious technical difficulties. They are likely to be the sort of difficulties that are very hard indeed to get out of.

HOWARD PATTERSON

# THE SURGEON'S LIBRARY

## THE BOOK SHELF

### THE BIRTH OF AN EMPEROR

RUDOLPH MARX, M D, F A C S, Los Angeles, California

IN the Crown Prince's Palace at Berlin on the night of January 26, 1859, there was hushed excitement. Victoria Louise, daughter of Queen Victoria of England and wife of the Crown Prince of Prussia, was expecting her first child—the heir apparent of Prussia.

The large chamber of the Crown Princess was being used as the delivery room according to the custom of the times. In a corner an old maid-servant tended a wood fire in a large white porcelain stove. Outside an icy blizzard drove large flakes of snow across the Avenue, Unter den Linden. Again and again the shrieking storm, muffled by the heavy window curtains, pierced the stillness of the room and made the timid little flames of the candles shiver in their glass chimneys on the wall. Their soft reflections danced in the glass of several small pictures whose gay colors tried vainly to brighten the austerity of the high walls. These were water colors painted by the talented young princess herself. Pathetically incongruous they looked amidst the heavy draperies and carved furniture of the room—a futile attempt of the English girl to introduce a personal note into the frigid formality of her surroundings.

Beneath the heavy coverings of a huge canopied four-poster bed lay Victoria, almost hidden, a slender girl with blond hair and gray-blue eyes, a fine, slightly upturned nose and proud lips. No utterance of pain showed that she was in labor. With the self-control inculcated from childhood, she was bearing up silently as the relentless waves of pain passed through her body.

In a heavy armchair at the bedside sat the doctor, Professor Martin, the famous chief of the school of midwifery at the Hospital Charite of Berlin. The prototype of the doctor of his day, he was about forty, wore side whiskers and frock coat, and had brown hair thinning at the temples. Early that morning he had arrived at the palace with his staff of doctors, midwives, and nurses.

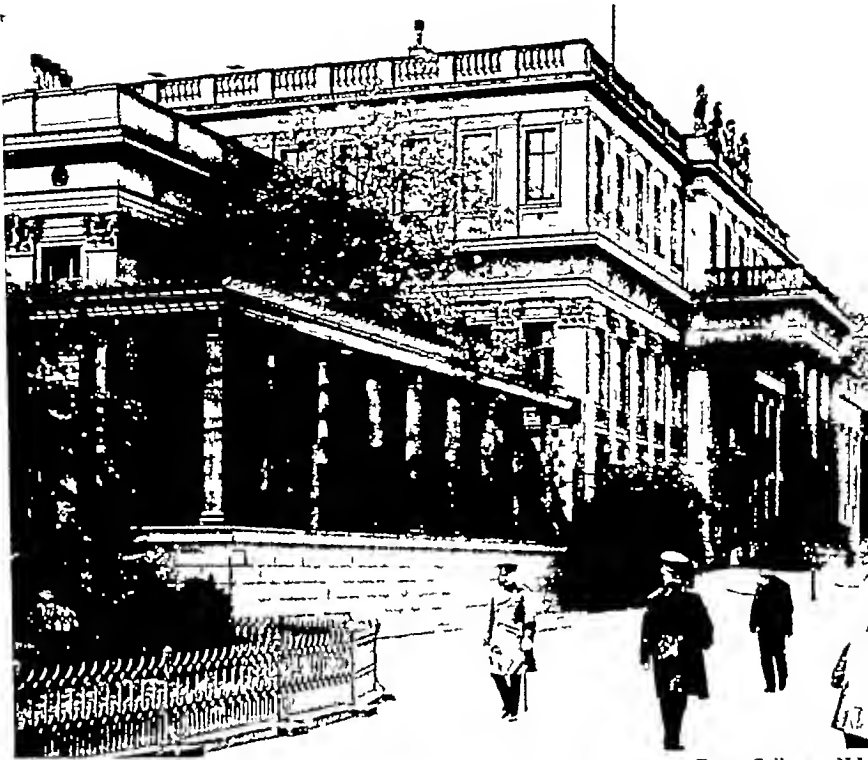
Now he sat motionless, his keen gray eyes under a deep frown of worry fixed on the expectant mother.

Only once before this day had he been permitted to examine the Crown Princess, and then only through her heavy clothing. Upon his arrival at the palace in the morning he had made a thorough examination—the findings had confirmed his worst suspicions. The position of the infant was abnormal. Instead of the head, the buttocks were poised above the pelvis. This complication, known as breech presentation, happened about once in thirty births, and was fraught with danger. Especially in a firstborn.

The doctor had tried to correct the wrong position by external version, the procedure which he had been one of the first to describe in medical literature. He had attempted to turn the infant in the womb by deep manipulation from the outside. The doctor's skilled hands, feeling the contour of the child through the abdomen, tried to shove the trunk of the baby to one side and up, at the same time pushing the head down into its proper place in the pelvis.

To relax the tense muscles of the patient, the doctor had even employed chloroform, which had been in use as an anesthetic for only ten years. But all his efforts had been in vain. The infant was apparently too large to be turned, its head too big to be accommodated in the pelvis of the small mother. During the anesthesia the doctor had also found that the birth canal had not yet widened enough to permit a manual extraction of the child.

All day long and into the night, unable to do anything further, the doctor had sat at the bedside of the princess, anxiously waiting upon the intolerably slow natural progress. He could not even relieve the travail of the expectant mother by continuing the anesthetic. The danger of chloroform for mother and child when kept up for



Ewing Galloway N.Y.

Birthplace of Wilhelm II of Germany—Crown Prince Palace, Unter den Linden, Berlin

a longer period was already known, as was also its paralyzing effect upon the spontaneous progress of labor

As the night wore on the labor pains became more frequent and severe. Finally the girl of eighteen, who had borne up for so many hours with heroic self-control, broke down. Her lips quivered, tears filled her eyes, and like any girl of her age, she cried for her mother. But the devoted mother, Queen Victoria of England, for reasons of State, could not be present. In her stead she had sent the girl's old governess to act as faithful companion and first lady-in-waiting. This little English baroness now leaned over the bed and stroked the young girl's cheek, murmuring tender words with restrained affection.

Suddenly a rustling was heard in the anteroom. Princess Augusta, wife of the Prince Regent and mother of the Crown Prince, was approaching. As she entered the room, followed by her lady-in-waiting, everyone rose and bowed.

The older princess leaned over the girl in the bed and spoke to her gently. Then she turned to the doctor and motioned him aside. In low tones the doctor told her the result of his examination

and explained the difficulties and dangers of the confinement. The only good word he could bring was the fact that his findings had revealed the baby to be a boy. Excitedly the old princess hurried out to carry the good and the bad news to her son, the blond young giant, Frederic Wilhelm of Hohenzollern, who like any other prospective father, was pacing the floor outside the room.

In a dark corner at the head of the bed, tall and motionless, stood the second lady-in-waiting, an old Prussian countess. Her black gown melted into the shadows of the heavy plush curtains on the canopied bed. Only her sharp white profile was visible in the dim light. With aquiline nose, jutting chin and stern mouth, she looked like a painting of one of her Crusader ancestors. She was of the oldest and proudest nobility of Prussia. The founder of her family, a famous Teutonic knight, had wrested the wilderness of East Prussia from the native Slavs in many a bloody battle.

Like other members of the old nobility of East Prussia, the countess looked with secret disdain upon the Hohenzollerns as newcomers and upstarts. Whereas the Teutonic knights had lived and died in Prussia since the 12th Century, the

Hohenzollerns, of undistinguished South German nobility, had not appeared until the 15th Century in Brandenburg. They had only acquired East Prussia in the 17th Century in a marriage bargain.

Now these new masters had given the Prussian nobility fresh cause for resentment. They had ignored the noble families of their own country and chosen a foreign bride for their Crown Prince.

The old countess had been watching the proceedings in the room all day with no sign of emotion. Her ears, sharpened by a lifetime of listening to the whispers of the Court, had overheard the low conversation between the doctor and the old princess.

Now she stepped forward and motioned the English baroness aside. Gravely she inquired if the baroness had heard the professor's bad news? Now she understood the dark rumors that had reached the palace from the royal court. The ghost of the "white lady" had been last night seen in the old palace at Potsdam. This apparition forbode evil to the house of Hohenzollern. The face of the little Englishwoman grew pale with anger and indignation.

"Spare me your silly superstitions and old fairy tales! You like to believe them because you hate us and wish us ill."

In a cold voice the countess answered, "But I tell you that they are not fairy tales. It is an evil omen for a child to be born breech first. Man is ordained to come into the world with his head leading. Creatures who enter the world by their extremities are possessed of base instincts."

With a gesture toward the bed the baroness tried to hush her, but the old Prussian woman would not be silenced. "Children brought forth by their feet are cursed—they are born as monsters, crippled in mind and body, and destined to bring misfortune into the world. It would be better if they were not born." Anxiously the Englishwoman searched the face of Victoria Louise, but the expectant mother, absorbed by her all-important task, was oblivious to everything outside of her.

The doctor looked up startled as snatches of the conversation reached his ears. His eyes met the cold gaze of the tall lady in black as she slowly retired into the dark corner. The doctor was well aware of the popular superstition that had survived since the Dark Ages about babies born feet first. Such children were believed to be possessed of the devil. And only too well did he know the facts on which the superstition was based. He could not help pondering the perils which this infant was facing during its journey into the world. He knew that almost one-third of firstborns de-

livered in this way were doomed to die. Of the remainder, many were crippled during birth and frequently in later life showed consequences of injury suffered during birth.

Reflecting on these dark prospects the doctor felt like a doomed man as he sat helplessly at the bedside. His was the superhuman task of solving a problem at which nature seemed to be failing. Put into his human hands was the fate of the heir of the great dynasty of the Hohenzollerns. How could a mere mortal bear the crushing burden of so great a responsibility? A silent prayer moved his lips.

The head midwife who had been listening to the heart sounds of the infant through the primitive wooden stethoscope, now motioned to the doctor. He took the stethoscope and listened. Under the continuous pressure of labor, the heart sounds of the child had become irregular—a signal of distress. The doctor checked the progress of labor and found that even after so many hours, the birth canal was still not dilated enough to allow a safe manual extraction of the child. But the ominous change of the infantile heart sounds left him no choice. There was no time to be lost if the child was to be saved. Hurdled he consulted with his assistants and ordered everything to be made ready for an immediate manual delivery.

The first assistant started to drop chloroform on a mask covering the nose and mouth of the princess. The doctor and second assistant removed their frock coats and turned up their shirt sleeves. A nurse tied aprons on them and they gave their hands a cursory wash, drying them on linen towels. Pasteur and Lister had not yet made their discoveries and the science of antiseptics was not born. The narcotized woman was placed on a marble table covered with sheets. The assistant administered the chloroform cautiously, drop by drop, aware of the narrow margin between the sleep-producing and the lethal dosage. The princess was still moving in her sleep as the doctor started his work of extracting the child.

He felt a leg and pulled on it. The left foot appeared. He succeeded in freeing the second leg without difficulty. Now he drew steadily on both legs and soon the slippery trunk emerged, the navel became visible. Quickly he loosened the tightened cord which carried the life-giving oxygen from mother to infant.

The real danger was now at hand. As the shoulder blades began to emerge, the head which followed began to encroach upon the cord, shutting off the circulation to the child. The doctor glanced at the clock on the wall impersonally ticking off the seconds. If the infant was to be born un-

harm, the doctor knew that he must complete the delivery within the next eight minutes. The brain would not be able to withstand the lack of oxygen longer without risk of permanent damage or even death.

The doctor was breathing heavily as he looked anxiously at the clock again and again. Perspiration dripped down his face and collected in drops upon his whiskers.

Now a further complication arose. During the extraction of the baby the arms had been pulled upward about the head, further reducing the narrow space within the pelvic cavity. The arms must first be freed before he would be able to draw the head through the funnel-shaped pelvis.

With some difficulty he released the right arm and pulled it down. Then his fingers searched for the left arm. To his consternation he found it caught in the nape of the neck and wedged in the pelvis. He attempted to free the arm by pushing back and rotating the infant. The arm did not budge. Frantically he looked at the clock. Six minutes had passed.

He tried again and again to free the stubborn left arm. The clock ticked on. Eight minutes were gone. Desperation gripped the unfortunate doctor. Here within his grasp was the heir to the Hohenzollerns, and it was suffocating before his eyes.

Grimly he hooked his right index finger in the crotch of the left arm and pulled with all his might. The dull, wooden sound of cracking bone sickened him—and the limp left arm fell out. Now by steady pulling, assisted by the midwife pushing from above, he succeeded at last in bringing forth the head of the infant.

The whole procedure had taken ten minutes. Hurriedly he cut and tied the cord and handed the limp blue baby boy to the midwife who carried it to another table prepared for the care of the newborn.

Pale and exhausted, the doctor staggered over and listened to the infant's heart. It was beating feverishly with scarcely perceptible sounds. But the child was not breathing. The dark blue color of the skin was changing from second to second into the paler hue of death. The midwife started artificial respiration, rhythmically compressing

and releasing the tiny chest. This brought momentarily a pinkish tinge to the baby's skin. But as soon as she stopped it turned blue again. The asphyxiated nerve centers were not yet able to animate the lungs. Every method known to science was used to revive the infant, stimulation of the skin with cold and warm water, swinging the child, but each time the external stimulation was discontinued, the lungs stopped breathing.

The greater part of an hour had passed since the birth. The infant's heart was still beating, not giving up its frantic struggle to live. In the excitement of trying to save the heir to the Prussian throne, the young mother had been almost forgotten. Lying in shock, she was unconscious of everything happening about her and seemed willing to share the fate of her firstborn.

Timidly the second midwife, a young peasant, came forward and suggested a method of resuscitation she had seen used in her village: the oldest and until today the most efficient method—mouth to mouth breathing, blowing the breath of the living into a lifeless body. The desperate doctor consented, and the young peasant girl placed her mouth to the mouth of the princeling and started rhythmically to exhale and inhale. The baby boy's color began to pinken. The legs twitched. After awhile the girl paused. All eyes were fixed on the infant. Then a miracle happened. The baby continued to breathe, filling its lungs with sufficient air to emit the complaining wail of the newborn, the first spontaneous expression of life.

The baby's first cry aroused the young mother from her deathlike slumber. And in another moment the silence of the room was broken by an outburst of joy. Doctors, nurses, and ladies of the Court were crowding around the baby, smiling, laughing, and shaking hands, as the first dim light of the morning of January 27 streaked into the room. No one paid attention to the limp left arm of the baby boy. Weeks passed before the doctors recognized that not only had the bone of the left upper arm been broken, but the nerve trunks had been injured as well. And it was years before the suspicion arose that the brain of the child had been damaged.

The infant born was Prince Wilhelm of Hohenzollern, later Emperor Wilhelm II of Germany.



## REVIEWS OF NEW BOOKS

THE volume *Conditioned Reflexes and Neuron Organization*,<sup>1</sup> by a Polish neurophysiologist working in England, is essentially a criticism of the Pavlovian theories and a rejection of them as being fundamentally unsound.

It is the opinion of the author that the Pavlov school's explanation of nervous processes is totally different from that of Sherrington, and that it constitutes a separate and independent line of inquiry. The author bases all his conceptions of higher nervous activity on the neuron theory, and though he is aware of much of the newer information concerning the rhythmic electrical activity of the brain, he feels that eventually the Sherrington concept of total nervous activity will adequately encompass the entire problem. It is his purpose in this book to extend the Sherrington theories of the total physiology of the nervous system, and at the same time to elucidate the fallacies of Pavlov. He was a pupil of Pavlov, but has rejected Pavlov's theories as actually incorrect and not adequate even for a working hypothesis in the light of experimental facts. It is the author's opinion "that study of the physiology of higher nervous activity is so complex and difficult that, if anyone formulated a system of working hypotheses which completely accorded with the factual evidence and were not internally contradictory, we should be prepared to accept that system."

The book does not present any new facts, but sticks to its purpose which is one of critique. The bibliography is largely Russian and Polish.

JOHN MARTIN

IN rereading Dr. Walter C. Alvarez' *An Introduction to Gastro Enterology*,<sup>2</sup> I have thought that few modern medical writers were so well equipped as he to write such an extensive guide to gastroenterological literature and research. George Santyana has said "Few have much time to read originals and to study facts. Leaders and busybodies must obey their momentum." Dr. Alvarez is a leader in medical thought but thanks to the Foundation of the Mayo Clinic has a wonderful opportunity to read and digest the gastroenterological literature. Those of us in the practice of medicine cannot but envy a man who has the time, energy, and ability to review and accept or reject the vast amount of material which this book embraces.

One does not like to write a review by saying the only thing for the reader to do is to read the book for him self, but it is almost impossible to point out all the many facts presented. Alvarez devotes consid-

erable space to the effects of vagotomy, because of the present day interest in the Dragstedt operation. He has added also to the chapters on the "pyloric nerves running to the bowel, the nerves of the bladder, the functions of the colon, staturoentero-enterograms, and technical methods and ratas."

This is not a clinical treatise of the scope of volumes by Bockus, but rather an application of physiology of the gastrointestinal tract to the practice of medicine. It emphasizes fundamental principles and research that may be of the greatest assistance in giving the clinician or research worker an idea such as that which started Banting on the way for insulin. For, while a great deal of laboratory and clinical work has been done (there is the quest for the Holy Grail), the problems have always been well chosen.

While we read the book for information, we cannot but be impressed by Alvarez' simple running theme comment. His style is unique and delightful.

The book is extremely important to all doctors because of the wealth of material on gastroenterology collected here. It is of equal help to busy practitioners without time to read the entire book because of the adequate summary of information at the end of each chapter. The book is a superb achievement and immensely informative. ARTHUR J. ATKIN

THE sixth edition of *Emergency Surgery*<sup>3</sup> by J. Ton Bailey is to be issued in 5 separate parts. This review covers the first 2 parts which are now available.

Part 1 contains 180 pages divided into 19 chapters. The first 4 chapters are devoted chiefly to the technique of fluid administration, including the preparation and storage of blood and plasma. The author is much impressed with the sternal route for rapid placement of blood or plasma when the need arises.

Chapter 5 covers the treatment of shock, and is little with which the reader might take issue.

Chapter 6 is devoted to the selection and administration of anesthesia for urgent operations with particular emphasis on the value of local, spinal, and intravenous methods used alone or in combination. Chapter 7 on "Impending Death under Anesthesia" reviews the methods for the treatment of blue (respiratory) asphyxia and white (cardiac) asphyxia with indications and technique for direct cardiac massage.

Chapter 8 on armamentarium is a short enumeration of the general types of instruments required for emergency surgery. This is followed by Chapter 9 which describes the technical details.

<sup>1</sup>CONDITIONED REFLEXES AND NEURON ORGANIZATION. By Jerzy Konorski. Translated from the Polish by under the author's supervision by Stephen Barry. Cambridge at the University Press, New York, Inc. Macmillan Co., 1948.

<sup>2</sup>AN INTRODUCTION TO GASTROENTEROLOGY. By Walter C. Alvarez. 14th Edition. A. C. Paul B. Hoeber, Inc., 1948.

<sup>3</sup>EMERGENCY SURGERY. Part 1 and 2. By J. Ton Bailey. 6th Edition. F. & J. T. FACCHINI, F. & J. T. FACCHINI, F. & J. T. FACCHINI, more. The Williams & Wilkins Co., 1948.

opening and closing the abdomen by various incisional approaches

Chapter 10 is devoted to the management of post-operative evisceration

Chapter 11 describes the more common lesions which may affect the abdominal wall and extraperitoneal tissues

Chapter 12 is an excellent guide for the inexperienced surgeon regarding the utilization of drainage

Chapter 13 reviews the principles concerned in the treatment of diffuse peritonitis of obscure origin and is followed by 2 chapters on the management of acute appendicitis and its complications. Many will take issue with the incision recommended for drainage of appendiceal abscess placed at right angles to the customary McBurney incision

Chapters 16 and 17 discuss the differentiation and management of acute salpingitis and other conditions simulating acute appendicitis

Chapter 18 describes in detail nonoperative methods for gastric, duodenal and intestinal decompression, and is followed by a short chapter reviewing the indications and technique for establishment of an enterostomy

Part 2 of *Emergency Surgery* contains chapters 20 through 37 and includes 207 pages

Chapters 20 and 21 describe the management of perforated gastric and duodenal ulcers, of bleeding ulcer, and of other causes of hematemesis and melena. Chapter 22 concludes the discussion of the stomach with a short review of acute dilatation, complications of gastric surgery and congenital lesions of the stomach

Chapter 23 is devoted to the common surgical lesions of the gall bladder and bile ducts. The ease with which the author is content to differentiate obstructive from toxic jaundice by the glucose tolerance test might be questioned by many surgeons. The inexperienced reader might benefit from a more detailed evaluation of the proper time for removal of common duct tubes

Chapter 24 on acute pancreatitis makes little reference to the diagnostic value of the amylase or diastase determination, but covers the treatment of this condition in a very satisfactory manner

Chapter 25 discusses the management of such miscellaneous abdominal conditions as subphrenic abscess, pylephlebitis, intraperitoneal rupture of hydatid cyst, and the recognition of abdominal crises of pernicious anemia

Chapter 26 is devoted to the management of patients who have ingested foreign bodies

Chapter 27 describes the treatment of patients with the more common intra-abdominal injuries, including rupture of the spleen or liver, lacerations of the mesentery, injuries to the pancreas, gall bladder, and bile ducts, and rupture of the intestine. This is followed by a chapter on the management of penetrating wounds of the abdomen and abdominothoracic injuries

Chapter 29 describes in detail methods of intestinal resection and anastomosis. It is doubtful whether

the telescoping method for end-to-end anastomosis warrants the enthusiasm afforded it

Chapters 30 through 37 review the common causes of intestinal obstruction in both infants and adults, and their management

These volumes represent an excellent and comprehensive review of the problems of emergency surgery by an exceptionally well qualified author

The reader may be slightly antagonized by the frequent use of the first person and constant reference to the successful accomplishments of the author, however, if one will bear in mind the tremendous experience and established ability of the author, this feature becomes only a minor annoyance. The multitude and excellence of the illustrations leave no questions in the mind of him who seeks advice from these books. The figures average nearly 2 to each page, they are sharp and distinct, and many are in color or tinted. In the opinion of the reviewer, this is a most valuable guide book for the resident surgeon and for those who must perform either emergency or elective surgery without benefit of extensive training or experience. To them, these volumes will give a real helping hand in a time of need

EDWARD W. GIBBS

THE third edition of the *Histopathology of the Peripheral and Central Nervous Systems*<sup>1</sup> has been considerably enlarged and is illustrated by 302 excellent figures, most of them photographs from the author's own collection. The division of the text into the 3 main chapters on diseases of the peripheral nerves, the spinal cord, and the brain is well suited as an aid to the clinical teaching of neurology, though this leads, of necessity, to repetitions when it comes to the description of the different neuropathologic manifestations

The book testifies to the author's encyclopedic knowledge of the neuropathologic literature. One has to appreciate the clarity with which controversial theories are cited and due credit is given to other authors. Of course, the author emphasizes his own theories though they may be opposed to other prevalent present day teaching. One wonders whether it might not have been wiser to accept some of the more modern, well established concepts, e.g. to change the idea that "the Virchow Robin spaces occupy the space between muscularis and adventitia" or that "the choroid plexus of the brain has nothing to do with the production of the cerebrospinal fluid" though others have demonstrated such secretion by injecting fluorescent dyes intravenously and observing them escaping from the choroid plexus of experimental animals

But such minor criticisms should not deter one from acknowledging the value of this textbook which has successfully guided several generations of neurologists in their study of neuropathology. The readers of this journal should be especially interested in the

<sup>1</sup>HISTOPATHOLOGY OF THE PERIPHERAL AND CENTRAL NERVOUS SYSTEMS. By George B. Hassin, M.D. 3rd rev. enl. ed. Chicago: The Author, 1948.

chapters on diseases of the muscles and of the peripheral nerves which are well represented

ARTHUR WEIL

THE second edition of *Clinical Urology*<sup>1</sup> by Lowrain E. McCrea, offers a concise kaleidoscopic picture of clinical urology for general practitioners, interns, and medical students. It consists of 503 pages, is well illustrated and the printing is very easy to read.

The author advises against all simultaneous bilateral retrograde pyelograms, but it seems to us there is very little basis for such teaching.

The treatment of sulfonamide anuria is described as excess hydration of the patient. The question of fluid exchange in such conditions is still a moot question. Many excellent clinicians believe these patients

<sup>1</sup>CLINICAL UROLOGY. ESSENTIALS OF DIAGNOSIS AND TREATMENT. By Lowrain E. McCrea, M.D. F.A.C.S. F.I.C.S. 2d ed. Philadelphia: J. A. Davis Co. 1948.

are drowned by excessive hydration.

The author should be congratulated for including a very adequate section on gonorrheal urethritis and its complications. It is refreshing to know that there are workers who realize that the genital adenitis must be checked before a gonorrheal urethritis can be pronounced cured.

It is suggested that the section of the book which deals with the so-called neurogenic bladder should include a statement concerning the transurethral resection of the vesical neck in certain of these patients.

A second edition of such a book is very commendable. The progress of medicine makes re-editions mandatory. This is valuable for general practitioners, who have so little time for extra reading. The author initiated this book for the sake of practicality. His original idea has been fulfilled. He has portrayed a simple, straightforward and logical story of urological disease and its treatment.

WILLIAM J. BAFF

## BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

MANUAL OF MEDICAL EMERGENCIES. By Stuart C. Cullen, M.D., and E. G. Gross, M.D. Chicago: The Year Book Publishers, Inc., 1949.

NEUE DEUTSCHE CHIRURGIE (P. v. Bruns) 63rd vol. NOTFALLCHIRURGIE DIE AUSFÜHRUNG DER DRINGENDEN BLUTIGEN EINGRIFFE. By Prof. Dr. Adolf Ritter. 2d revised ed. Stuttgart: Ferdinand Enke, 1949.

LA CHIRURGIE DU MOUVEMENT. By Raphaël Massart. Paris: G. Doin & Cie, 1949.

PLANNING, DESIGN AND PRODUCTION OF THE MODERN SCIENTIFIC BOOK. By Paul Perles. Brooklyn: George McKibbin & Son, 1949.

FEMALE SEX ENDOCRINOLOGY, CONCISE THERAPY. By Charles H. Birnberg, M.D. Philadelphia, London, and Montreal: J. B. Lippincott Co., 1949.

TONICS AND SEDATIVES. By Morris Fishbein, M.D. Philadelphia, London, Montreal: J. B. Lippincott Co., 1949.

FUNKTIONELLE PATHOLOGIE IN DER CHIRURGIE, CHIRURGIE UND VEGETATIVES SYSTEM, EINFÜHRUNG IN DIE KORRELATIVE CHIRURGIE. By Dr. Christiaan van Gelderen. 2d revised ed. Berlin, Göttinger, Heidelberg: Springer Verlag, 1949.

SURFACE AND RADIOLOGICAL ANATOMY FOR STUDENTS AND GENERAL PRACTITIONERS. By A. B. Appleton, M.D. (Cantab.), W. J. Hamilton, M.D., D.Sc., F.R.S., and G. Simon, M.D., B.Ch., D.M.R.I. (Cantab.). 3d ed. Baltimore: The Williams & Wilkins Co., 1949.

ESSENTIALS OF ORTHOPAEDICS. By Philip Wiles, M.D. (Lond.), F.R.C.S. (Eng.), F.A.C.S. Philadelphia: Toronto: The Blakiston Co., 1949.

THE PRACTICE OF REFRACTION. By Sir Stewart Duffelder, K.C.V.O., M.A., B.Sc. (St. And.) Ph.D. (Lond.) M.D., F.R.C.S. Hon. B.Sc. (North Western). 5th ed. St. Louis: The C. V. Mosby Co., 1949.

ATLAS OF ROENTGENOGRAPHIC POSITIONS. By Virgil Merrill. Vols. 1 and 2. St. Louis: The C. V. Mosby Co., 1949.

ESTUDOS CIRÚRGICOS. By Eurico Branco Ribeiro. Série São Paulo, Brasil. São Paulo: Editora S. A. Imprensa, 1949.

DIAGNOSTIC HORMONAL TREATMENTS HORMONAL GYNECOLOGIE. By Claude Bélère. 2d ed. 1a. Masson et cie, 1949.

THE VALUE OF HORMONES IN GENERAL PRACTICE. W. N. Kemp, M.D. Minneapolis: Burgess Publishing Co., 1949.

LEHRBUCH DER GYNEKOLOGIE. By Prof. Dr. M. Heinrich Marinius. 2d revised ed. Stuttgart: Georg Thieme Verlag, 1949.

# CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

DALLAS B. PHEMISTER, Chicago, *President*  
FREDERICK A. COLLIER, Ann Arbor, *President-Elect*

## PRELIMINARY PROGRAM FOR THE 35th CLINICAL CONGRESS—THE STEVENS, CHICAGO, OCTOBER 17 TO 21, 1949

**T**ELEVISED operations in color will be one of the new features of the thirty-fifth Clinical Congress of the American College of Surgeons and the Sixth Inter-American Congress of Surgery which will be held from October 17 through 23 with headquarters at The Stevens in Chicago. The Inter-American Congress will meet concurrently with the Clinical Congress from October 17 to 21 and will continue in session two days longer. Many delegates and other surgeons from Latin-American countries are registering, along with their colleagues from the United States and Canada, with the anticipation of a seven-day surgical program of extremely great interest. More than the usual number of guests from other continents are also expected as a result of the holding of the thirteenth Congress of the International Society of Surgery in New Orleans the week preceding the two Chicago Congresses, many of the delegates to that meeting are planning to remain in this country to attend the Clinical Congress.

Every Fellow of the American College of Surgeons is a member of the Association of Inter-American Congresses of Surgery by virtue of the fact that the College is a signatory member of that organization. Its scientific and social sessions on Saturday and Sunday are therefore open to all Fellows. The members of the other signatory societies of the Association are likewise entitled to attend the Clinical Congress clinics and scientific meetings, since it is the practice for the host country to make a joint event of its own annual surgical Congress and that of the Inter-American group.

In making hotel reservations it is therefore well to bear in mind the seven-day extent of the Congresses. The program of the separate sessions of the Inter-American Congress is quite different in

nature from that of the Clinical Congress and will offer an unusual opportunity to hear important surgical themes discussed from the standpoint of similarities and differences in methods of treatment in a number of countries. The Inter-American Congress of Surgery will undoubtedly enhance the international prestige of the American College of Surgeons and will familiarize North American Fellows and overseas guests with surgical progress in the other Americas.

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chapters on diseases of the muscles and of the peripheral nerves which are well represented

ARTHUR WEIL

THE second edition of *Clinical Urology*<sup>1</sup> by Lowrain E McCrea, offers a concise kaleidoscopic picture of clinical urology for general practitioners, interns, and medical students. It consists of 503 pages, is well illustrated and the printing is very easy to read.

The author advises against all simultaneous bilateral retrograde pyelograms, but it seems to us there is very little basis for such teaching.

The treatment of sulfonamide anuria is described as excess hydration of the patient. The question of fluid exchange in such conditions is still a moot question. Many excellent clinicians believe these patients

<sup>1</sup>CLINICAL UROLOGY. ESSENTIALS OF DIAGNOSIS AND TREATMENT. By Lowrain E McCrea, M D F A C S, F I C S. 2d ed. Philadelphia F A Davis Co. 1948.

are drowned by excessive hydration.

The author should be congratulated for including a very adequate section on gonorrheal urethritis and its complications. It is refreshing to know that there are workers who realize that the genital adnexa must be checked before a gonorrheal urethritis can be pronounced cured.

It is suggested that the section of the book which deals with the so called neurogenic bladder should include a statement concerning the transurethral revision of the vesical neck in certain of these patients.

A second edition of such a book is very commendable. The progress of medicine makes re-editions mandatory. This is valuable for general practitioners, who have so little time for extra reading. The author initiated this book for the sake of practicability. His original idea has been fulfilled. He has portrayed a simple, straightforward and logical story of urological disease and its treatment.

WILLIAM J BAKER

## BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

MANUAL OF MEDICAL EMERGENCIES. By Stuart C Cullen, M D, and E G Gross, M D. Chicago: The Year Book Publishers, Inc., 1949.

NEUE DEUTSCHE CHIRURGIE (P v Bruns) 63rd vol. NOTFALLCHIRURGIE DIE AUSFÜHRUNG DER DRINGLICHEN BLUTIGEN EINGRIFFE. By Prof Dr Adolf Ritter. 2d rev ed. Stuttgart: Ferdinand Enke, 1949.

LA CHIRURGIE DU MOUVEMENT. By Raphaël Massart. Paris: G Doin & Cie, 1949.

PLANNING, DESIGN AND PRODUCTION OF THE MODERN SCIENTIFIC BOOK. By Paul Perles. Brooklyn: George McKibbin & Son, 1949.

FEMALE SEX ENDOCRINOLOGY, CONCISE THERAPY. By Charles H Birnberg, M D. Philadelphia, London, and Montreal: J B Lippincott Co., 1949.

TONICS AND SEDATIVES. By Morris Fishbein, M D. Philadelphia, London, Montreal: J B Lippincott Co., 1949.

FUNKTIONELLE PATHOLOGIE IN DER CHIRURGIE, CHIRURGIE UND VEGETATIVES SYSTEM, EINE EINFÜHRUNG IN DIE KORRELATIVE CHIRURGIE. By Dr Christiaan van Gelderen. 2d rev ed. Berlin, Göttinger, Heidelberg: Springer Verlag, 1949.

SURFACE AND RADIOLOGICAL ANATOMY FOR STUDENTS AND GENERAL PRACTITIONERS. By A B Appleton, M A, M D (Cantab), W J Hamilton, M D, D Sc, F R S L, and G Simon, M D, B Ch, D M R E (Cantab). 3d ed. Baltimore: The Williams & Wilkins Co., 1949.

ESSENTIALS OF ORTHOPAEDICS. By Philip Wiles, M S (Lond), F R C S (Eng), F A C S. Philadelphia and Toronto: The Blakiston Co., 1949.

THE PRACTICE OF REFRACTION. By Sir Stewart Duke Elder, K C V O, M A, B S (St And), Ph D (Lond), M D, F R C S. Hon B Sc. (North Western). 5th ed. St Louis: The C V Mosby Co., 1949.

ATLAS OF ROENTGENOGRAPHIC POSITIONS. By Vinita Merrill. Vols 1 and 2. St Louis: The C V Mosby Co., 1949.

ESTUDOS CIRÚRGICOS. By Eurico Branco Ribeiro. 5th série. Sao Paulo, Brasil: São Paulo Editora S A imprima, 1949.

DIAGNOSTIC HORMONAL ET TRAITEMENTS HORMONAUX EN GYNÉCOLOGIE. By Claude Bécclère. 2d ed. Paris, Masson et cie, 1949.

THE VALUE OF HORMONES IN GENERAL PRACTICE. By W N Kemp, M D. Minneapolis: Burgess Publishing Co., 1949.

LEHRBUCH DER GYNÄKOLOGIE. By Prof Dr Med Heinrich Martius. 2d rev ed. Stuttgart: Georg Thieme Verlag, 1949.

# CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

DALLAS B PHEMISTER, Chicago, *President*  
FREDERICK A COLLER, Ann Arbor, *President-Elect*

## PRELIMINARY PROGRAM FOR THE 35th CLINICAL CONGRESS—THE STEVENS, CHICAGO, OCTOBER 17 TO 21, 1949

TELEvised operations in color will be one of the new features of the thirty-fifth Clinical Congress of the American College of Surgeons and the Sixth Inter-American Congress of Surgery which will be held from October 17 through 23 with headquarters at The Stevens in Chicago. The Inter-American Congress will meet concurrently with the Clinical Congress from October 17 to 21 and will continue in session two days longer. Many delegates and other surgeons from Latin-American countries are registering, along with their colleagues from the United States and Canada, with the anticipation of a seven-day surgical program of extremely great interest. More than the usual number of guests from other continents are also expected as a result of the holding of the thirteenth Congress of the International Society of Surgery in New Orleans the week preceding the two Chicago Congresses, many of the delegates to that meeting are planning to remain in this country to attend the Clinical Congress.

Every Fellow of the American College of Surgeons is a member of the Association of Inter-American Congresses of Surgery by virtue of the fact that the College is a signatory member of that organization. Its scientific and social sessions on Saturday and Sunday are therefore open to all Fellows. The members of the other signatory societies of the Association are likewise entitled to attend the Clinical Congress clinics and scientific meetings, since it is the practice for the host country to make a joint event of its own annual surgical Congress and that of the Inter-American group.

In making hotel reservations it is therefore well to bear in mind the seven-day extent of the Congresses. The program of the separate sessions of the Inter-American Congress is quite different in

nature from that of the Clinical Congress and will offer an unusual opportunity to hear important surgical themes discussed from the standpoint of similarities and differences in methods of treatment in a number of countries. The Inter-American Congress of Surgery will undoubtedly enhance the international prestige of the American College of Surgeons and will familiarize North American Fellows and overseas guests with surgical progress in the other Americas.

Preliminary plans for the program of the Sixth Inter-American Congress of Surgery are described in a separate article which follows. The opening or inaugural session will be held on Friday morning, October 21. This session is for delegates and special guests only. The scientific sessions on Saturday and Sunday, and the official banquet on Saturday evening, will be open to all Fellows, whose presence will help to show how deeply interested the American College of Surgeons is in the cultivation of mutually beneficial professional and social relationships among surgeons throughout the Americas.

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A general assembly for both surgeons and hospital personnel on Monday morning, October 17, will be the opening session of the varied and comprehensive program of meetings which will be held at the headquarters hotel and nearby auditoriums. Scientific sessions, official meetings, hospital conferences, showings of medical motion pictures, telecasts, and exhibits will follow during the five days of the Clinical Congress. The special sessions of the Sixth Inter-American Congress of Surgery on Friday, Saturday, and Sunday, will, according to present plans, be held in the John B. Murphy Auditorium of the College. All registrants for both Congresses will be interested in the ex-

tensive display of technical and scientific exhibits in the exhibition hall on the lower level of the headquarters hotel

#### CLINICS

Operative and nonoperative clinics will be held in some twenty hospitals in the Chicago area each day during the Clinical Congress. The hospitals which will participate in the clinical program, and which are listed later in this article, are approved by the American College of Surgeons for graduate training in surgery. The schedule of clinics, which will cover general surgery, obstetrics and gynecology, fractures and other traumas, orthopedic surgery, thoracic surgery, plastic surgery, neurosurgery, genitourinary surgery, and ophthalmology and otorhinolaryngology, will be published in a *Daily Clinical Bulletin* which will be issued each day during the Clinical Congress. The clinic schedules will also be posted on bulletin boards.

#### TELEVISION

Operations will be telecast, in color, to the hotel from St. Luke's Hospital at scheduled periods each day. The television program will be over a closed circuit, impossible to pick up on public sets. The operations and demonstrations will be transmitted to about twenty color transmission receivers in the hotel. The engineers anticipate excellent reception since the hospital is in a direct line of vision from the roof of The Stevens. The television will be sponsored by Smith, Kline & French Laboratories.

The successful demonstrations of television at the Clinical Congress in New York in 1947, and at the Clinical Congress in Los Angeles in 1948, make it highly desirable to continue the use of this medium. Even when limited to black and white images, as it was then, the surgeons were most enthusiastic. Color, demonstrated in televised surgery telecasts for the first time at the American Medical Association's convention in Atlantic City in June, greatly enhances the value of the telecasts.

Television has proved to be an ideal means of furthering the "Show me" purpose which was the main incentive for the founding of the Clinical Congress of Surgeons of North America in 1910, three years before the American College of Surgeons was organized. That first Clinical Congress was held in Chicago. The 1949 meeting will be the ninth held in that city.

#### PRESIDENTIAL MEETING

The Presidential Meeting will be held on Monday evening, October 17. The complete program

appears on another page. At this meeting the officers-elect, consisting of Dr. Frederick A. Collier, of Ann Arbor, president, Dr. Donald G. Tollefson, of Los Angeles, first vice-president, and Dr. Robert M. Moore, of Galveston, second vice-president, will be installed. The outgoing president, Dr. Dallas B. Phemister, of Chicago, will preside and will deliver the Presidential Address. His subject will be, "An Evaluation of Full-time and Group Practice for the Clinical Faculty of a Medical School."

Sir James R. Learmonth, of Edinburgh, will deliver the fourth Martin Memorial Lecture. His subject will be "Collateral Circulations, Natural and Artificial."

#### CONVOCATION

The formal initiation ceremonies for the new Fellows will be a colorful feature of the annual Convocation which will be held on the final evening, Friday, October 21. Honorary fellowships will also be conferred on this occasion. Lord Webb-Johnson, of London, president of the Royal College of Surgeons of England, will deliver the Fellowship Address. His subject will be "Science in Surgery—Stop, and Look, and Listen."

#### GENERAL SURGERY

In general surgery, the program at the headquarters hotel will embrace three evening symposia and six afternoon panel discussions.

The subjects for the symposia on Tuesday, Wednesday, and Thursday evenings, respectively, will be "Acute Surgical Emergencies in Gynecology and Obstetrics", "Blood Coagulation and the Use of Anticoagulants", and "Malignant Disease." At the Wednesday evening session there will also be presented the Fracture Oration by Dr. Otto J. Hermann, of Boston, on the subject "Fracture Hazards."

The following subjects have been chosen for the afternoon panel discussions in general surgery, the first one of which will be held from 1:30 to 3:00 and the second from 3:30 to 5:00 o'clock on Monday, Tuesday, and Wednesday: "Surgical Lesions of the Breast", "Fractures of the Skull", "Massive Upper Abdominal Hemorrhage", "New Surgical Technics in Drug Treated Infections", "The Management of Acute Emergencies Occurring during Operations", and "Preoperative and Postoperative Care and Anesthesia for Infants."

Detailed programs appear on succeeding pages.

#### SURGICAL SPECIALTIES

Panel discussions for the surgical specialties will be held on Friday afternoon from 1:30 to 4:45.

o'clock. The panels will be held concurrently in the following fields: orthopedic surgery, plastic surgery, urology, thoracic surgery, neurological surgery, and obstetrics and gynecology. Programs are shown on succeeding pages.

#### OPHTHALMOLOGY AND OTOLARYNGOLOGY

Separate programs for specialists in ophthalmology and otolaryngology are being planned, the details of which will be announced later. Operative clinics in these specialties in the hospitals will also be particularly emphasized this year.

#### SYMPOSIA ON AMPUTEES AND ON TRAUMA

A symposium on "The Care and Education of Amputees" will be held on Tuesday morning from 10 00 a m until noon. On Tuesday afternoon from 2 00 until 5 00 o'clock, a symposium on trauma will be held at which the following subjects will be discussed: "Plastic Surgical Repair of Radiation Injuries", "Observations on Results of Shoulder Cuff Repair", "Use of Intramedullary Fixation in Fractures", "A Prolonged End Result Study of 235 Intracapsular Fractures of the Femoral Neck", "An Analysis of the Management and Complications of Multiple (3 or more) Rib Fractures", "Blood and Blood Substitutes in Trauma", "Fractures of the Tarsal and Metatarsal Bones", and "Reconstructive Surgery Following Trauma." Dr. Robert H. Kennedy, of New York, chairman of the Committee on Trauma, will preside at both sessions. The programs appear on succeeding pages.

#### SYMPOSIUM ON CANCER

A symposium on cancer will be held on Wednesday afternoon from 2 00 until 5 00 o'clock, with Dr. Grantley W. Taylor, of Boston, chairman of the Cancer Committee, presiding. The program appears on a succeeding page.

#### HOSPITAL CONFERENCES

The twenty-eighth Hospital Standardization Conference will be held during the first 4 days of the Clinical Congress. Its opening meeting will constitute the first formal session of the Clinical Congress and will be for both surgeons and hospital representatives. Dr. Dallas B. Phemister, president of the College, will preside.

Hospital administrators, trustees, members of medical staffs, nurses, technicians, dietitians, and heads of the various hospital departments and their personnel, are invited to participate in the discussions at the hospital conferences which will be directed by leading authorities in the hospital

field in the United States and Canada. The program will include formal sessions, panel discussions, round table conferences, symposia, and forums. An outline of the program appears on a succeeding page.

#### FORUM ON FUNDAMENTAL SURGICAL PROBLEMS

The Forum on Fundamental Surgical Problems, one of the most popular features of Clinical Congresses during the past few years, will be held on Monday through Thursday afternoons, and Tuesday through Friday mornings. Two concurrent sessions will be held on Wednesday morning only. Brief reports of original clinical and experimental observations relating to the broad aspects of surgery and the surgical specialties will be presented under the general direction of Dr. Owen H. Wangenstein, chairman of the committee, Forum on Fundamental Surgical Problems. An outline of the main topics follows: Monday, 2 00—5 00 p m —Gall Bladder and Pancreas, Urology, Orthopedics, Plastic Surgery.

Tuesday, 9 00—12 00 a m —Surgery of the Heart

Tuesday, 2 00—5 00 p m —Vascular Surgery and Surgery of Hypertension

Wednesday, 9 00—12 00 a m —Neurosurgery

Wednesday, 9 00—12 00 a m —Thyroid, Lungs, Esophagus, Anesthesia

Wednesday, 2 00—5 00 p m —Stomach and Intestines

Thursday, 9 00—12 00 a m —Wounds and Wound Healing, Burns, Infections, Shock

Friday, 9 00—12 00 a m —Blood and Body Fluids, Portacaval Anastomosis, Cancer

The Thursday afternoon session, from 1 00 to 3 30, will be conducted as a seminar, with Dr. I. S. Ravdin as moderator, on the subject "Nutritional Problems including a Consideration of the Use of Fluids and Electrolytes."

#### ASSEMBLY OF INITIATES

The 1949 initiates will attend an assembly on Friday afternoon from 1 45 to 2 30 o'clock. Dr. Frederick A. Collier, newly installed president of the College, will preside. Dr. Irvin Abell, chairman of the Board of Regents, and Dr. Bowman C. Crowell, Dr. Malcolm T. MacEachern, and Dr. H. Prather Saunders, associate directors, will present briefly an outline of the program of the College.

#### OTHER OFFICIAL MEETINGS

The annual meeting of the Governors and Fellows of the College will be held on Thursday afternoon at 3 30 o'clock. Reports on activities



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The Advisory Committee on Programs consists of Dr George H Miller, chairman, and Doctors Warren H Cole, Sumner L Koch, Michael L Mason, Charles B Puestow, Bowman C Crowell, H Prather Saunders, Charles F Branch, and Malcolm T MacEachern

#### MEDICAL MOTION PICTURES

The showing of medical motion pictures each day will again be a popular feature of the Clinical Congress. The latest available films on surgery and related subjects will be presented. Special showings will be arranged of medical motion pictures in the fields of ophthalmology and otorhinolaryngology. Both sound and silent films will be shown, all of which will have been approved by the Committee on Motion Pictures.

Some of the newer medical motion pictures which have been or are being produced under Directing Committees of the College, will be presented during the Clinical Congress. Among these will be the film entitled "Injuries of the Peripheral Nerves" directed by Dr Loyal Davis, under a grant from the Johnson & Johnson Research Foundation. A premiere showing of this particular film will take place in the Murphy Memorial Auditorium of the College at the time of the Congress in October.

#### TECHNICAL AND EDUCATIONAL EXHIBITION

The Technical and Educational Exhibits will be held in the Exhibition Hall on the lower level of The Stevens. There will be represented leading manufacturers of surgical instruments, of x-ray apparatus, of sterilizers, of operating room lights, of ligatures, of dressings, of hospital apparatus and supplies of all kinds, and of pharmaceuticals, and publishers of medical books.

There will also be presented exhibits depicting the work of the College.

#### ADVANCE REGISTRATION

Surgeons who wish to attend the Congress should register in advance. Advance registration will greatly expedite the procedure of registering. No registration fee will be charged Fellows whose dues are paid to December 31, 1948. For endorsed Junior and Senior Candidates, the fee will be \$5.00. Non-Fellows who after individual consideration are permitted to register, will pay a fee of \$10.00. No registration fee will be required of initiates of the class of 1949.

#### HOTEL RESERVATIONS

It is desirable to make hotel reservations as early as possible. In making these, communica-

tions should be addressed to the Convention Housing Bureau, 105 West Madison Street, Chicago, stating that you will be attending the Clinical Congress of the American College of Surgeons. All hotel reservations, both for surgeons and hospital representatives, are to clear through this Bureau. No correspondence should be sent directly to the hotels. A form for reservations was recently sent to Fellows.

A list of the principal participating hotels and minimum rates follows:

Chicago Hotels	Single	Double
Atlantic	\$3.50	\$5.00
Bismarck	5.00	8.00
Brevoort	3.50	6.00
Chicagoan	3.75	5.50
Drake	4.50	7.50
Eastgate	3.50	5.50
Hamilton	4.00	6.00
Harrison	3.00	4.00
Knickerbocker	5.00	8.00
Maryland	4.00	6.00
Midland	3.00	4.50
Palmer House	4.00	8.00
Sheraton	3.85	6.40
Stevens	4.50	7.00

### PRELIMINARY PROGRAM

#### PRESIDENTIAL MEETING

*Monday, 8 15-10 30 p m —Ballroom, The Stevens*  
DALLAS B PHEMISTER, M D, F A C S, Chicago, president, American College of Surgeons, presiding

Processional—Officers, Regents, and Distinguished Guests

Invocation

Address of Welcome WARREN H COLE, M D, F A C S, Chicago, chairman, Committee on Arrangements

Introduction of Distinguished Guests ARTHUR W ALLEN, M D, F A C S, Boston, vice chairman, Board of Regents

Address of the Retiring President An Evaluation of Full-time and Group Practice for the Clinical Faculty of a Medical School DALLAS B PHEMISTER, M D

Inauguration of Officers

Presented by HOWARD A PATTERSON, M D, F A C S, retiring first vice president

First vice president DONALD G TOLLEFSON, M D, F A C S, Los Angeles

Second vice president ROBERT M MOORE, M D, F A C S, Galveston

President FREDERICK A COLLIER, M D, F A C S, Ann Arbor

The Fourth Martin Memorial Lecture Colateral Circulations, Natural and Artificial

of the American College of Surgeons, of great interest to all of its Fellows, will be presented by officers, chairmen, and administrative staff members, following the election of officers

Four important committee meetings will be held on Wednesday as follows: State and Provincial Executive Committees, 10 00 to 11 00 a m, State and Provincial Credentials Committees and Committees on Applicants and Judiciary Committees, 11 00 a m to 12 00 noon, the Committee on Trauma and Regional Committees (formerly the Committee on Fractures and Other Traumas), 3 30 to 5 30 p m, and the annual dinner and meeting of the Cancer Committee, 6 30 p m

Thursday committee meetings will include a meeting of the Committee on the Library and the annual dinner meeting of the Committee on Trauma

#### COMMITTEE ON ARRANGEMENTS AND EXECUTIVE COMMITTEE

The Chicago Committee on Arrangements and the Executive Committee for the Clinical Congress are actively at work on arrangements for the program. The membership of these committees follows

##### *Committee on Arrangements*

Warren H. Cole, M D, F A C S, chairman  
Lester R. Dragstedt, M D, F A C S, vice chairman  
Michael L. Mason, M D, F A C S, secretary  
Dallas B. Phemister, M D, F A C S, president and regent of the College  
William C. Adams, M D, F A C S  
James J. Callahan, M D, F A C S  
Fremont A. Chandler, M D, F A C S  
Edward A. Christofferson, M D, F A C S  
Vernon C. David, M D, F A C S  
Loyal Davis, M D, F A C S  
M. Edward Davis, M D, F A C S  
Paul W. Greeley, M D, F A C S  
Paul H. Holinger, M D, F A C S  
Sumner L. Koch, M D, F A C S  
Herman L. Kretschmer, M D, F A C S  
Walter G. Maddock, M D, F A C S  
Foster L. McMillan, M D, F A C S  
Karl A. Meyer, M D, F A C S  
Harry A. Oberhelman, M D, F A C S  
Willis J. Potts, M D, F A C S  
Charles B. Puestow, M D, F A C S  
Herbert E. Schmitz, M D, F A C S  
Derrick T. Vail, M D, F A C S

##### *Executive Committee*

Warren H. Cole, M D, chairman  
Lester R. Dragstedt, M D, vice chairman  
Michael L. Mason, M D, secretary  
Dallas B. Phemister, M D, president and regent of the College  
James J. Callahan, M D  
Loyal Davis, M D  
Walter G. Maddock, M D

#### PARTICIPATING HOSPITALS AND HOSPITAL CLINICS COMMITTEE

Augustana Hospital OSCAR E. NADEAU, M D, F A C S  
Children's Memorial Hospital PAUL F. FOX, M D, F A C S  
Cook County Hospital MANUEL E. LICHTENSTEIN, M D, F A C S  
Evanston Memorial Hospital J. EDWARD KEARNS, JR., M D, F A C S  
Illinois Eye and Ear Infirmary MAURICE D. PEARLMAN, M D  
Lewis Memorial Maternity Hospital HERBERT E. SCHMITZ, M D, F A C S  
Mercy Hospital-Loyola University Clinics JOHN B. O'DONOGHUE, M D, F A C S  
Michael Reese Hospital MORRIS L. PARKER, M D, F A C S  
Mount Sinai Hospital DAVID A. WILLIS, M D, F A C S  
Passavant Memorial Hospital WALTER W. CARROLL, M D, F A C S  
Presbyterian Hospital FRANCIS H. STRAUS, M D, F A C S  
Provident Hospital ULYSSES GRANT DAILEY, M D, F A C S  
St. Elizabeth's Hospital MARTIN GIRARD LUKEN, M D, F A C S  
St. Joseph Hospital LEONARD KRATZ, M D, F A C S  
St. Luke's Hospital FOSTER L. McMILLAN, M D, F A C S Assistant JOHN T. REYNOLDS, M D, F A C S  
St. Mary of Nazareth Hospital ANTHONY S. SAMPOLINSKI, M D, F A C S  
University of Chicago Clinics  
Albert Merritt Billings Hospital J. GARROTT ALLEN, M D, F A C S  
Bobs Roberts Memorial Hospital for Children J. GARROTT ALLEN, M D, F A C S  
Chicago Lying in Hospital and Dispensary WILLIAM DRECKMANN, M D  
Home for Destitute Crippled Children J. GARROTT ALLEN, M D, F A C S  
University of Illinois Hospitals JOHN T. REYNOLDS, M D, F A C S  
Wesley Memorial Hospital EARL O. LATIMER, M D, F A C S  
Hines Veterans Administration Hospital CHARLES B. PUESTOW, M D, F A C S Assistant JAMES H. CROSS, M D, F A C S

#### SPECIAL COMMITTEE ON TELEVISION

Foster L. McMillan, M D, F A C S, St. Luke's Hospital, Chairman  
Burton C. Kilbourne, M D  
Charles E. Shannon, M D, F A C S

#### GENERAL AND PROGRAM COMMITTEES

The Clinical Congress general committee which operates under the Administrative Board of the College, consists of Dr. Malcolm T. MacEachern, chairman, Miss Eleanor K. Grimm, secretary, Doctors Bowman C. Crowell, Charles F. Branch, George H. Miller and H. Prather Saunders, and Mr. Edward G. Sandrok, Mr. James S. Shannon, and Miss Laura G. Jackson. The Clinical Congress Committee on Program consists of Dr. Frederick A. Collier, chairman, and Doctors Henry W. Cave, Evarts A. Graham, and Alton Ochsner

The Advisory Committee on Programs consists of Dr. George H. Miller, chairman, and Doctors Warren H. Cole, Sumner L. Koch, Michael L. Mason, Charles B. Puestow, Bowman C. Crowell, H. Prather Saunders, Charles F. Branch, and Malcolm T. MacEachern.

#### MEDICAL MOTION PICTURES

The showing of medical motion pictures each day will again be a popular feature of the Clinical Congress. The latest available films on surgery and related subjects will be presented. Special showings will be arranged of medical motion pictures in the fields of ophthalmology and otorhinolaryngology. Both sound and silent films will be shown, all of which will have been approved by the Committee on Motion Pictures.

Some of the newer medical motion pictures which have been or are being produced under Directing Committees of the College, will be presented during the Clinical Congress. Among these will be the film entitled "Injuries of the Peripheral Nerves" directed by Dr. Loyal Davis, under a grant from the Johnson & Johnson Research Foundation. A premiere showing of this particular film will take place in the Murphy Memorial Auditorium of the College at the time of the Congress in October.

#### TECHNICAL AND EDUCATIONAL EXHIBITION

The Technical and Educational Exhibits will be held in the Exhibition Hall on the lower level of The Stevens. There will be represented leading manufacturers of surgical instruments, of x-ray apparatus, of sterilizers, of operating room lights, of ligatures, of dressings, of hospital apparatus and supplies of all kinds, and of pharmaceuticals, and publishers of medical books.

There will also be presented exhibits depicting the work of the College.

#### ADVANCE REGISTRATION

Surgeons who wish to attend the Congress should register in advance. Advance registration will greatly expedite the procedure of registering. No registration fee will be charged. Fellows whose dues are paid to December 31, 1948. For endorsed Junior and Senior Candidates, the fee will be \$5.00. Non-Fellows who after individual consideration are permitted to register, will pay a fee of \$10.00. No registration fee will be required of initiates of the class of 1949.

#### HOTEL RESERVATIONS

It is desirable to make hotel reservations as early as possible. In making these, communica-

tions should be addressed to the Convention Housing Bureau, 105 West Madison Street, Chicago, stating that you will be attending the Clinical Congress of the American College of Surgeons. All hotel reservations, both for surgeons and hospital representatives, are to clear through this Bureau. No correspondence should be sent directly to the hotels. A form for reservations was recently sent to Fellows.

A list of the principal participating hotels and minimum rates follows:

Chicago Hotels	Single	Double
Atlantic	\$3.50	\$5.00
Bismarck	5.00	8.00
Brevoort	3.50	6.00
Chicagoan	3.75	5.50
Drake	4.50	7.50
Eastgate	3.50	5.50
Hamilton	4.00	6.00
Harrison	3.00	4.00
Knickerbocker	5.00	8.00
Maryland	4.00	6.00
Midland	3.00	4.50
Palmer House	4.00	8.00
Sheraton	3.85	6.40
Stevens	4.50	7.00

### PRELIMINARY PROGRAM PRESIDENTIAL MEETING

*Monday, 8 15-10 30 p m — Ballroom, The Stevens*  
DALLAS B. PHEMISTER, M.D., F.A.C.S., Chicago, president, American College of Surgeons, presiding.

Processional—Officers, Regents, and Distinguished Guests

Invocation

Address of Welcome WARREN H. COLE, M.D., F.A.C.S., Chicago, chairman, Committee on Arrangements

Introduction of Distinguished Guests ARTHUR W. ALLEN, M.D., F.A.C.S., Boston, vice chairman, Board of Regents

Address of the Retiring President. An Evaluation of Full-time and Group Practice for the Clinical Faculty of a Medical School. DALLAS B. PHEMISTER, M.D.

Inauguration of Officers

Presented by HOWARD A. PATTERSON, M.D., F.A.C.S., retiring first vice president

First vice president DONALD G. TOLLEFSON, M.D., F.A.C.S., Los Angeles

Second vice president ROBERT M. MOORE, M.D., F.A.C.S., Galveston

President FREDERICK A. COLLIER, M.D., F.A.C.S., Ann Arbor

The Fourth Martin Memorial Lecture. Collateral Circulations, Natural and Artificial

SIR JAMES R. LEARMONTH, M B, Ch M,  
F R C S (Ed), Edinburgh, Scotland

Recessional

### CONVOCACTION

*Friday, 8 15-10 30 p m*—Ballroom, The Stevens

FREDERICK A. COLLIER, M D, F A C S, Ann Arbor, President, American College of Surgeons, Presiding

Processional—Initiates, Officers, Regents, and Distinguished Guests

Invocation

Presentation of Initiates for Fellowship IRVIN ABELL, M D, F A C S, Louisville, Chairman, Board of Regents

Fellowship Pledge Recital by Initiates

Conferring of Fellowships by the President FREDERICK A. COLLIER, M D

Conferring of Honorary Fellowships The President

Fellowship Address Science in Surgery—Stop, and Look, and Listen LORD WEBB-JOHNSON, K. C V O, C B E, D S O, T D, F A C S (Hon), London

Recessional

### EVENING SCIENTIFIC SESSIONS

*Tuesday, 8 00—10 30 p m*

Symposium on Acute Surgical Emergencies in Gynecology and Obstetrics—

General Introduction NEWELL W. PHILPOTT, M D, F A C S, Montreal

Tubal Pregnancy, Its Diagnosis and Treatment LEWIS C. SCHIFFEY, M D, F A C S, Philadelphia

Pelvic Peritonitis Occurring in the Obstetrical or Gynecological Patient FRANK GLENN, M D, F A C S, New York

Emergency Cesarean Section WILLIAM E. STUDDIFORD, M D, F A C S, New York

*Wednesday, 8 00—10 30 p m*

Fracture Oration Fracture Hazards ORTO J. HERMANN, M D, F A C S, Boston

Symposium on Blood Coagulation and the Use of Anticoagulants—

The Significance of Different Methods for Prothrombin Estimation and Their Relative Values JOHN H. OLWIN, M D, F A C S, Chicago

Studies on Antithrombin and Etiologic Factors in Phlebothrombosis JOHN H. KAY, M D, New Orleans

A Further Report on Dicumarol Prophylaxis Against Venous Thrombosis in Women

GEORGE VAN S. SMITH, M D, F A C S,  
Brookline, Massachusetts

*Thursday, 8 00—10 30 p m*

Symposium on Malignant Disease—

Chemotherapy in Malignant Neoplastic Disease CARL V. MOORE, M D, St Louis

Hormone Therapy of Cancer CHARLES B. HUGGINS, M D, Chicago

What We Have Learned from Isotopes Concerning Depletion and Repair in Surgical Patients FRANCIS D. MOORE, M D, F A C S, Boston

The Use of Radioactive Iodine in Studying the Pathologic Physiology of Thyroid Cancer RULON W. RAWSON, M D, New York

### PANEL DISCUSSIONS

#### GENERAL SURGERY

*Monday, 1 30—3 00 p m*

Surgical Lesions of the Breast—

Moderator GEORGE G. FINNEY, M D, F A C S, Baltimore

Collaborators J. MONTGOMERY DEEVER, M D, F A C S, Philadelphia, STUART W. HARRINGTON, M D, F A C S, Rochester, Minnesota, W. PERRIN NICOLSON, M D, Atlanta, HUGH H. TROUT, M D, F A C S, Roanoke

*Monday, 3 30—5 00 p m*

Fractures of the Skull—

Moderator ELDRIDGE H. CAMPBELL, M D, F A C S, Albany

Collaborators FRANK H. MAYFIELD, M D, F A C S, Cincinnati, DONALD MUNRO, M D, F A C S, Boston, HARRY B. WILKINS, M D, F A C S, Oklahoma City

*Tuesday, 1 30—3 00 p m*

Massive Upper Abdominal Hemorrhage—

Moderator JOHN H. MULHOLLAND, M D, F A C S, New York

Collaborators ROBERT ELMAN, M D, F A C S, St Louis, CHARLES G. JOHNSTON, M D, F A C S, Detroit, JOHN D. STEWART, M D, F A C S, Buffalo

*Tuesday, 3 30—5 00 p m*

New Surgical Technics in Drug Treated Infections—

Moderator CHAMP LYONS, M D, New Orleans

Collaborators HARVEY S. ALLEN, M D, F A C S, Chicago, FRANK B. BERRY, M D,

F A C S , New York, GEORGE K CARPENTER, M D , F A C S , Nashville

*Wednesday, 1 30—3 00 p m*

The Management of Acute Emergencies Occurring During Operations—

Moderator I MIMS GAGE, M D , F A C S , New Orleans

Collaborators BENTLEY P COLCOCK, M D , F A C S , Boston, DANIEL C ELKIN, M D , F A C S , Atlanta, NORMAN E FREEMAN, M D , F A C S , San Francisco, CARL A MOYER, M D , F A C S , Dallas

*Wednesday, 3 30—5 00 p m*

Preoperative and Postoperative Care and Anesthesia for Infants—

Moderator THOMAS H LANMAN, M D , F A C S , Boston

Collaborators C EVERETT KOOP, M D , Philadelphia, WILLIS J POTTS, M D , F A C S , Chicago, ROBERT M SMITH, M D , Boston

## SYMPOSIUM ON AMPUTEES

*Tuesday, 10 00 a m —12 00 noon*

ROBERT H KENNEDY, M D , F A C S , New York, chairman, Committee on Trauma, Presiding

The Care and Education of Amputees RUFUS H ALLDREDGE, M D , F A C S , New Orleans, HENRY H KESSLER, M D , F A C S , Newark, and LEONARD T PETERSON, M D , F A C S , Washington, D C

## SYMPOSIUM ON TRAUMA

*Tuesday, 2 00—5 00 p m*

ROBERT H KENNEDY, M D , F A C S , New York, chairman, Committee on Trauma, Presiding

Plastic Surgical Repair of Radiation Injuries JAMES BARRETT BROWN, M D , F A C S , St Louis

Observations on Results of Shoulder Cuff Repair HARRISON L McLAUGHLIN, M D , F A C S , New York

Use of Intramedullary Fixation in Fractures HAROLD A SOFIELD, M D , F A C S , Chicago

A Prolonged End-Result Study of 235 Intracapsular Fractures of the Femoral Neck MATHER CLEVELAND, M D , F A C S , New York

An Analysis of the Management and Complications of Multiple (3 or more) Rib Fractures DUNCAN A CAMERON, M D , Detroit

Blood and Blood Substitutes in Trauma JONATHAN E RHOADS, M D , F A C S , Philadelphia

Fractures of the Tarsal and Metatarsal Bones FRANCIS M MCKEEVER, M D , F A C S , Los Angeles

Reconstructive Surgery Following Trauma TRUMAN G BLOCKER, JR , M D , F A C S

## SYMPOSIUM ON CANCER

*Wednesday, 2 00—5 00 p m*

GRANTLEY W TAYLOR, M D , F A C S , Boston, chairman, Cancer Committee, American College of Surgeons, Presiding

Melano-epitheliomas HAMILTON MONTGOMERY, M D , Rochester, Minnesota

Benign Bone Tumors MURRAY M COPELAND, M D , F A C S , Washington, D C

Branchiogenic Cancer HAYES MARTIN, M D , F A C S , New York

What Is a Precancerous Lesion? FRED W STEWART, M D , New York

Cancer of the Kidney HERMAN L KRETSCHMER, M D , F A C S , Chicago

Sarcomas of the Soft Parts ARTHUR PURDY STOUT, M D , New York

## SURGICAL SPECIALTIES

### PANEL DISCUSSIONS

*Friday, 1 30—4 45 p m*

### ORTHOPEDIC SURGERY

Moderator GUY A CALDWELL, M D , F A C S , New Orleans

Management of Established Non-Union of the Long Bones

Collaborators HUGH SMITH, M D , F A C S , Memphis, FRANK E STINCHFIELD, M D , F A C S , New York, ALEJANDRO VELASCO ZIMBRON, M D , Mexico City

Indications and Technic for Arthrodeses of the Joints of the Foot and Ankle in Post-Traumatic Conditions

Collaborators HAROLD B BOYD, M D , F A C S , Memphis, JAMES A DICKSON, M D , F A C S , Cleveland, C LESLIE MITCHELL, M D , F A C S , Detroit

### PLASTIC SURGERY

Moderator JEROME P WEBSTER, M D , F A C S , New York

Plastic Surgery and the Treatment of Malignant Skin Disease

Collaborators JAMES BARRETT BROWN, M D ,  
F A C S , St Louis, W BRANDON MACOM-  
BER, M D , F A C S , Albany, CLAIRE L  
STRAITH, M D , F A C S , Detroit

#### The Use of Skin Homografts

Collaborators JAMES F CONNELL, M D ,  
Fort Sam Houston, WILLIAM P LONGMIRE,  
Jr, M D , Los Angeles, BLAIR O ROGERS,  
M D , Minneapolis

#### UROLOGY

Moderator GEORGE F CAHILL, M D , F A C S ,  
New York

#### Hydronephrosis Due to Upper Ureter Obstruction

Collaborators GRAYSON L CARROLL, M D ,  
F A C S , St Louis, FRED E B FOLEY,  
M D , St Paul, PARKER G SMITH, M D ,  
F A C S , Cincinnati

#### Ureteral Intestinal Transplantation

Collaborators CHARLES C HIGGINS, M D ,  
F A C S , Cleveland, VICTOR F MARSHALL,  
M D , F A C S , New York, JAMES T  
PRIESTLY, M D , F A C S , Rochester

#### THORACIC SURGERY

Moderator BRIAN B BLADES, M D , F A C S ,  
Washington

#### Surgery of the Heart and Great Vessels

Collaborators ALFRED BLALOCK, M D ,  
F A C S , Baltimore, THOMAS H BURFORD,  
M D , F A C S , St Louis, EDWARD M KENT,  
M D , Pittsburgh

#### Intrathoracic Tumors

Collaborators (Same as above)

#### NEUROLOGICAL SURGERY

Moderator ALFRED W ADSON, M D , F A C S ,  
Rochester, Minnesota

#### Chemical and Physical Diagnostic Aids in the Localization of Brain Tumors

Collaborators GEORGE MOORE, M D , Min-  
neapolis, ERIC OLDBERG, M D , F A C S ,  
Chicago, BERTRAM SELVERSTONE, M D ,  
Boston, HENDRICK J SVIEN, M D , Roches-  
ter, WILLIAM H SWEET, M D , Boston

#### Diagnosis and the Localization of Intraspinal Tumors

Collaborators PAUL C BUCY, M D , F A C S ,  
Chicago, T C ERICKSON, M D , Madison,  
HAROLD C VORIS, M D , F A C S , Chicago

#### OBSTETRICS AND GYNECOLOGY

Moderator FRANKLIN L PAYNE, M D , F A C S ,  
Philadelphia

#### Carcinoma of the Uterine Cervix—Modern Con- cepts in Diagnosis and Treatment

Collaborators ROBERT GORDON DOUGLAS,  
M D , New York, HERBERT F TRAUT, M D ,  
F A C S , San Francisco, PAUL A YOUNGE,  
M D , Brookline

#### Cesarean Section—Should the Latitude of Its Indications be Broadened

Collaborators D ANTHONY D'ESOPPO, M D ,  
New York, CARL P HUBER, M D , Indian-  
apolis, H HUDNALL WARE, Jr, M D ,  
F A C S , Richmond

#### TWENTY-EIGHTH ANNUAL HOSPITAL STANDARDIZATION CONFERENCE

*Monday, 10 00 a m -12 30 p m*

#### GENERAL ASSEMBLY

DALLAS B PREMISTER, M D , F A C S , Chicago,  
president, American College of Surgeons, Pre-  
siding

The Ever Present Challenge—Good Care of the  
Patient IRVIN ABELL, M D , F A C S , Chi-  
cago, chairman, Board of Regents, American  
College of Surgeons

The Health of the Nation—Our Greatest Asset  
HARRISON RAY ANDERSEN, D D , Chicago,  
Pastor, Fourth Presbyterian Church

The Voluntary Hospital—The Foundation of the  
Present Hospital System REV JOHN W BAR-  
RETT, Chicago, director of Catholic Hospitals,  
Archdiocese of Chicago, president, Catholic  
Hospital Association

Trends in Legislation Affecting Hospitals GEORGE  
BUGBEE, Chicago, executive director, American  
Hospital Association

*Monday, 2 00-5 00 p m*

Panel Discussion—Standards of Professional Ser-  
vices for the Good Care of the Patient as Ren-  
dered by

The Radiologist, the Pathologist, the Anes-  
thesiologist, the Physical Therapist

*Tuesday, 10 00 a m -12 30 p m*

Standards for the Institutional Care of Psychi-  
atric Patients in (a) Mental Hospitals, (b) Gen-  
eral Hospitals, Tuberculous Patients in (a)  
Sanatoria, (b) General Hospitals

*Tuesday, 2 00-5 00 p m*

Seminar and Round Table Conference  
Discussion of Standards for Hospitals

*Tuesday, 7 30-10 00 p m*

Special Collaborative Conference for Doctors,  
Hospital Trustees and Administrators

Theme Understanding and Cooperation from the standpoint of the Doctor, the Trustee, and the Administrator

*Wednesday, 8 00-9 30 a m*

Breakfast Conference on Public Relations—Joint Session for Press and Radio Representatives and Hospital and Medical Personnel

*Wednesday, 10 00 a m -12 30 p m*

Theme—Hospital Costs and Maintenance of Standards

Present and Future Trends in Hospital Costs, Financial Responsibility for the Indigent, Blue Cross and Blue Shield Plans as Factors in Relieving the Hospital's Financial Burden

*Wednesday, 2 00-5 00 p m*

Theme—The Medical Staff of the Hospital Basic Considerations in Organization, Duties and Responsibilities

Essentials of Adequate Medical Staff Organization, Control of the Professional Work, Review and Analysis of the Clinical Work

*Wednesday, 8 00-10 00 p m*

Discussion Conference with the Field Staff of the American College of Surgeons on the Activities of the College as they Affect Hospitals

Hospital Standardization and Point Rating, Graduate Training in Surgery, Medical Service in Industry, Library and Department of Literary Research, Medical Motion Pictures, Sectional Meetings, Committee on Trauma, Cancer Committee, Publications, Public Relations

*Thursday, 8 00-9 30 a m*

Breakfast Conference for Graduates and Administrative Residents of University Programs in Hospital Administration, and Course Directors Experience Exchange My First Year of Administering a Hospital

*Thursday, 10 00 a m -12 30 p m*

Theme—Discussion of Current Problems in Hospitals

General Practice Division, Methods of Improving Medical Records, Dental Service, the Administrator and the Atom, Problems of the Small Hospital

*Thursday, 2 00-5 00 p m*

Forum on Trends in Hospital Administration, New Ideas and Special Hospital Problems

Selected topics from transcripts submitted by graduates in hospital administration and administrative residents

*Thursday, 8 00-10 00 p m*

Open Forum on Nursing

Representatives of American Medical Association, American Hospital Association, American College of Surgeons, American College of Physicians, Catholic Hospital Association, American Protestant Hospital Association, American Nurses' Association, National League of Nursing Education, United States Public Health Service, United States Veterans Administration

*Friday, 10 00 a m -12 00 Noon  
and 2 00-5 00 p m*

Demonstrations in Selected Chicago Hospitals



# SIXTH INTER-AMERICAN CONGRESS OF SURGERY

Chicago, Illinois, October 17 to 23, 1949

Separate Sessions - October 21, 22, and 23

THE Sixth Inter-American Congress of Surgery will be included in the Thirty-fifth Clinical Congress of the American College of Surgeons from October 17 to 21, with headquarters at The Stevens in Chicago, and will continue on October 21, 22, and 23 with its own business, scientific, and social sessions, most of which will be held in the John B. Murphy Memorial Auditorium of the College at 50 East Erie Street.

The following surgical societies, in addition to the American College of Surgeons, are members of the Association of Inter-American Congresses of Surgery:

Argentine Association of Surgery, Buenos Aires, Argentina

Bolivian Society of Surgery, La Paz, Bolivia

Brazilian College of Surgery, Rio de Janeiro, Brazil

Society of Surgery of Chile, Santiago de Chile, Chile

Society of Hospital Surgeons, Santiago de Chile, Chile

National Society of Surgery, Havana, Cuba

Society of Medicine and Surgery of Quito, Ecuador

Mexican Academy of Surgery, Mexico, D. F.

Indo-Latin College of Surgery, Mexico, D. F.

National Association of Medicine and Surgery, Panama

Society of Medicine and Surgery, Asuncion, Paraguay

Peruvian Academy of Surgery, Lima, Peru

Society of Surgery, Montevideo, Uruguay

The American College of Surgeons joined the association by vote of the Board of Regents on June 27, 1943. This action was preceded by an invitation from Dr. Luis Vargas Salcedo of Santiago, Chile, to send two delegates as guests of honor to the First Inter-American Congress of Surgery, held in Santiago November 15 to 19, 1942. Dr. Leo Eloesser, of San Francisco, attended as delegate, and it was upon his enthusiastic recommendation that the College joined the association. He also attended the second Congress, in Buenos Aires, October 10 to 15, 1943. Dr. Alton Ochsner, of New Orleans, was delegate to the third Congress, held in Montevideo,

Uruguay, October 1 to 6, 1946. No delegates were sent to the fourth Congress, held in Rio de Janeiro in 1947. Dr. E. Payne Palmer, of Phoenix, and Dr. Hu Crim Myers, of Philippi, West Virginia, were delegates and co-relators at the fifth Congress, held in La Paz, Bolivia, October 17 to 21, 1948.

Dr. Frederick A. Collier, who will be installed on October 17 as President of the American College of Surgeons, will, as President of the signatory society of surgeons in the host country, serve as President of the Sixth Inter-American Congress of Surgery. Dr. Arnaldo Caviglia, of Buenos Aires, is Secretary-General of the Association of Inter-American Congresses of Surgery, and will set up an office in Chicago prior to and during the meeting.

The Department of State of the United States of America has issued official invitations to the governments of the eleven other countries which have surgical societies belonging to the Association of Inter-American Congresses of Surgery, to send officially authorized delegates to the forthcoming Sixth Congress of Surgery. Most of the member societies have signified the intention of appointing delegates to the Congress and most of the co-relators have also been named.

## THE PROGRAM

A preliminary outline of the program for the Sixth Inter-American Congress of Surgery follows:

*Friday morning, October 21*

Inaugural Ceremony

Address of the President of the Sixth Inter-American Congress of Surgery: FREDERICK A. COLLIER, M.D., F.A.C.S., Ann Arbor, President, American College of Surgeons

Report of the Secretary-General: ARNALDO CAVIGLIA, M.D., Buenos Aires, Secretary-General, Association of Inter-American Congresses of Surgery

Official Greetings: United States Government representatives

Greetings from the Signatory Societies: Official representatives to the Sixth Inter-American Congress of Surgery

# AMERICAN COLLEGE OF SURGEONS

Friday, 12 00-1 30, October 21

Luncheon

Friday afternoon, October 21

Specialty panels of the Clinical Congress

Saturday morning, October 22

Main Theme Acute Cramocerebral Trauma  
Relator E JEFFERSON BROWDER, M D,  
F A C S, Brooklyn, New York, U S A  
Co-relators To be appointed by each member  
country

Saturday afternoon, October 22

Main theme Treatment of Injuries in the Region  
of the Ankle with Complications and  
Sequelae  
Relator HARRISON L McLAUGHLIN, M D,  
F A C S, New York, New York, U S A  
Co-relators To be appointed by each member  
country

Saturday evening, October 22

Official Banquet

Sunday morning, October 23

Business Session  
Luncheon

Sunday afternoon, October 23

Main Theme Pulmonary Carcinoma  
Relator EVARTS A GRAHAM, M D, F A C S,  
St Louis, Missouri, U S A  
Co-relators To be appointed by each member  
country

The following committees will aid in the ar-  
rangements for the Sixth Inter-American Con-  
gress of Surgery

## COMMITTEES ON INTER-AMERICAN RE- AMERICAN COLLEGE OF SURGEONS

### General Committee on Inter-American Relations

IRVIN ABELL, Louisville, Chairman  
ALFRED BLALOCK, Baltimore  
FRANCIS P CORRIGAN, New York  
LEO ELOESSER, San Francisco  
RUDOLPH MATAS, New Orleans  
OSCAR L MILLER, Charlotte, N C  
HOWARD C NAFFZIGER, San Francisco  
ALTON OCHSNER, New Orleans

### Advisory Committee

FRANCIS P CORRIGAN, New York, Chairman  
JAMES T CASE, Chicago  
CHEVALIER L JACKSON, Philadelphia  
OSCAR L MILLER, Charlotte, N C  
HU CRIM MYERS, Philippi, W Va  
M N NEWQUIST, New York  
E PAYNE PALMER, Phoenix  
EDWARD I SALISBURY, New York

### Program Committee

ALTON OCHSNER, New Orleans, Chairman  
HENRY W CAVE, New York  
FREDERICK A COLLIER, Ann Arbor  
EVARTS A GRAHAM, St Louis

### Committee on Press and Radio

JAMES T CASE, Chicago, Chairman

### Administrative Board Committee

MALCOLM T MACEachern, Chicago, Chairman  
ALTON OCHSNER, New Orleans, Adviser  
GEORGE H. MILLER, Chicago  
ELEANOR K GRIMM, Chicago  
LAURA G JACKSON, Chicago

### Ex-Officio

WARREN H COLE, Chicago  
LESTER R DRAGSTEDT, Chicago  
MICHAEL L MASON, Chicago  
DALLAS B PEMISTER, Chicago

# THIRTEENTH CONGRESS, INTERNATIONAL SOCIETY OF SURGERY

(Société Internationale de Chirurgie)

New Orleans, Louisiana, U S A , October 9 to 15, 1949

**T**HE following announcement has been received from Dr L Dejardin, Secretary-General of the International Society of Surgery

Plans for the Thirteenth Congress of the International Society of Surgery, which will take place in New Orleans, Louisiana, under the Presidency of Professor George Grey Turner, of London, England, are now in course of preparation

The scientific program was settled by the General Assembly at the last Congress in London, held in September, 1947. This body, at the recommendation of the Scientific Committee, also accepted two additional subjects, and decided who should open each discussion. The final arrangements were as follows

- 1 Surgery and Pathology of the Pancreas, Especially in Relation to Its Endocrine Function. Opened by PROFESSOR IAN AIRD, London
- 2 Surgery of the Parathyroid Glands. Opened by DR. PAOLUCCI, Rome
- 3 Surgery of the Suprarenal Glands. Opened by DR. M R. FONTAINE, Strasburg
- 4 Pathology and Surgery of the Pituitary Glands. Opened by DR. M P MARTIN, Brussels
- 5 Treatment of Postoperative Thrombosis and Its Sequelae. Opened by DR ALTON OCHSNER, New Orleans, and DR. MICHAEL DE BAKEY, Houston
- 6 Causes of Recurrence after Operations on the Biliary Tract. Opened by DR. M R DEMEL, Vienna

In addition, the American Organizing Committee has arranged that two or three days of the meeting shall be devoted to the presentation of shorter papers on subjects of immediate interest.

The complete program, both scientific and social, will be circulated in due course

The program is being formulated by Vice President Evarts A Graham, of St Louis, Missouri

## OFFICERS FOR THE BIENNIUM

GEORGE GREY TURNER, London, England, *President*  
GORDON GORDON-TAYLOR, London, England, *Vice-President*

P MATHIEU, Paris, France, *Vice-President*  
R. DOS SANTOS, Lisbon, Spain, *Vice-President*  
EVARTS A GRAHAM, St Louis, Missouri, U S A , *Vice-President*  
SERGEI S YUDIN, Moscow, U S S R , *Vice-President*  
J VERHOOGEN, Brussels, Belgium, *President of International Committee*  
LEO A M DEJARDIN, Brussels, Belgium, *Secretary-General*  
PAUL E LORTHOIR, Brussels, Belgium, *Treasurer*  
G SPEHL, Brussels, Belgium, *Editor, "Journal International de Chirurgie"*  
I MIMS GAGE, New Orleans, Louisiana, *Secretary of the 13th Congress*

## NATIONAL COMMITTEE FOR THE UNITED STATES

RUDOLPH MATAS, New Orleans, Louisiana, *Honorary Chairman*  
ARTHUR W ALLEN, Boston, Massachusetts, *Chairman*  
ALFRED BLALOCK, Baltimore, Maryland, *Vice-Chairman*  
W BARCLAY PARSONS, New York, New York, *Secretary*  
FREDERIC W BANCROFT, New York, New York, *Treasurer*  
HARRY H KERR, Washington, District of Columbia, *Recorder*

## ADVISORY COMMITTEE FOR THE UNITED STATES

CHARLES G MIXTER, Boston, Massachusetts  
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DALLAS B PHEMISTER, Chicago, Illinois  
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HOWARD C NAFFZIGER, San Francisco, California  
IRVIN ABELL, Louisville, Kentucky  
DANIEL C ELKIN, Atlanta, Georgia  
ALTON OCHSNER, New Orleans, Louisiana

Inquiries should be directed to  
DR L DEJARDIN, *Secretary-General*  
International Society of Surgery  
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# SURGERY GYNECOLOGY AND OBSTETRICS

*Supplement*

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to preserve the sphincter mechanism at the lower end of the common duct

More than three decades ago one of Bevan's distinguished pupils, Evarts Graham, became interested in the problems of liver injury following biliary tract disease and in the repair of the liver subsequent to injury. In the intervening years we have come to know more of the changes which occur as the result of liver injury and of some of the factors which favorably influence repair. It is chiefly these problems which I want to talk about tonight. They must always be considered in the jaundiced patient who is being subjected to operation. Anyone who has studied the liver has come to know that of the three specially differentiated cells which constitute this organ (the hepatic or parenchymal cells, the cells of the bile ducts, and the reticuloendothelial cells), the hepatic cells are often the only ones to show evidence of severe, acute injury. The exception to this statement may be found in acute obstruction of the common duct associated with cholangitis. However, even under such circumstances, while the cells which line the ductal system may show severe evidence of inflammation, careful study of sections of the liver in patients suffering from cholangitis will usually show large masses of completely necrotic hepatic cells and other cells in such a state of degeneration that survival can occur only under particularly favorable circumstances. In the more chronic lesions, the hepatic cells are frequently involved in a number of processes, but the outstanding histologic change is an increase in the lobular fibrous supporting tissue.

Every clinician interested in hepatic and biliary disease has time and again seen a patient with every evidence of hepatic competency who became desperately ill within a few hours as the result of what normally is considered only a minor assault. No clear-cut delineation can now be made of the state that separates hepatic competency from incompetency. Even the results of the newer function tests are at times difficult to correlate with the changes observed upon histologic examination. The liver alone presents so serious an enigma, in it serious acute injury may coexist with evidence of vigorous regeneration. In fact, no other organ of the body possesses the ability functionally to regenerate itself under circumstances which are frequently far from the ideal.

It is important to remember that clinical jaundice in itself is of no serious consequence. The seriousness of jaundice is related to the conditions which initiated it and the factors which intensify and prolong it. In contradistinction to the jaundice associated with infectious hepatitis, the jaun-

dice of common duct obstruction may be associated with few, if any, untoward symptoms. In infectious hepatitis serious cellular injury can be demonstrated. In jaundice due to obstruction of the common bile duct without infection, extensive or even slight hepatic injury rarely is demonstrable. It is only when cholangitis intervenes that the patient becomes critically ill, and in such cases the seriousness of the illness is related to the virulence of the cholangitis and the extent of the hepatitis.

For years surgeons have talked and written of suppurative cholangitis, when in reality even a mild cholangitis is associated with varying degrees of hepatic degeneration and necrosis. The prolonged jaundice that is observed in patients who have been relieved of common duct obstruction but in whom parenchymal injury persists in spite of the fact that bile drains freely from a tube in the common duct is mute testimony of the persisting liver cell injury. Himsworth (16), in reviewing this aspect of the problem, has stated, "It would seem, therefore, justifiable to suggest that our attitude to lesions of the biliary tract should be reoriented. Cholangitis—or to speak more accurately, cholangio-hepatitis—would then be regarded as the central condition, mechanical obstruction to the large bile passages, if present, as a predisposing cause to this."

The primary conditions which confront the surgeon under these circumstances are the degree and virulence of the existing infection and the resulting parenchymal injury which these circumstances have imposed upon the patient.

It is incumbent upon the surgeon that he shall from the beginning of preoperative therapy, throughout the operation, and into the postoperative period surround the patient with those conditions which will prevent further injury and which at the earliest moment will facilitate repair. He must always assume a minimal margin of safety as regards functioning liver tissue. The sharp decline in prothrombin concentration from a relatively safe to a potentially dangerous level following anesthesia and common duct exploration, which is observed nearly daily in every large surgical clinic is an excellent example of the speed of change which may take place in the functional capacity. Whatever the degree of hepatic injury present at the time of operation, death, if it comes, is due usually to hepatic cell failure. This may be evidenced by hemorrhage, by hypoglycemia, by coma, or by a variety of other symptoms. It is evident that the condition of the liver as found at operation has become extended by further degeneration or necrosis, or both.

If we accept this concept, how can we so influence the pathological state which is present in the liver to decrease the morbidity and mortality of anesthesia and operation to the greatest extent?

The infecting organism in the majority of instances in cholangiohepatitis is a member of the colon group. Occasionally a streptococcus can be demonstrated. Zaslow, Counsellor, and Heilman have suggested that streptomycin may be ineffectual in assisting in the control of the infections associated with common duct obstruction. They have confirmed the studies of Zintel and his associates that streptomycin is excreted in the bile although the concentration in the bile does not reach that in the blood. Zaslow and his group found that as evidence of liver injury became more evident, especially in the presence of jaundice, little or no streptomycin appeared in the bile, except when the obstruction had been relieved. Our experience with the use of streptomycin has fortunately been happier than theirs. We have on numerous occasions used streptomycin with favorable influence on the objective and subjective symptoms of cholangiohepatitis. We have on a few occasions found sterile purulent material in the common duct at operation following streptomycin therapy. This has convinced us that this agent, when administered in adequate dosage, gains entrance to the liver and bile ducts and will frequently assist in the control of serious infection. Even though the surgeon is forced to operate in an emergency, the use of streptomycin will facilitate a more rapid control of the existing ductal and hepatic infection. In the chronic and recurring instances of cholangitis, streptomycin will frequently provide a sterile bile tract at the time of operation. Our limited experience with aureomycin, in a physician with an extensive and diffuse pylephlebitis with multiple abscesses, jaundice, and a positive blood culture due to an atypical diphtheroid, leads us to hope that this more recently developed antibiotic may prove to be of even greater value in the infections associated with cholangiohepatitis.

In a liver which is already the site of parenchymal cell injury as the result of pre-existing infection, further injury can be imposed by factors which detrimentally influence the blood flow to this organ. We have all observed the intense cellular changes which may occur between operation and autopsy. The mild degeneration and very limited areas of necrosis seen in the sections made from biopsy material removed at operation contrast strongly with the widespread degeneration and centrilobular necrosis found only a few days later at autopsy. These changes may at times be re-

lated directly to the anesthetic, which may have been a direct toxic agent, but they are more frequently related to circumstances that have imposed periods of oxygen deprivation on the parenchymal cells, which cells are exceedingly susceptible to oxygen deprivation.

Some years ago Goldschmidt, Ravdin, and Lucke (9) showed that when animals were subjected to anesthesia with hepatotoxic agents, the extent of the degeneration and necrosis induced by these agents could be modified favorably or adversely by varying the concentration of oxygen used with the anesthetic agent. Furthermore, degeneration and necrosis could be induced in the liver by exposing the animals to prolonged periods of low oxygen tension without the use of direct hepatotoxic agents.

The available evidence from many laboratories points strongly to the fact that an adequate and optimal oxygen supply is essential for the complete functional activity of the normal hepatic cell. The injured cell is more easily condemned to necrosis by any circumstance that alters a normal blood flow to the liver.

In 1937, Ravdin and Frazier called attention to the serious effects which at times may follow the sudden decompression of a completely obstructed common duct when the obstruction had been present for some time. The increased intraductal pressure coincident with obstruction impedes the portal blood flow and, to a lesser degree, the hepatic arterial circulation. If considerable fibrosis has taken place, the condition is still further aggravated. One of Bevan's colleagues, Herrick, showed in 1907 that the circulation of the liver was reduced greatly in cirrhosis. With the rapid release of the increased intraductal pressure an intense hyperemia in the liver is induced, and a still further impediment to the blood flow results. The degeneration and necrosis of parenchymal cells are multiplied to the extent to which further oxygen want is imposed by such a process.

Wakim and Mann demonstrated that the death of liver cells did not occur until 12 hours after rats had been exposed to the prolonged inhalation of volatilized carbon tetrachloride. Parenchymal liver cell necrosis occurs in a like period after ligation of the entire hepatic arterial supply, and so-called "liver shock," which in reality is an expression of a similar condition, rarely makes its appearance before the twelfth hour after operation.

Any circumstance which adversely affects physiological oxygenation of the hepatic cells may induce further injury. Severe anoxia due to the use of low concentrations of oxygen during anesthetization, prolonged periods of hypotension during

spinal anesthesia or in the recovery period, cyclopropane shock, and the failure to relieve gastric or intestinal distention may all condition circumstances favorable to further parenchymal injury.

Estrada, Simpson, and Vars have recently demonstrated massive or confluent centrilobular necrosis in the partially hepatectomized rat following exposure of the liver to massive gastric distention. The severity of the liver lesions which these workers produced was proportional to the strain to which the animals were subjected. A prolonged period of protein starvation accentuated the liver injury which they observed following gastric distention. Here again the adverse effect on the portal venous and hepatic arterial circulations manifested itself by extensive injury. I am not aware that any previous workers have demonstrated the importance of preventing distention, especially of the stomach, in the patient seriously ill with biliary tract disease. The demonstration that the more protein-depleted the rat was prior to operation and the greater the insult given it, the more frequent and severe was the resulting liver injury, clearly illustrates the importance of diet in the conditioning of liver injury even in the absence of direct hepatotoxic agents.

Thus, ductal obstruction with its resulting jaundice may cause little or no parenchymal injury and only minor physiological disturbances in the patient, while infection, anoxia, hepatotoxic agents, an inadequate diet, and distention may so alter the parenchymal architecture as to cause serious illness or even death of the patient.

Twenty years ago every surgeon was giving jaundiced patients glucose by the intravenous route, prior and subsequent to anesthesia and operation. It had come to be accepted following the investigations of Opie and Alford, Davis and Whipple, and others that a substantial increase in the liver glycogen would make anesthetization and operation safer. These workers had also shown that a diet containing a large amount of fat increased the susceptibility of the liver to chloroform. Nevertheless, for a period of nearly 20 years emphasis in regard to diet in the jaundiced patient was placed on the carbohydrate fraction of the dietary.

Goldschmidt, Vars, and myself (10) then demonstrated that glycogen per se did not protect the liver from injury. Our data led us to conclude that the incidence and degree of injury following anesthetization by chloroform increased with increasing concentrations of hepatic lipid regardless of the concentrations of hepatic glycogen.

The incidence and severity of the injury could be modified by the amount of protein present in the dietary for several days prior to anesthetiza-

tion. A high concentration of hepatic glycogen failed to confer any discernible protection against the hepatotoxic action of chloroform with the same concentration of hepatic lipid and a similar intake of protein in the diet. The protection against hepatic injury following a diet high in carbohydrate was found to be largely due to the reduction in the lipid content of the liver which resulted from such a diet.

A high protein diet prior to anesthetization with chloroform markedly reduced the incidence of hepatic cellular degeneration and necrosis, even in livers with a high lipid content, and therefore in the face of a severe attack by chloroform. Protein, moreover, proved to be an exceedingly active lipotropic agent. Starved animals exhibited the greatest degree of parenchymal cell injury, the incidence and degree of damage were always greater than in fed animals with the same content of hepatic lipid. These experiments suggested that the increased susceptibility of the starved animals was very likely due to their depleted protein stores, for such animals will lose as much as 20 per cent of the liver protein within 24 to 48 hours and as much as 40 per cent in 7 days (1). The direct protection against injury by protein was, in our opinion, due to some "component or components of the protein molecule." Miller, Ross, and Whipple (20) soon showed that methionine was the most important fraction of the protein molecule providing this protection in the protein-depleted dog.

The influence of diet in conditioning liver injury without the addition of direct hepatotoxic agents has more recently received widespread attention (12, 16, 18). In 1935 Weichselbaum showed that rats fed for several weeks on a diet low in protein suddenly became ill and died. He further showed that the condition could be prevented by adding cystine or methionine to the dietary. The early histologic appearance of the livers of the animals suffering from such a deficiency was one of marked hyperemia and degeneration and necrosis of the hepatic cells, continuing on to acute massive necrosis.

Himsworth (15) believes that a similar circumstance occurs in man. He states, "The original reluctance to accept a severe lesion like dietetic massive necrosis as the result of a nutritional deficiency has now been largely removed by appreciating the part played by circulatory factors in its production. It is only necessary to postulate that the deficiency leads eventually to severe swelling of the hepatic parenchyma for, once such is produced, the peculiar circulatory arrangements in the liver will automatically ensure the development of a lesion with the characteristics of mas-

sive necrosis" The interrelationship of diet and the integrity of the cellular blood supply received new emphasis from these studies

The advantages of providing a diet before and after operation on patients with jaundice and liver injury, which contained an adequate amount of a complete protein and ample carbohydrate seemed obvious The protein stored or elaborated into hepatic and other body tissue served, on the one hand, to protect the hepatic cells from further injury and to replenish a structure already attacked

The so-called labile protein which is rapidly lost during starvation is rapidly replenished by adequate feeding Miller (19) has recently reported that the loss of protein from the liver was related to the loss of certain enzyme activities Schultz has shown that in the course of a 6 day fast there was close to a 50 per cent loss of liver weight and liver nitrogen along with an average loss of body weight of only 10 per cent The enzyme activity of the liver which Schultz studied was decreased by 66.6 per cent during the 6 day fast The importance of normal enzyme activity in maintaining cell integrity is now well recognized These studies provide an additional explanation of the physiological deficiencies which occur in the liver during protein starvation

Studies of the human liver from specimens taken by us at operation showed that unusually large increments of lipid were frequently present in the livers, especially those of patients with cholangiohepatitis The presence of large increments of fat in these patients may be a predisposing factor, in addition to infection, in the production of the hepatic fibrosis which certain of the patients develop with enlargement of the spleen, ascites, and even hematemesis It seemed highly desirable that such excess hepatic lipid be released from the liver prior to operation and kept out of it later

It was upon such evidence and reasoning that we suggested the high carbohydrate, high protein, low fat diet as a means of preparing the patient with cholangiohepatitis for operation When this dietary was used in patients in whom we had reason to believe from our earlier studies that excess lipid existed in the liver, the lipids found in the liver at operation were at, or only slightly above, the normal level We became convinced that such patients did better after anesthesia and operation We gained the impression, based purely on clinical response, that recovery was facilitated The surgeon's responsibility does not cease with the removal of one or more common duct stones or the successful excision of a disabling stricture In the cure of the patient regeneration of the damaged parenchyma, once the obstruction of bile flow and

the infection are relieved is of fundamental importance

There are indeed evidences in infectious hepatitis and more rarely in the milder types of cholangiohepatitis, that the two processes of damage and repair proceed at the same time under favorable conditions

The older literature on liver regeneration is concerned chiefly with the total liver mass and with morphology Relatively little was known regarding the chemical composition of the liver during repair The pioneer study of Higgins and Anderson on regeneration in terms of total liver mass included some values for the water component Also, very little was known concerning the behavior of liver protein after partial hepatectomy The latter is important from a number of viewpoints Walter and Addis had suggested that the protein content of the liver, rather than the organ's total mass, is the measure of effective liver size Since regenerating parenchyma requires protein components for cell synthesis, it seemed interesting to determine the rate of regeneration on a normal diet, on abnormal diets, and on dietaries containing proteins known to be deficient in certain essential amino acids

It was found by Gurd, Vars, and myself that during a 14 day interval after partial hepatectomy both protein-fed and nonprotein-fed rats regenerated liver tissue which was essentially normal in gross composition Water, glycogen, lipid, and protein were all incorporated into the new liver substance in relatively normal proportions, although at varying rates

The rate of appearance of new liver protein was most rapid during the first 2 days in both the protein-fed and protein-starved groups which suggested that survival indeed depended upon rapid regeneration, as well it may The higher the concentration of an adequate protein (casein) in the diet, the more rapid and complete the regeneration of the liver The difference in rate and completeness of regeneration closely paralleled the amount of protein available The necessity of the protein-starved group to obtain protein for regeneration from endogenous sources greatly limited complete repair Nevertheless, the increment of liver protein formed by the protein-starved group represented an increase of almost two and one-half times the liver protein present at the close of the partial hepatectomy In both groups the increase in liver protein between the eighth and fourteenth days was small Only when the diet consisted of casein in amounts of 50 per cent of the total calories was a significant increase obtained Under these circumstances the most nearly com-

plete regeneration of the original protein was achieved. It is interesting to note that Cole found such high protein diets of great help in overcoming protein deficits in surgical patients.

An outstanding fact was that protein-starved rats regenerated liver tissue by utilizing protein solely from endogenous sources. The fact that the liver protein reached a plateau after 8 days suggests that an equilibrium was reached between the liver and body tissues when a certain level of regeneration was obtained. It would seem as if the emergency needs of the liver to replace its own deficiency of protein having been met, other body tissues participated more actively in their demands for protein.

The data are interesting also because they contain evidence suggesting that the rate of regeneration may be greater in the case of greater need. The most rapid rate of regeneration was during the first 2 postoperative days. The percentage increase in the rate of appearance of new liver protein in the first 2 days was greater in the protein-starved animals than in the animals fed casein before and after operation. Such a circumstance strongly suggests a more potent stimulus to liver recovery in the animals with an initial more severe reduction of liver substance. Survival may indeed have been dependent upon the ability of such livers more actively to express their urge to regenerate even under unfavorable circumstances.

In an extension of these studies it was found that the ingestion of 5 per cent of casein in the diet, although inadequate to prevent weight loss or to keep the animals in positive nitrogen balance, led to a substantial increase in the liver protein following hepatectomy. At higher levels of protein intake the increase in body weight and liver protein appeared roughly parallel. Attention should be directed to the animals fed 5 per cent casein with and without methionine. Without showing a gain in body weight they all displayed a significant increase in regenerating liver protein over that in the rats on the nonprotein diet. While progressive increases in the intake of an adequate protein were associated with progressive increases in the amount of liver protein laid down, the introduction of methionine at a 1 per cent level into each such dietary appeared to augment the effect of the protein alone to a small but consistent degree.

The feeding of other proteins at dietary levels isonitrogenous with the 10 per cent casein diet led to widely varying effects. Gelatin and zein led to no more regeneration of liver protein than occurred on a nonprotein diet. These data illustrate the fallacy of depending on nitrogen balance studies. Wheat gluten resulted in a moderate in-

crease. Liver protein was comparable to casein. Fibrin and whole egg protein led to a greater amount of new liver protein than did casein at the same dietary level. The quality of the ingested protein was of importance in facilitating complete repair.

The degree of regeneration of liver protein occurring in previously protein-starved animals may be greatly enhanced by postoperative protein feeding in proportion to the level and the biological value of the protein fed.

There are certain inherent difficulties in the feeding of a diet, either to the experimental animal or man, in which dietary fat is excluded or limited to a very great extent. Not only are necessary dietary components important in a nutritional program, but the ingestion of a sufficient number of calories is equally important to both the experimental animal and, to an even greater extent, in man the total food consumption and therefore the caloric intake is increased by the addition of fat to the diet.

Several years ago Hoagland raised the question as to whether it was necessary that dietary fat be greatly restricted in patients with, and recovering from, infectious hepatitis.

In our earlier studies we had indeed obtained some data which demonstrated that this was possible. In our later studies of liver protein regeneration and nitrogen metabolism the diets used were made to contain only 3 per cent of fat, which provided 7 per cent of the calories. The work of Fox, Swift, and their associates (7, 8), of Deuel and of others suggests that the inclusion of adequate amounts of fat in the diet improves utilization of energy and the physical fitness of normal animals. Vars, Friedgood, and I have more recently investigated the effect of adding 10 per cent and 30 per cent of a good fat to a nonprotein diet and to diets containing casein upon liver protein regeneration and nitrogen metabolism after partial hepatectomy.

An increased percentage of fat calories in a nonprotein diet did not increase the conservation of nitrogen as measured by liver protein regeneration, although it decreased the negative nitrogen balance somewhat. A good fat added to a protein diet in which the protein to fat calorie ratio remained constant caused a greater food intake with an associated increase in liver protein generation and a more positive nitrogen balance. This was also true in controls not operated upon. Ingestion of an increased percentage of calories as fat during a period of isonitrogenous, isocaloric feeding produced an equal amount of, and in some instances an increase in, liver protein regenera-



as when fat was restricted Liver protein regeneration also occurred even when the liver became excessively fatty after removal of choline from the diet

When the liver is to be exposed to hepatotoxic agents with necrotizing action which is intensified by the presence of large increments of hepatic lipid, a diet in which fat is somewhat restricted may still be advantageous Our data would suggest, however, that when proteins of good quality containing adequate amounts of methionine, cystine, and choline are incorporated in the dietary, there occurs no increase in the liver lipid content, but a substantial increase in liver protein Surely during periods of recovery when attempts are being made to stimulate liver regeneration, the addition of an adequate fat to an otherwise satisfactory ration would appear now to be highly desirable and should be adopted in the care of patients with liver disease

I would have enjoyed discussing with you many of the other problems associated with surgical jaundice They are numerous and important, but their pathologic physiology is in many instances not yet clear I therefore preferred to talk about several aspects of the subject about which, as the result of the work of many investigators, more is known These data provide a rational basis for improving the condition of the liver prior to, and subsequent to operation If generally accepted, they should lead to reduction of the morbidity and mortality of operations on the biliary tract associated with jaundice and to reduction of the incidence of disabling fibrosis of the liver due in part to deficiencies of a dietetic nature and to infection

While Bevan himself did not participate in such studies, his intellectual descendants have added immeasurably to our fuller understanding of a wide variety of man's diseases, and their contributions to our knowledge of the pathologic physiology of biliary tract disorders are of great importance

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# ABSTRACTS OF CURRENT LITERATURE

## SURGERY OF THE HEAD AND NECK

### EYE

**Ocular Signs in Head Trauma** ARTHUR B. KING and FRANK B. WALSH *Am J Ophthalm*, 1949, 32 379

In prefrontal lobotomy the anterior oculogyric pathways are seldom interrupted so that deviation of the eyes rarely follows. In the parietal lobe, bilateral trauma of the angular gyri results in spatial agnosia. At the level of the temporal lobe interruptions of the optic radiations produce sector defects or complete homonymous hemianopsia with or without macular sparing.

Removal of one occipital lobe results in hemianopsia but the associated interference with the fixation reflex may account for sufficient unsteadiness of fixation so that sparing of the macula results. In more anterior lesions the optic fixation reflex is not impaired and splitting results. Cortical control of convergence and divergence has not been proved by injury cases, but the divergence during sleep, anesthesia, and trauma supports this concept. Visual hallucinations, when formed, point to the temporal lobe, but when they are but a vague sensation of light the occipital lobe is probably involved.

Injuries to the brain stem produce transient ocular muscle palsies. Ptosis is not uncommon. Conjugate deviation of the eyes of pontine origin tends to be permanent while that of cortical origin tends to be transient. Persisting nystagmus points to brain stem damage.

In carotid-cavernous sinus fistula, the detection of a bruit must be accompanied by engorgement of ocular vessels or proptosis to establish the diagnosis. The globe pulsates synchronously with the heart beat. Papilledema in the affected eye occurs late. Ligation of the internal carotid artery produces a cure generally.

In extradural hematoma from ruptured middle meningeal artery there is early a sluggish pupillary light reflex on one side, later there is inequality and a dilated fixed pupil. Incomplete ptosis or divergent strabismus may be present. After 24 hours papilledema may be noted. When both pupils become dilated and fixed, death is near.

Chronic subdural hematoma often shows an enlarged pupil sluggishly reacting to light, if at all. Papilledema develops late. Subhyaloid retinal hemorrhages are commonly seen in infants but almost never in adults.

Ecchymosis of the lids and conjunctiva seen in basal skull fracture is distinguished by several features: the extravasated blood makes a circle limited by the palpebral fascia to the orbital margin, the discoloration is purplish from the beginning, the hemorrhage is subconjunctival and shows no pos-

terior limit, and the blood is first seen in the lower lid at the medial border.

Subarachnoid hemorrhage should be treated conservatively. Ventriculograms, encephalograms, and arteriograms are not recommended in the acute stage of head injury. Operative intervention is indicated for the evacuation of collections of blood, and for the repair of compound and depressed fractures. Subtemporal decompression for increased intracranial pressure has questionable value.

JAMES E. LEBENSOHN, M.D.

**The Eyes in Mongolism** RONALD F. LOWE *Brit J Ophthalm*, 1949, 33 131

Retardation of growth in mongolism affects the whole body. The small maxillae and orbital ridges cause the flattened appearance of the face. The short sagittal diameter of the skull changes the inclination of the orbital axes from the normal 45 degrees to about 75 degrees. The mongoloid palpebral features are characterized by epicanthus, obliquity, shortness, and an even arch of the upper lid margin—all due to a developmental disturbance of the surface ectoderm. Alopecia is moderately common.

The iris frequently shows poverty of the stromal fibers in the outer third of its surface, and in blue irides there is peripheral pigment speckling in the form of small golden or whitish splashes. In adults the eyes are set about 5 mm. closer than normal, the average interpupillary distance being 55 mm. The pupils are normal.

Cataractous changes of various types are commonly seen after the age of 8. The slit lamp may show arcuate opacities in the deepest layers of the fetal nucleus, and dustlike and flake opacities in the infantile and adult nucleus. About 1 in 4 eyes reveal opacities of the Y sutures of the fetal nucleus. The arcuate opacities are opaque lens fibers, probably caused by abnormalities in the regressing tunica vasculosa. The flakes are of two types: (a) minute dots internal to the equator and more peripherally and (b) equatorial white spokes resembling the usual coronary cataract. The ordinary congenital cataract may also be present in the lamellar, disc shaped, and posterior polar types. Myotonic cataracts superficially resemble those in mongolism but involve the cortex especially and advance rapidly to maturity.

Congenital myopia occurs in one third of the cases. Nystagmus is common and is associated generally with lens opacities or high myopia, the exclusion of suitable retinal impulses preventing the development of the fixation reflex. Convergent strabismus affects more than half of the cases. Divergent strabismus or vertical deviation does not occur. Abduction weakness is frequently seen with congenital myopia.

## SURGERY OF THE HEAD AND NECK

Mongoloids are very susceptible to infection of all mucous surfaces. The conjunctiva, respiratory and gastrointestinal tracts are particularly susceptible. Intraocular infection is rare.

The developmental anomalies suggest that the disturbance begins very early in fetal life, probably in the first 4 to 8 weeks.

JAMES E. LEBENSOHN, M.D.

**Studies in Experimental Ocular Tuberculosis Effect of "Promin" and "Promizole" in Experimental Ocular Tuberculosis in the Normal Rabbit** ALAN C. WOODS and EARL L. BURKY  
*Arch Ophthalmol*, Chic, 1948, 40: 1

The authors have previously shown that promizole and promine exert a strongly deterrent effect on ocular tuberculosis in immune-allergic rabbits. The current experiments were performed on normal animals that had not developed an immunity to reinfection. The anterior chambers were inoculated with a virulent human strain of tubercle bacilli, and equal groups were observed as controls or were treated with promine or promizole.

Clinically a slight deterrent action of the drugs was noted after 2 weeks of treatment and this was somewhat more pronounced after a period of 8 weeks. Histologically there was but slight difference in the degree and the extent of the disease in the eyes of treated and control animals. All transmission experiments with the treated animals gave positive results indicating that large numbers of living virulent bacilli were still present in the uveal tracts. It is concluded that promine and promizole have a limited bactericidal effect on the tuberculous process becomes evident only when the tuberculous process is so restrained by a systemic immunity that it is brought within the therapeutic range of the compounds.

FRANK W. NEWELL, M.D.

**Motor Block of Extraocular Muscles by Deep Orbital Injections** HAROLD GIFFORD, JR.  
*Arch Ophthalmol*, Chic, 1949, 41: 5

The author gives a detailed description of the anatomy of the orbit with specific details as to the position of the motor nerves and muscle cone. He favors a more complete retrobulbar anesthesia for extraocular muscle paralysis to prevent the loss of vitreous in intraocular surgery.

The method used by him requires a 5 cm needle, No. 25 (Becton Dickinson). It is inserted through the skin just inside of the lower temporal rim of the orbit. It is directed toward the apex of the orbit so that it goes through Tenon's capsule midway between the lower edge of the external rectus muscle and the lateral edge of the inferior rectus muscle. The needle is plunged through the fascia into the muscle cone and is "floated" back from here toward the upper lateral corner of the orbit. The needle is plunged in 5 cm. Two cubic centimeters of 2 or 4 per cent procaine hydrochloride with 0.4 cc of adrenalin to the ounce is used. If complete anesthesia is not obtained with the first cubic centimeter the

needle is withdrawn slightly and re-inserted to reach the active muscle, and more anesthesia is injected.

EARL H. MERZ, M.D.

**Fractures of the Orbital Floor** ARTHUR GERARD DE-VOE  
*Arch Ophthalmol*, Chic, 1948, 39: 595

In this article the author presents 34 cases in which the late treatment of orbital floor fractures was discussed.

Such repair is best carried out by the ophthalmologist, and may take the form of operation on the extraocular muscles or substitution of inert substance in the orbital floor in order to restore orbital volume or elevate the globe to proper position. The inert substance may be cartilage, spun glass, bone, vitallium, or tantalum.

The early treatment of orbital fractures is discussed in a review of the recent literature because most of the patients were treated by surgeons other than ophthalmologists.

EARL H. MERZ, M.D.

**A Fundus Dystrophy with Unusual Features (Late Onset and Dominant Inheritance of a Central Retinal Lesion Showing Edema, Hemorrhage, and Exudates Developing into Generalized Choroidal Atrophy with Massive Pigment Proliferation)** ARNOLD SORSBY, MARY E. JOLL MASON, and NORMAN GARDENER  
*Brit J Ophthalmol*, 1949, 33: 67

This is a carefully prepared, exacting report on 5 families whose members showed certain similar ocular characteristics designated as a fundus dystrophy.

- 1 The affection was dominant in character
- 2 It became manifest at about the age of 40
- 3 It began as a central lesion showing edema, hemorrhage, and exudation. This was followed by atrophy and excessive pigmentation involving the entire choroid.

The condition in all of the family members followed the same pattern and offered a poor prognosis. The choroid was the diseased tissue. This condition seems to be a clear cut disease entity.

EARL H. MERZ, M.D.

**Mycotic Infection of Eye** HUGH C. DONAHUE, JR.  
*J Ophthalmol*, 1949, 32: 207

Concretions of the canaliculi due to fungus infection have been frequently noted but mycotic involvement of the lacrimal sac and duct is rare. Such infection from *Aspergillus niger* has not been previously described. Of the *Aspergillus* family, only the species *fumigatus* and *niger* are pathogenic to man. Infection occurs most often in those exposed to fungus spores, such as bird feeders, fur cleaners, and agricultural workers.

The case reported concerned a 12 year old girl who complained of left epiphora and discoloration of the conjunctival aspect of the medial angle of the left lower lid. Around the lower punctum was a discoid, brown-black elevated area, 1 cm in diameter. The punctum itself was completely occluded by a black substance which resembled the tip of a lead pencil.

No fluid could be irrigated into the nose from the upper punctum, and pressure on the lacrimal sac yielded no discharge. After a tiny incision over the lower punctum a sticky tenacious molasseslike fluid was expressed with complete disappearance of the previous discoloration. Fluid was then easily irrigated through either canaliculus into the nose. Permanent recovery from the symptoms followed.

Direct examination of the material showed mycelium fragments and numerous spores. Culture on Sabouraud's dextrose agar gave a growth of typical *Aspergillus niger* with the characteristic conidiphores and spore changes.

JAMES E. LEBENSOHN, M D

**Role of Inheritance in Glaucoma** ADOLPH POSNER and ABRAHAM SCHLOSSMAN *Arch Ophthalmol*, Chic, 1949, 41 125

Of 373 unselected patients with primary glaucoma, 51 belonging to 30 families had one or more relatives affected with the disease. In many families there were similarities in the behavior of the disease with respect to type, refractive error, severity, and response to surgical treatment. All the pedigrees showed dominant heredity except one in which it may have been recessive. The pedigrees of 28 of the 30 families are included.

FRANK W. NEWELL, M D

**The Technique of Goniotomy for Congenital Glaucoma** OTTO BARKAN *Arch Ophthalmol*, Chic, 1949, 41 65

This article explains in detail the technique of goniotomy for the treatment of congenital glaucoma. The embryonic tissue in the angle is peeled or stripped away to allow free access of the aqueous to the drainage system in the anterior angle.

In 66 of a total of 76 eyes, pressure was normalized and vision was maintained or restored. Early surgery is certainly advantageous.

The mode of action, and the indications, contraindications, and technique of goniotomy are discussed.

EARL H. MERZ, M D

**Necrosis of the Intraocular Tissues** BERNARD SAMUELS *Arch Ophthalmol*, Chic, 1948, 40 101

The present article on necrosis of intraocular tissues is based on a series of 800 eyeballs which presented microscopically visible necrotic tissue.

Degeneration, atrophy, and gangrene are associated with necrosis. Degeneration signifies alteration in the metabolism of the cells of a tissue, atrophy denotes diminution in the size of cells or of tissues after maturity. Degenerated or atrophic tissue may be converted into necrotic tissue. Gangrene denotes necrosis which follows invasion by saprophytic organisms. Necrosis means the local death of cells or of tissues in an organ which continues to live.

There are two types of intraocular necrosis—non-inflammatory and inflammatory.

In the noninflammatory type, necrosis may be caused by circulatory disturbances (1) in iridod-

alysis, when the arteries, veins, and nerves of the iris are severed from their connection with the ciliary body, (2) in cyclodialysis, when the anterior ciliary arteries are severed, part of the ciliary muscle becomes necrotic, (3) in glaucoma, when the blood supply is arrested the iris and the ciliary processes become necrotic.

In the inflammatory type, the necrosis is caused by the toxins of pyogenic bacteria which may be *exogenously* located in the cornea. The toxins from a serpiginous ulcer may diffuse into the aqueous to set up a condition of intoxication which is severe enough to cause necrosis of the iris and hyperemia of the blood vessels of the ciliary processes and even of those of the retina. Bacteria may also be located *endogenously* (a) in the anterior chamber, setting up an infection in contradistinction to an intoxication, and (b) in the vitreous body. Infection confined to the anterior chamber is far less serious than that which is located in the posterior chamber or in the vitreous, because the ciliary body is affected in the latter. Bacteria within the vitreous create toxins which irritate the ciliary body and retina, and cause migration of pus cells from the ciliary processes toward the bacteria in the vitreous to form an abscess (endophthalmitis septica). Panophthalmitis septica is characterized by total and widespread tissue necrosis in which no part of the eye escapes.

Necrosis may be caused by the retention of lens matter. The necrotizing effect on the iris and cornea of a large amount of lens matter resembles that caused by colonies of bacteria.

Necrosis caused by trauma is exemplified by damage to the cornea by heat arising from hot metal, or by strong acids.

Neuropathic necrosis, or neurokeratitis paralytica, may occur in herpes of the iris, and is characterized by eruptive, circumscribed, reddish elevations on the surface of the iris, similar to those on the skin. The pathologic picture is characterized by plastic iridocyclitis and an excessive amount of necrosis in the stroma of the iris, which is identical with the inflammatory toxic type of necrosis that is produced by pyogenic bacteria.

In acute primary necrosis of the uvea, bacteria, glaucoma, and trauma (conditions known to produce necrosis) are excluded.

Necrosis of a malignant melanoma of the choroid may cause necrosis of pre-existing tissues. Spontaneous death of an intraocular malignant melanoma is the common fate of all neoplasms. Resultant toxins may set up an iridocyclitis and glaucoma resembling an acute fulminating glaucoma.

The larger the melanoma, the more likely it is to become necrotic. Most tumors are composed of different types of cells—spindle cells in one part and round cells in another. Groups of dead cells are present in almost every melanoma. In some tumors, bands of connective tissue surround necrotic areas.

Necrosis of pre-existing tissues is described. In necrosis of the sclera, the sclera may be replaced by pus which discharges into Tenon's capsule. In

necrosis of the choroid the normal part of the choroid is the least likely of all the layers of the eye to undergo necrosis. In necrosis of the retina the highly organized retina succumbs to virulent toxins, and "falls to pieces" (the ora serrata is particularly vulnerable). In necrosis of the papilla the papilla may be converted into an indefinite weblike groundwork lying over the lamina cribrosa. In necrosis of the ciliary body the nonpigmented layer disappears completely. In necrosis of the iris the side of the iris next to the tumor is more affected. In necrosis of the vitreous and zonule these structures have no resistance. In necrosis of the lens the lens capsule is invariably distended.

Necrosis may be artificially induced as a therapeutic measure in irradiation for retinoblastoma, and by diathermy for detachment of the retina.

JOSHUA ZUCKERMAN, M D

**Use of Pooled Human Vitreous** MILO H. FRITZ *Am J Ophthalm*, 1949, 32 45

This study deals with the experimental injection into the human eye of pooled human vitreous. One of the problems was to determine the bacteriological status of the material to be used. The source of the vitreous represented eyes donated to the Eye Bank, which for various reasons had been rejected as unsuitable for use in corneal transplants. The technique was not complicated, the essential feature being to obtain clear vitreous. The purpose was to determine if vitreous substitution could be made in cases of cloudy vitreous due to hemorrhages or inflammatory reactions, and in hypotony following cataract surgery or retinal detachment operations.

It was established that pooled human vitreous could be stored at temperatures ranging from 32° to 50° F without any loss of clarity. It was further established that from 1 to 15 cc of vitreous could be injected into an eye without any great reaction or interference with vision. The tension remained about the same for 10 months when there was no further reason for loss of tone. Cerebrospinal fluid was also successfully used as a vitreous substitute.

J WOODHULL OVERTON, M D

**Retrolental Fibroplasia** WILLIAM COUNCILMAN OWENS and ELLA UHLER OWENS *Am J Ophthalm*, 1949, 32 1

Retrolental fibroplasia was described in Terry in 1942. It is seen in premature infants and characterized by an opaque, vascular membrane against the posterior surface of the lens. Terry thought the disease developed after birth because of the development of embryonic connective tissue. Reese and Payne, however, thought it was a congenital disease.

The incidence of retrolental fibroplasia in the present series was based on regular examinations of premature infants weighing 4.5 lb or less. There were 214 in the series, 40 weighing less than 3 lb, and 174 weighing between 3 lb and 4.5 lb. The authors did not find any cases at birth. They examined the infants for a period of 6 months or more

and found an incidence of 12.1 per cent in those weighing under 3 lb and one of 1.3 per cent in the group weighing more than 3 lb.

All visible remains of the hyaloid system disappeared. The dilatation and tortuosity of the retinal arteries and veins were the first signs, the veins becoming 3 times their normal size. Then there were grayish yellow elevations of the retina in the periphery, the disc became blurred, and there was a generalized retinal edema. This was followed by formation of a grayish membrane and vessels in the periphery of the retrolental space. A yellowish red reflex was observed. Finally a complete retrolental membrane was formed. Broad ciliary processes were observed on the membrane, which was also vascular. The eye appeared smaller, the anterior chamber was shallow, posterior synechias formed, and the iris was atrophic. In some cases a secondary glaucoma developed.

The onset of the disease occurred between the second and fifth months.

These studies do not coincide with Terry's theory of a fibroplastic overgrowth of the hyaloid artery and tunica vasculosa lentis, nor with the theory of Reese and Payne, who thought the lesion was due to a persistence of the primary vitreous. The authors believe the lesion is a postnatal development characterized by an angiomatous dilatation of the retinal vessels followed by a gross retinal detachment. The etiological factor has not yet been determined.

J WOODHULL OVERTON, M D

**Scleromalacia Perforans Report of a Case** MELVIN HARBATER *Arch Ophthalm*, Chic., 1949, 41 183

Scleromalacia perforans is an insidious degenerative disease of later life characterized by holes in the sclera producing exposure of the uvea. It is usually accompanied by rheumatoid arthritis. The lesion begins as a small sterile abscess surrounded by epithelioid cells, and after a variable period the contents of the abscess are extruded and the uvea is exposed.

A case is reported in a white female, aged 70, who had rheumatoid arthritis since the age of 30. Vision was markedly reduced, there was severe photophobia and numerous posterior synechiae preventing dilatation of the pupil. Four millimeters superior to the limbus in both eyes, there were scleral holes from 3 to 4 millimeters in diameter. Marginal necrosis of the cornea was present. Local administration of penicillin resulted in subjective improvement but did not modify the progress of the disease. In the course of 20 months most of the anterior portion of the sclera became necrotic. The right eye was enucleated and the left eye became blind from an associated uveitis.

FRANK W NEWELL, M D

**The Blindspot Syndrome** KENNETH C SWAN *Arch Ophthalm*, Chic., 1948, 40 371

In a series of 296 cases of esotropia, observed in the clinics of two medical schools, 102 were found to have in common certain symptoms and signs which

have been designated as the "blindspot syndrome." For distant fixation, the physiologic blindspot of the deviating eye was found to overlie the point of fixation in 85 cases, i.e., the deviation was from 12 to 18 degrees. The physiologic blind-spot was only part of a suppression scotoma and its position was inconstant, however, there were cases in which it seemed probable that the physiologic scotoma provided the essential mechanism for alleviation of diplopia and played an important role in maintaining the esotropic state. This group of cases seemed to represent a clinical entity which was designated as the "blindspot syndrome." Since the initial report of 7 cases was submitted, an additional 95 cases have been observed.

The most significant symptom was periodic diplopia, the history of which was seldom volunteered because in only a few cases was the diplopia annoying, but it could be elicited in 75 of 102 cases. In every case, homonymous diplopia could be created under ordinary visual conditions by the use of prisms just large enough to shift the rays of light off the blind-spot of the squinting eye. The most obvious sign was concomitant esotropia of from 10 to 20 degrees. The average deviation was from 14 to 16 degrees for distant fixation. The deviation was proportionately greater for near vision, but greater variations were found. In 62 cases, a hypermetropia of more than 2 diopters or anisometropia of more than 1 diopter was present.

Normal retinal correspondence seems a consistent feature of the blindspot syndrome. It was demonstrated as being present in all of the cases by the usual methods of examination. Potentially available or immediately demonstrable good fusion was considered as part of the syndrome. In less than half of the cases, the initial examination revealed fusional movements of appreciable degree at the angle of deviation, however, after sensory and motor fusional ability was established, orthoptic training was feasible in all of the cases. The blindspot syndrome may develop spontaneously in association with an uncorrected refractive error. It may also be acquired after a partial correction of a larger degree of esotropia, either by glasses or surgically. Occasionally, it may develop after a period of occlusion of an amblyopic eye or in association with the establishment of normal retinal correspondence. The syndrome does not seem to develop in the presence of anomalous retinal correspondence, at least it cannot be demonstrated to play a role in the alleviation of diplopia in such circumstances.

The prognosis of restoration of single binocular vision is excellent. It is necessary to correct the refractive error, to establish an ample range of fusional movements before operation, to correct fully the deviation by surgical means, and then to follow operation with orthoptic training in order to establish a reserve of fusional movements adequate to overcome any residual deviation without undue stress on the accommodation or convergence mechanism.

MICHAEL LOUGHELAN, M.D.

#### Subretinal Drainage in Retinal Detachment

DR. W. DE ROETHI, SR. *Am J Ophth*, 1940, 3: 55

In retinal detachment, the subretinal fluid is drained off or absorbed by the choroid which allows the retina to come in contact again with the choroid. It is thought the hypotony occurring in detachments is due to this absorption. The condition of the choroid vessels is an important factor in the absorption.

Many surgical procedures to remove the subretinal fluid have been attempted, they include scleral puncture, trephine, sclerectomy, iridopuncture, and aspiration with a hypodermic syringe. Later, thermocautery was used. More recently, surface and perforating diathermy have been used. One of the problems involved when no tear is present is to get sufficient drainage over a period of time, as the openings in the sclera and choroid tend to close off. If a retinal tear is present, the fluid is absorbed by the choroidal vessels after the tear is sealed, provided the vessels are functioning.

Surface diathermy is performed and a drain is placed in position through the sclera and choroid for from 1 to 2 weeks. Hemorrhage is a complication to be reckoned with when the choroid is punctured. Air is injected into the anterior chamber to increase the preretinal pressure and force the retina back against the choroid.

The article is summarized as follows:

1. Subretinal hemorrhage occurred in 3 of 7 eyes that were operated upon.
2. The risk of a sympathetic ophthalmia should be considered.
3. In 3 of the 7 eyes the retina was reattached.
4. A normal choroid absorbs subretinal fluid and produces a fibrin which helps to reattach the retina.

J. WOODHULL OVERTON, M.D.

#### Surgical Treatment of Retinal Detachment

P. VERDAGUER *Am J Ophth*, 1940, 3: 63

The author limits his discussion to cases of retinal detachment in which there is a fair chance for good results, namely, idiopathic cases occurring in myopia, senility, or disinsertion of the ora serrata, as well as traumatic cases.

The fundus examination before and during surgery is very important since the tear in the retina must be localized and sealed off. The search for the tears should be extensive and thorough. The location and prominence of the detachment suggest the location of the tears. They are usually found near the equator.

In localizing the tear, the author uses a fundus chart to determine its meridian and the number of disc diameters from the ora serrata.

Preoperative care is important and retinal bed with both eyes bandaged for a week is a good policy. The operative treatment requires adequate exposure and the application of diathermy.

Surface diathermy is applied in the preretinal areas, and the intensity is controlled to give a grayish appearance. In general, from 50 to 100 m are used. The electrode is 1 mm in diameter and held

applied to a dry globe. The next step is to drain off the fluid with a puncture needle, but each coagulation should be stopped when fluid appears. Then gentle suction may be applied. The points of coagulation are made 3 mm apart and completely encircle the tear.

Three types of detachment should be considered in addition to the one we have mentioned (1) detachment or disinsertion of the retina at the ora serrata, (2) detachment due to tear at the macula, and (3) detachment due to aphasia. In the last type, a new approach was attempted. After the surface coagulation, the sclera was incised and a fine silk suture passed through the lips of the sclera to include the deep layers. Then, before the fluid was removed through the scleral incision, the suture was tied.

A large sarcoma causing a retinal detachment is easily revealed by its shadow, but a small tumor is not always easy to diagnose. However, a direct trans scleral transillumination is helpful, particularly when used with the ophthalmoscope. A small tumor reveals a shadow with this method. An excellent procedure is done with the slit lamp, with a flat Koeppe contact glass, by which it can be determined whether the elevated retina is translucent.

J. WOODHULL OVERTON, M D

**Use of Roentgen Therapy for Retinal Diseases Characterized by New-Formed Blood Vessels (Eales' Disease, Retinitis Proliferans) A Preliminary Report** JACK S. GUYTON and ALGERNON B. REESE *Arch. Ophthalmol.*, Chic., 1948, 40: 389

Over a period of 18 months prior to this report, a total of 22 eyes in 14 patients were treated by intensive roentgen therapy to the posterior ocular segment for certain ocular diseases. These diseases were characterized by retinal and vitreous hemorrhages with secondary fibrous tissue formation and new-formed blood vessels extending into the vitreous (Eales' disease, typical or atypical, and diabetic retinitis proliferans).

The irradiation technique was the same as that devised by Martin and Reese for the treatment of retinoblastoma. In the original cases from 8,000 to 10,000 roentgens (in air) were given through the temporal portal, and from 5,000 to 6,000 roentgens were given through the nasal portal, however, in later cases, a total between 3,500 and 6,000 roentgens were given only through the temporal portal. If the total dose did not exceed 6,000 roentgens, the patients could tolerate 500 roentgens three times a week through the temporal portal alone, which shortened the treatment time.

The first and most striking effect of roentgen therapy was the diminution of the new-formed vessels. The smaller vessels began shrinking within 2 or 3 weeks after therapy was begun and invariably disappeared from ophthalmoscopic view within 4 to 8 weeks, even if the total dose was only 3,500 roentgens. If a dose of not more than 4,000 roentgens was given, the larger new-formed vessels usually showed a shrinkage in caliber but remained patent

indefinitely. However, in eyes which received a total dose of 10,000 roentgens, or more, even the largest new-formed vessels completely disappeared from ophthalmoscopic observation. There has as yet been no definite recurrence of new-formed vessels in any of the 22 eyes treated. Regression of the fibrosis was less striking. If fibrosis was scanty, almost translucent, a dose of 10,000 roentgens or more produced a marked regression of the fibrous tissue. If fibrosis was dense and of long duration, it was reduced only slightly, even with heavy dosage.

In 8 patients with "typical" Eales' disease, there has been only 1 recurrent hemorrhage. In the group of 4 patients with "atypical" Eales' disease, there has been a recurrent hemorrhage only in 1 patient with an anomalous localized constriction of a retinal vein. In the 2 patients with diabetic retinitis proliferans, fresh retinal hemorrhages have continued to appear, and in 1 patient, fresh vitreous hemorrhages developed 5 months after therapy, even though the new-formed vessels were markedly diminished. It seems unlikely that roentgen therapy could result in permanent benefit for patients in this category until an effective treatment for diabetic retinopathy itself has been discovered.

MICHEL LOUTFALLAH, M D

**Retinoblastoma (Retinal Glioma) Cured by Radon Seeds: Report of a Case** JOSEPH WALDMAN and C. E. G. SHANNON *Arch. Ophthalmol.*, Chic., 1949, 41: 32

The authors report a case of retinoblastoma in which the left eye was enucleated and the right eye treated with radon seeds. Seeds were placed in an applicator devised by one of the authors, and sutured to the sclera under the conjunctiva and Tenon's capsule.

The authors arrived at the following conclusions:

- 1 Unilateral involvement requires immediate enucleation.
- 2 In bilateral involvement the more diseased eye should be enucleated and the other eye should be irradiated.
- 3 Radon should be used as described in this article, i.e., according to the technique of Martin and Reese.

EARL H. MERZ, M D

**The Treatment of Bilateral Retinoblastoma** ALGERNON B. REESE, GEORGE R. MERRIAM, JR., and HAYES E. MARTIN *Am. J. Ophthalmol.*, 1949, 32: 175

Since 1933 Reese and Martin have practiced the combined method of treatment for bilateral retinoblastoma. This consists of the surgical removal of the eye with the more advanced lesion and the treatment by fractionated roentgen irradiation of the remaining eye. Of 53 patients in the series, 25 are living with vision of 20/20 to 20/200, 16 are living without vision, and 12 have died of retinoblastoma. The average mortality of bilateral retinoblastoma treated by enucleation only is about 50 per cent. The combined treatment certainly does not adversely affect the chance of survival. The involvement of the two eyes is the result of independent origins of

quently suffered with polyarthritis, abortions, tumor, or diabetes. The patients themselves often had endocrine disturbances and other congenital defects. In the group studied there were 4 patients with luxation of the hip, 1 patient with congenital aplasia of an ear, and another with an imperfectly developed limb.

In most instances, before ankylosis manifests itself, the parents notice the lower jaw to be small, asymmetry of the face, faulty occlusion, and difficulty in widely opening the mouth. When examined the patients usually had brachycephalic head measurements, micrognathia, faulty dentition, and inability to open the mouth. Roentgen examination revealed underdevelopment of one or all of the bony structures in the region of the joint. The author considers both the prophylactic and the definitive treatment to be far less than desired. He advises general supportive therapy, such as vitamins, endocrines, adenoidectomy, and indicated orthodontal treatment, as soon as the premonitory signs are observed. Radical surgical interference, including bone grafts, insertion of metal prostheses, and manipulation, usually becomes necessary in the advanced cases.

N. CHRISTIAN MEYER, M.D.

**Cancer of the Tongue** JAMES ENGLISH *Oral Surg.*, 11, *Path*, 1949, 2: 231

Cancer of the tongue is most commonly of epithelial origin and may result from chronic irritation. Lack of vitamin B should not be overlooked as a related causal factor. Frequently, if not always, certain premalignant states precede the cancerous lesion. These include leucoplakia, ulceration, and induration. The fact that pain is often not an early symptom may delay detection of the tumor. The importance of early diagnosis is emphasized because the prognosis is very grave after metastasis has occurred. Metastatic spread is by way of the lymphatic system and primarily involves the deep cervical chain of lymph nodes. The submaxillary and submental lymph nodes are frequently involved. The most successful method of treatment has been that of radium implantation in the primary lesion and complete surgical removal of the lymph nodes draining the affected side. Adjunctive roentgen therapy is frequently advocated.

Two cases of squamous cell carcinoma of the tongue are reported which illustrate several factors described in the review. The first patient was treated by roentgentherapy and radium, and the primary lesion regressed satisfactorily without recurrence, but subsequent lymphatic involvement occurred. Roentgentherapy was administered and repeated several times over a period of 31 months, when the patient died of an acute monocytic leukemia. The second patient had been treated previously with roentgen rays and radium. There was recurrence locally, so the primary lesion was treated by surgical removal of two-thirds of the tongue. Metastases to the cervical lymph nodes followed 2½ months later and were treated by radical neck dis-

section. The patient succumbed shortly thereafter to a flare-up of an old tuberculosis with massive involvement of both lungs, liver, spleen, and kidneys by acute tuberculous processes.

LOUIS T. BYARS, M.D.

## PHARYNX

**Prognostic Criteria and Therapeutic Suggestions for the Treatment of Tumors of the Pharynx** (Il criterio prognostico e l'indirizzo terapeutico nel trattamento dei tumori della faringe) GIOVANNI PALTRINIERI *Radiol. med.*, Milano 1948, 34: 779

The prognosis of tumors of the pharynx is based on correlation between histologic findings and radio sensitivity, also between radiosensitivity and curability, and especially with regard to epitheliomas. Other criteria, namely, anatomoclinical and radio clinical factors, represent important items.

Epitheliomas of mucous type are more radiosensitive than highly differentiated cancers. Not only the histologic structure, but the site of their origin determines the response of epitheliomas to irradiation. Those located in the pyriform fossa or at the base of the tongue show a poorer response than those of the tonsils or the tonsillar pillars.

Roentgenographic studies of the base of the skull are important in the prognosis, for they may demonstrate an invasion which escaped clinical detection. Such studies are valuable not only in patients with tumors of the nasopharynx but also in those with neoplasms of the mesopharynx and hypopharynx. Epitheliomas of the upper portion of the hypopharynx respond well to radiotherapy while those of the lower portion give a very bad prognosis.

The anatomoclinical findings, in addition to the results of histologic studies, determine the prognosis. For instance, vegetating forms without deep infiltration are amenable to cure while so called interstitial forms, with a deep infiltration, give a poor prognosis.

Angioreticulomas and lymphangioreticulomas are relatively radioresistant while reticuloendotheliomas and their polymorphous variety are sensitive to irradiation. The author discusses the merits of fractional irradiations over short and prolonged periods of time. He advocates the use of electrocoagulation in the treatment of circumscribed epitheliomas accessible to direct or indirect endoscopy.

JOSEPH K. NAKAT, M.D.

## NECK

**Foreign Body in the Thyroid Following Perforation of the Esophagus** EDWARD J. JENSEN and JACOB S. ALTOFF *Surg.*, 1949, 5: 52

Three instances in which an unusual sequence of events followed perforation of the esophagus by a foreign body have been encountered at the Mount Sinai Hospital, in New York, since 1911. In all 3 cases clinical and roentgenographic evidence of cervical and retroesophageal infection developed and external cervical drainage was performed. The first



ings, however, were at variance with the predominantly retroesophageal or paraesophageal infection that is usually found. Instead, the infection was chiefly confined within one of the lateral lobes of the thyroid gland, embedded within which was also found the foreign body. The perforation had apparently taken place more or less directly into the lateral thyroid lobe. Study of the literature has revealed no similar cases.

Perforation occurs also in a lateral, or even anterolateral, direction although this seems less likely when an instrument is the agent than in the case of a foreign body. In such an instance the foreign body can make its way directly into the corresponding lateral lobe of the thyroid gland. Conceivably, even a foreign body perforating posterolaterally might find its way into the thyroid gland if its course after perforation was lateral or anterolateral. This is what probably occurred in Case 1 in which a posteriorly situated perforation was seen endoscopically, although this might have represented instead a secondary evacuation site of the undrained retroesophageal abscess.

The infection which follows develops not only paraesophageally, but in the thyroid lobe as well. If the course has been directly into the thyroid with minimal traversal of the retroesophageal space, the infection may be entirely or chiefly within the gland. In Case 1, the infection was chiefly within the gland, only a small retroesophageal component being found at the secondary operation. In Case 2 the infection was confined entirely to the gland, at operation only edema was found in the retroesophageal space. In Case 3 the abscess cavity was both paraesophageal and intraglandular.

Characteristically, the infection should be anaerobic with putrid odor, and liquefaction with abscess formation should be the rule. Phlegmonous extension should occur if drainage is too long delayed, but apparently this is more characteristic of perforation into the retroesophageal plane than when the dense confines of the thyroid have been penetrated. An abscess was the pathologic lesion in all 3 of the authors' cases, the infection was putrid in 2, and odorless in 1 case (Case 2).

In all 3 cases the foreign body was found entirely within the thyroid gland. Whether the initial vis a tergo carried it there, or whether the subsequent swallowing and gagging movements did, cannot be said. It should be noted that an edentulous, plated upper jaw probably predisposes to the ingestion of foreign bodies since the customary discriminatory sensation is eliminated from this area. This was mentioned by Myerson. Two of the patients wore upper plates, in the case of the third patient, no record was made although, in view of the patient's age, it is likely that she also did.

The diagnosis of esophageal perforation with paraesophageal infection is not difficult. A history of the ingestion of a foreign body followed by neck pain, dysphagia, and fever is usually obtained. The physical signs are those of an inflammatory process

in the neck consisting of tenderness, mass, and fixation or displacement of the trachea. With perforation into the thyroid, the swelling and tenderness may be largely confined to the corresponding lateral thyroid lobe, which may suggest the specific diagnosis, as in Case 3. Esophagoscopy may be of assistance in demonstrating that a perforation has occurred. A lateral roentgenogram of the neck is indispensable. This will usually show the foreign body and air trapped in a widened retrotracheal space. The frontal film may show lateral tracheal displacement. Apparently there is not as great a tendency in these cases for infection to travel down the retrovisceral compartment into the superior mediastinum as when perforation has taken place into that compartment. This is manifested by tapering of the retrotracheal widening in the direction of the superior thoracic aperture.

Treatment consists of the establishment of external drainage through the neck and removal of the foreign body. The operation should be performed under local anesthesia. The technique, patterned after Marschik, is now well standardized. It is described in detail in Neuhof and Jemerin's monograph. There should be no mortality. Chemotherapy will not substitute for surgery, and has a place only after adequate drainage has been effected.

It is important to retrieve the foreign body during the procedure as otherwise relief may prove to be only temporary, as in Case 1. Unless a definite search is made with the finger within the cavity in the thyroid gland, the foreign body may be missed as its location makes it difficult or impossible to bring it into the field of vision. The experience in Case 1 was instrumental in guiding the search in Cases 2 and 3 into the cavity in the thyroid gland where the foreign body was located.

JOHN E. KIRKPATRICK, M.D.

#### Observations on Disorders of the Thyroid Gland Associated with Exposure of the Suprarenal Glands to X-Rays. KLAUS A. J. JÄRVINEN. *Ann med int fenn*, 1948, 37: 227.

As a rule, a continuous correlation can be observed in the activity of the endocrine glands. Especially, the hypophysis has been found to exert a marked action on the function of the thyroid gland. The author observed 23 patients whose suprarenal glands had been exposed to roentgen rays.

As samples of the intimate relation of the thyroid to the sexual glands, the author mentions (1) enlargement of the thyroid gland during puberty and in connection with menstruation, (2) the frequent appearance of goiter during pregnancy, and dysfunctions of the thyroid gland subsequent to it, and (3) disturbances of thyroid secretion frequently observed in connection with the menopause.

Three patients developed strong symptoms, and 4 developed slight symptoms of hyperthyroidism. Ten others exhibited symptoms of hyperthyroidism, but owing to insufficient data (death of the patient) or other difficulties, these cases were not fully con-



clusive. In all of the patients with symptoms of hyperthyroidism, including the 10 doubtful cases, these symptoms appeared in from 1 to 3 months following roentgen therapy of the suprarenal glands. These symptoms receded spontaneously and partly disappeared in from one-half year to 3 years.

In 6 patients it was not possible to demonstrate any symptoms of hyperthyroidism following roentgen therapy applied to the suprarenal glands.

The author believes that a causal correlation exists between the roentgen therapy applied to the suprarenal glands and the symptoms of hyperthyroidism which subsequently developed in several cases.

From the author's investigations, it appears that treatment of the suprarenal glands by x-rays was, in several cases, the cause of a rapidly developing hyperthyroidism typical of Basedow's disease.

It is known that Basedow's disease frequently develops following tonsillitis, pneumonia, diphtheria, or influenza. On the other hand, the author believes that disturbances of the suprarenal glands may occur as a result of these diseases.

Furthermore, it must be remembered that hypoplasia of the suprarenal glands is most commonly observed in severe forms of Basedow's disease.

This view is also supported by the close similarity of morbus Basedowi to Addison's disease. The following features are mentioned as common to both: loss in weight, myasthenia, intestinal disorders, increased pigmentation, loss of hair, atrophy of the sexual glands, hyperplasia of the thymus and of lymphatic tissue, liver disorders, and mental disturbances.

There are circumstances which would seem to indicate that suprarenal lesions may have a greater significance as an etiologic factor in Basedow's disease than is generally ascribed to them.

Among other observations made during this investigation, the author mentions the effect of roentgen treatment of the suprarenal glands on blood pressure, noting a rise. In one case of diabetes mellitus the blood sugar, and particularly the amount of sugar excreted in the urine, decreased considerably

after exposure of the suprarenal glands to roentgen rays.

GEORGE W. RICHARDSON, M.D.

#### The Surgical Treatment of Thyrotoxicosis. K. PATERSON BROWN. *Edinburgh M J*, 1948 55:265.

The operative treatment of hyperthyroidism in Edinburgh hit a low point in 1943 when thiouracil was introduced but since then it has risen again. Thyroidectomy is indicated in primary hyperthyroidism when thiouracil fails to control the symptoms, in complications resulting from drug treatment, when thiouracil causes excessive gland enlargement, if the patient wishes the operation, and in nonco-operative patients. In secondary toxic goiter, surgical measures give better results, as in recurrent goiter and in substernal goiter, in which thiouracil seems contraindicated. Persistent cardiovascular complications are more rare after operation. Malignant degeneration of a nodular goiter is not uncommon, and there is a theoretical question whether it may not occur after thiouracil treatment. Cardiac patients seem to feel better following thyroidectomy than after medical measures alone. Recurrent goiters should be treated by drugs rather than by a second operation, unless drugs fail. The author charts the pulse rate every 5 minutes and believes that the pulse curve gives a better indication of the patient's condition than the absolute pulse level during operation.

Brown uses thiouracil in the preparation of the patient, thus he discontinues 12 days before the operation and gives iodine as a substitute. During the operation he uses an oxidized cellulose gauze for the control of oozing. Tetany is a rare complication, bilateral recurrent nerve injury has not occurred. Of 3 patients with unilateral injuries 2 had completely recovered, but the third had not recovered completely at the time of writing. Late bleeding occurs rarely and must be controlled by prompt intervention. There was no mortality in this series, but the over all mortality in all types of cases was 1.6 per cent.

F. W. S. MODERN, M.D.

# SURGERY OF THE NERVOUS SYSTEM

## BRAIN AND ITS COVERINGS, CRANIAL NERVES

**The Diagnosis of Focal Epilepsy** (Diagnóstico da epilepsia focal) DJALMA CHASTINET *Rev brasil cir*, 1948, 17 733

The concept of focal epilepsy is purely objective it is based on the demonstration of an area in the central nervous system, a focus, in which originate the periodic neuronal discharges that characterize the clinical attack of the disease. The epileptogenic focus has no autonomous existence, it always arises in connection with a neighboring lesion which is the epileptogenic lesion. This may be a structural change in the nervous substance, such as a cerebral scar or an encephalic tumor, or it may act indirectly on the cerebral tissue as in the case of extradural and subdural hematoma, tumor of the dura mater, or localized hyperostosis of the skull. No matter what it is, the epileptogenic lesion in itself cannot induce an epileptic attack because its tissue is electrically and biologically inactive. However, this is not the case with the neighboring nervous tissue whose neurons are functionally active and subjected to irritation by the lesion, they are stimulated to hyperactivity and become the epileptogenic focus. Both lesion and focus are indispensable etiopathogenic elements of focal epilepsy, the lesion is the primary determining cause, and the focus is its neighborhood reflex.

The diagnosis of focal epilepsy includes the clinical study of the attack, the topographic study of the lesion, and electroencephalography, completed by the operative diagnosis which requires cortical stimulation tests and electrocorticography. For the clinical study of the attack the patient often has to be hospitalized. When the observed symptoms allow the epileptic manifestation to be referred to a certain cerebral area, the diagnosis of focal epilepsy may be safely made, but when the epileptic attack presents no signs of focus, the hypothesis of focal epilepsy should not therefore be rejected. Focal epilepsy may be expressed also by generalized attacks without any sign or symptom of localization. The topographic study of the lesion indicates only indirectly the location of the focus which is in the vicinity of the lesion.

Cortical stimulation, which is based on the provoked repetition of the initial phenomena of the clinical attack, presents the same diagnostic difficulties as the clinical study of the attack. It is necessary to conduct a very complete observation of the beginning of the clinical attack in its smallest details to be able to estimate with certainty the localizing value of the answers received from the stimulation. Electroencephalographic examination may be performed in the ambulant patient, it causes no disturbance, may be repeated as many times as found necessary, and, like electrocorticography which is a

variant of it, is highly efficient and allows exact localization of the epileptogenic focus.

In conclusion, electroencephalographic examination is the method of choice for the diagnosis of focal epilepsy, in this as in the other modalities of epilepsy, its value is superior to that of any other procedure and can be summarized in its principal advantages: convenience, innocuity, efficacy, and precision. However, the author does not mean to exclude other examination methods in order to arrive at the diagnosis.

RICHARD KEMEL, M D

**Gangrene of the Face Following Occlusion of the Posterior Inferior Cerebellar Artery** NATHAN SAVITSKY and SIDNEY P. ELPERN *Arch Neurol Psychiat*, Chic, 1948, 60 388

The authors point out that skin lesions following disease of the trigeminal nerve have rarely been reported. The majority of such skin lesions follow surgical section of the nerve, and are characterized by temporary herpetic lesions.

A case is reported with occlusion of the posterior inferior cerebellar artery and associated hypalgesia on the left side of the face. The patient subsequently developed an ulceration of the ala of the nose, and a progressive deep ulceration involving part of the nose and cheek, which was entirely painless. There was no evidence of any syphilitic lesion.

The rarity of such trophic lesions is pointed out, and the possibility of trauma as an etiological factor is discussed.

HOWARD A. BROWN, M D

**The Absence of Headaches in Certain Types of Frontal Lobe Tumors** (Pourquoi certaines tumeurs frontales évoluent-elles sans céphalées) J-A CHAVANY and E. WORINGER. *Presse med*, 1948, 62 738

In reviewing their cases of intracranial tumors, the authors noticed that headaches were not always present in patients who had frontal lobe tumors. They then analyzed the symptoms presented by 137 proved cases of tumors restricted to the frontal lobes and accompanied by papilledema, and found that 26, or 19 per cent of them, had not been accompanied by headaches. Most of the patients without headaches presented the psychic disturbances grouped under the name of frontal lobe syndrome. There appeared to be a direct relationship between the psychic disturbances and the headaches in the clinical course of these patients. Thus, when the disease started with frontal lobe symptoms it would often not be accompanied by headaches, or the headaches would disappear with the onset of psychic symptoms, at times these two symptoms would alternate but not be present simultaneously. Headaches were present in 61.4 per cent of the patients without psychic disturbances and in only 8.9 per cent of those with frontal lobe symptoms, while 22.3 per

cent of patients with frontal lobe tumors and only 4.3 per cent of the nonpsychotic patients had no headaches.

The authors believe that the absence or recession of pain is caused by an anatomical or functional interruption of the thalamofrontal pathways and that in certain cases the frontal lobe tumors produce the same effect as a prefrontal lobotomy.

GEORGE PERRET, M D

**Giant Adenomas of the Hypophysis, Considerations on 2 Cases** (Adenomas gigantes da hipófise—considerações sobre dois casos) CANDIDO DE OLIVEIRA *Rev brasil cir*, 1948, 17 721

Adenomas occur frequently in the hypophysis. Their classification depends on their cellular composition which causes a characteristic symptomatology: acidophil cell tumors are responsible for gigantism and acromegaly, chromophobe cell tumors for infantilism or adiposogenital dystrophy, and basophil cell tumors for Cushing's syndrome. In general, the tumors are grayish red, well vascularized, and of varying size. They may grow slowly or rapidly, and be endosellar, suprasellar, or infrasellar. When endosellar, the tumor remains for a long time in the sella, then, because of constant pressure by the tumoral mass, the sella is destroyed and the tumor may grow upward in the direction of the hypothalamic region, compressing the floor of the third ventricle and the optic chiasma, or backward in the direction of the cerebellum and the cerebral peduncles, it may even reach the corpus callosum, the lateral ventricles, and the frontal and temporal lobes. There is no direct relationship between the size of the tumor and its endocrine activity. The basophil cell adenoma is the least common of the three types of tumor.

In a study of large tumors of the hypophysis, Carrillo found that, after a prolonged local phase, the tumor destroys the framework of the sella, grows rapidly, and causes clinical symptoms which simulate those of cerebral and not hypophyseal tumor. This has been confirmed by White and Warren who stated that the clinical diagnosis then becomes so difficult that surgeons have been led to intervene in zones remote from the primary tumor. Another characteristic of these large tumors is their mortality in connection with some operation: death may occur suddenly after or during a simple lumbar or ventricular puncture and even in the course of a decompression operation. Carrillo and Ghersi have called attention to the fact that acidophil adenoma in the terminal phase of acromegaly may become voluminous through adenocarcinomatous degeneration. Ghersi has found that the prognosis of large tumors of the hypophysis is usually favorable when their growth is toward the frontal region, uncertain when it is toward the third ventricle, and grave when it is toward the posterior fossa, compressing the protuberance and the bulb.

Chromophobe adenomas are the hypophyseal tumors which most frequently reach a considerable

size. In their growth they cause clinical symptoms which have nothing to do with the histologic nature of their cells but which result from compression and destruction. Even when small, these tumors which do not secrete hormones destroy the secreting cells, and thereby cause glandular hyposecretion which results in amenorrhea in the female and impotence in the male, dry skin, and low basal metabolism.

The author reports 2 cases of giant tumor of the hypophysis: one of chromophobe adenoma with Simmond's syndrome, the other of acidophil adenoma with acromegaly. Neither patient presented the deceptive symptomatology mentioned by Carrillo, White, and Warren. The tumors weighed 77 and 146 gm, respectively, and it is interesting to note that the chromophobe adenoma, which easily attains a considerable size, was smaller than the acidophil adenoma, which generally remains small. In addition, the great volume of the chromophobe adenoma was not due to malignant degeneration. Morphologic examination of the 2 tumors revealed hemorrhagic foci distending the mass and demonstrating the direct cause of death of the 2 patients.

RICHARD KEMEL, M D

**Frontonasal Encephalomeningocoele Corrected by Meningeal and Bony Plastic Procedure** (L'encéphalomeningocèle frontonasale guérie par plastic mningée et osseuse) G. LAZORTHES, F. DEODATI, and P. FAGE *Presse méd*, 1949, 59 3

The authors have previously reviewed the various types of encephalomeningocoeles and have discussed briefly the pathogenesis of this cranial deformity which they believe is due to a simple agenesis of the bone at certain predominant suture lines. They note that it is commonest at the lambda and bregma, but from reports of other authors it occurs also in the parietal, nasal, nasopharyngeal, and orbital regions.

They report in some detail their own experience with a 2 year old child who had a progressively increasing lesion of the soft tissues between the eyes over the base of the nose, due to an encephalomeningocoele through the anterior ethmoidal region, with a defect in the frontal bone in the midline and at its junction with the nasal bones. Through a bifrontal osteoplastic flap, they found the right frontal pole herniated out into the subcutaneous levels. The contained brain, broadly pediculated, was transected and left in place so as not to open the nasal fossae into the intracranial spaces. The dura mater was closed with amniotic membrane and the bony defect closed by a 5 cm long piece of rib removed from the child's mother. This bone was placed below in the ethmoidal plate. Recovery was prompt and rapid with a general improvement in the patient's condition.

JOHN MARTIN, M D

**Glossopharyngeal Neuralgia—Extracranial Neurectomy** JOHN T. MORRISON *Brit J Surg*, 1948 36 208

Theoretically, extracranial avulsion of the ninth nerve should give merely transient relief of glossop-

pharyngeal neuralgia, whereas intracranial preganglionic section of the nerve affords permanent relief. The author cites the cases of 2 patients of his colleague, Professor Herbert Williams, who had termination of pain for 8 and 10 years respectively after performance of the former procedure. For this reason, and the fact that most individuals suffering from this malady are quite elderly, the extracranial approach is believed worthy of consideration.

The incision is started behind the mastoid process and curved forward toward the hyoid bone with a slight convexity downward. A partial section of the sternocleidomastoid muscle may be performed with exposure of the spinal accessory nerve. The posterior belly of the digastric muscle and the external carotid artery, which lies deep to it, are retracted forward and upward. The styloid process may be palpated posteriorly, and, if long, may be cracked to enable better exposure. Upward traction on the digastric muscle and nearby structures may cause pressure on the lowest branch of the seventh nerve with occasional temporary paresis.

The spinal accessory nerve should be traced over the internal jugular vein to the point at which it disappears into a well defined fascial layer, an upward prolongation of the carotid sheath which is firmly attached to the outer edge of the jugular foramen. Incision of the fascia over the nerve leads one directly to the jugular foramen where the ninth, tenth, and eleventh nerves emerge. For better exposure it is occasionally necessary to divide the small inferior petrosal sinus where it joins the internal jugular vein, about an inch below the foramen. The glossopharyngeal is the smallest and most anterior nerve running forward across the internal carotid artery. It is grasped with a forceps, divided, and avulsed proximally by continuous traction. Avulsion of the nerve causes anesthesia of the tongue, fauces, and posterior portion of the pharynx, and some interference with the swallowing reflex.

The author cites a case in which this procedure was performed on a 66 year old white female. On the day after operation she had severe pain in the neighborhood of the ear, which was believed to be due to central stimulation of the area from which the nerve was torn. Likewise there was trivial discomfort felt in front of and behind the ear for a few days, but this gradually diminished. It was thought that these symptoms were probably due to stimulation of the auricular branch of the vagus which connects with the petrous ganglion. Since approximately an inch of nerve was avulsed from the jugular foramen it is difficult to see how this could be done without likewise avulsing the jugular and petrous ganglia which lie in and just above the foramen. Thus the author believes that this type of avulsion actually causes preganglionic section of the fibers, and is most likely the reason for the prolonged relief of the neuralgia.

RICHARD C SCHNEIDER, M D

## SPINAL CORD AND ITS COVERINGS

**Tumors of the Spinal Cord** R N COOPER *Ind J Surg*, 1948, 10 321

The author reviews the principles of diagnosis of spinal cord tumors, including clinical, mechanical, chemical, and roentgen ray methods.

A classification of tumors of the spinal cord is presented, and the treatment and prognosis are discussed.

HOWARD A BROWN, M D

**The End Results of Operations for Intrathecal Extramedullary Spinal Tumors, with a Report of 9 Patients Whose Tumors were Removed 14 to 22 Years Previously** LAMBERT ROGERS *Austral N Zealand J Surg*, 1948, 18 119

The author presents a follow-up study on 9 patients who had been operated upon for intrathecal extramedullary spinal tumors 14 to 22 years previously. Six of the group had meningiomas and 3 had neurinomas. In none of the group was there recurrence of the tumor, but it was necessary to reoperate upon one of these patients because of pain from intercostal neuralgia. At operation this patient was found to have arachnoiditis. After separation of adhesions there was relief of the symptoms.

It is concluded that the outlook is good if pressure from these tumors has not compressed the cord beyond the point of recovery of its conduction. From various recorded series, it would seem that results following the removal of spinal neurinomas are particularly favorable, whereas results following the removal of meningiomas are less satisfactory because of the danger of recurrence, or the occurrence of local arachnoiditis at the operative site. To prevent these complications it is advisable to excise a sufficient area of dura mater at the base of the meningioma.

RICHARD C SCHNEIDER, M D

**Considerations Based on a Statistical Study of Spinal Cord Surgery, 113 Observations (Réflexions sur une statistique de chirurgie médullaire 113 observations)** PIERRE WERTHEIMER and SAUTOT *Rev chir*, Par, 1948, 67 321

The authors review 113 operations for spinal cord disease, not including cordotomies, myelotomies, or rhizotomies. Their studies do not include surgery of the lumbosacral syndrome.

Nineteen of these patients had intramedullary tumors, 33 had intradural and extramedullary tumors, and 18 had extradural tumors. Twenty-two patients had recent or old spinal cord injuries such as wounds or contusions of the cord, traumatic arachnoiditis, compressions, and so forth. There were, in addition, 2 cases of syringomyelia, 1 case of hematomyelia, 7 cases of nontraumatic arachnoiditis, and 5 cases of acute or chronic subdural inflammatory lesions.

In this group there was a total mortality of 26 per cent up to several months after surgical intervention. The authors state that follow-up observation of the motor, sensory, sphincter, and trophic condition of patients after they have left the hospital is a very

difficult task and makes documentation of the results of spinal cord surgery very difficult in those very patients who do have the best operative results, since they live to leave the hospital and return to their normal surroundings

Obviously, the poorest results are in those patients who have glioma of the spinal cord, in whom the mortality rate was 40 per cent. The mortality rate was only 10 per cent for subdural tumors and 20 per cent for extradural lesions

The authors have found the generous use of whole blood very useful in the postoperative care of patients. They emphasize, particularly, that the earliest possible surgical intervention is important in patients with a surgical lesion of the spinal cord. Without doubt, the nature of the functional results does depend on the nature of the lesion, its anatomic site, the actual chance which its intrinsic nature offers for complete removal, the age of the person, and particularly the length of time which compression has been in effect. They have found that (in addition to a case history and the findings of lumbar puncture) lipiodol myelography has allowed earlier and more accurate diagnosis, thus leading to the desired earlier operation

JOHN MARTIN M D

### PERIPHERAL NERVES

**Electrodiagnosis of Lesions of Peripheral Nerves in Man** LEWIS J POLLOCK, JAMES G GOLSETH, FRANK MAYFIELD, ALEX J ARIEFF, and Y T OESTER *Arch Neur Psychiat*, Chic, 1948, 60 1

The authors attempt to describe the characteristics of response of muscle to all stimuli studied, and to define a formula for normal, degenerative, denervated, regenerating, and recovered states of muscles

One-hundred per cent neurotization time is defined as the percentage or multiple based on a rate of regrowth of 5 mm a day

The authors continue to define galvanic, progressive, and faradic currents, and rheobase. They discuss galvanic anodal and cathodal opening and closing stimuli, as well as galvanic tetanus ratio, strength-duration currents, chronaxia, Pflueger's law, and the reaction of degeneration

Their conclusions concerning the characteristic response to various stimuli in the several states may be broadly summarized as follows

**Normal** Chronaxia a fraction of a millisecond, rheobase ratio greater than 1, tetanus ratio of 3.2 to 9.5, a continuous strength-duration curve, response to faradic stimuli, and slight facilitation

**Denervation** Chronaxia greater than 15 milliseconds, rheobase ratio of 1 or less, tetanus ratio of 1, continuous strength-duration curve, no response to faradic stimuli, and pronounced facilitation

**Early degeneration** A high tetanus ratio at a time before regeneration could have occurred, followed later by a tetanus ratio of 1

**Early regeneration** A high tetanus ratio, increase of rheobase and, occasionally, shortening of chronaxia

**Maturation** A chronaxia of 15 milliseconds or less, a high tetanus ratio, response to faradism, and a flat curve to repetitive stimuli

**Partial lesion** Chronaxia of less than 15 milliseconds, tetanus ratio of about 2 at a time less than 100 per cent neurotization, but after complete denervation should have occurred, a reaction to faradic stimulation and a flat strength-interval curve may likewise be noted

HOWARD A BROWN, M D

**The Painful Sequelae of Injuries to Peripheral Nerves** S SUNDERLAND and M KELLY *Austral N Zealand J Surg*, 1948, 18 75

The authors present an excellent review of painful symptoms following peripheral nerve injuries. A complete bibliography is appended

The various sources of pain in these injuries are listed. Causalgia is defined as severe pain in an extremity, which has persisted for at least 5 weeks after the receipt of injury to a nerve trunk. Examination of 339 peripheral nerve injuries in 301 patients revealed that only 34 patients, all of whom had sustained war injuries, met the criteria of causalgia after the exclusion of all doubtful cases. The case histories of all these individuals are given in detail. The periods of follow-up ranged from 2 to 5 years

The clinical features of the pain are described. The quality of the pain is evaluated and an attempt is made to determine what influence physical measures played in its relief. In all cases the pain was noted in the hand or foot and involved the distribution of the injured nerve. When the causalgia accompanied complete interruption of conduction it was referred to the denervated area. It is pointed out that areas of returning sensation are hyperalgesic, but in causalgic individuals the pain is of a greater degree, more persistent, and covers a much greater area than that of the injured nerve. In most individuals the onset of pain was shortly after injury, within 24 hours to a week. The pain could be increased by any increase in activity of the limb or any stimulation of activity of the central nervous system. In about half the patients the causalgia became bearable in 4 or 5 months, while most of the remaining patients lost their discomfort in a year

In a large majority of the patients with causalgia there was involvement of the brachial plexus, sciatic nerve, and median nerve. Their susceptibility to this type of pain is due to the fact that these trunks carry the bulk of sensory and sympathetic fibers to the limbs. The relationship of causalgia to the site of injury, the type of wound, the etiologic agent, trophic changes, injuries to associated tissues, and the psychogenic component are all reviewed. The indications of sympathetic involvement, such as sweating and flushing of the extremities, and the results following sympathectomy are described completely

Anatomical and physiological concepts are presented, with special reference to the pain pathways and the presumed alterations in them caused by

**injury** The effects of injury to the cell body, neuron, and the central nervous system are discussed, and the importance of antidromic conduction is emphasized

The results of surgical treatment are tabulated under the headings of nerve block, neurolysis, neurotomy, amputation, posterior rhizotomy, chordotomy, ablation of the sensory cortex, and sympathectomy It is speculated that the success of the last procedure is due to a modification of the disordered pattern of internuncial neuronal activity in the spinal cord

Inasmuch as most cases of causalgia undergo spontaneous cure, the authors believe that surgery should be reserved for the stubbornly persistent cases, and that preganglionic sympathectomy is definitely the procedure of choice if operation is undertaken

RICHARD C SCHNEIDER, M D

**Experimental and Anatomosurgical Study of Anastomosis of Phrenic and Recurrent Nerves for Treatment of Traumatic Lesions of the Inferior Laryngeal Nerve** (Ricerche sperimentali ed anatomochirurgiche sulla anastomosi frenicoconcorrente nella terapia delle lesioni traumatiche del nervo laringeo inferiore) RENZO VERNETTI *Arch ital chir*, 1948, 70 363

An end-to-end anastomosis of the proximal end of the phrenic and the distal end of the recurrent nerve was performed by the author on 5 dogs In 2 dogs the anastomosis was performed immediately following a trauma of the inferior laryngeal nerve—in 1 dog 20 days, in 1 dog 40 days, and in 1 dog 60 days after such injury After the anastomosis, the paresis and atrophy of the vocal cord disappeared in all animals and the mobility of the corresponding side of the larynx was restored A complete restitution of movements of the vocal cord and the hemicartilage

took place within 52 to 72 days after the anastomosis Studies on cadavers convinced the author that this procedure may be employed in man without danger and without great technical difficulties

JOSEPH K NARAT, M D

**Personal Experiences with the Surgical Treatment of Essential Hypertension** (Über die chirurgische Behandlung der essentiellen Hypertonie auf Grund eigener Erfahrungen) W BRUNNER *Helvet chir acta*, 1948, 15 307

The author presents 10 cases of hypertension in patients who were operated upon at the Zurich University Clinics Supradiaphragmatic sympathectomy with splanchnicectomy was performed in 6 cases and thoracolumbar sympathectomy with splanchnicectomy in 4 cases In this group of patients, who were between the ages of 41 and 65, there were 2 with nephrosclerosis, 2 with cardiac insufficiency, and 1 patient who had had two apoplectic attacks Four of the patients who underwent supradiaphragmatic sympathectomy had a recurrence of their hypertension and associated symptoms within 8 months after operation Those who had thoracolumbar sympathectomies showed better and more permanent results

The results depend to a large extent on the anatomical changes that have taken place in the peripheral vessels, on the presence of hypertonic substances in the blood, and on the degree of the heart and kidney damage Good results were obtained in the patients who responded preoperatively with a drop in blood pressure from paravertebral or splanchnic blocks or reacted to the sympathicolytic drug, dibenamin Age, old encephalopathy, or cardiac enlargement were not considered as contraindications for the surgical treatment of malignant hypertension

GEORGE PERRET, M D

# SURGERY OF THE THORAX

## CHEST WALL AND BREAST

**Plasma-Cell Mastitis** MAX CUTLER. *Brit M J*, 1949, 1 94

Since plasma-cell mastitis was first described by Cutler and Cheate in 1931, fewer than 50 cases have been reported. Despite its rarity, its importance in the differential diagnosis of carcinoma of the breast warrants emphasis.

Plasma-cell mastitis has a sudden onset with pain, tenderness, and redness of the skin. It usually occurs in a nonlactating breast. At first the entire breast is swollen and there is painful axillary lymphadenopathy. Fever, sometimes accompanied by chills, is usually present. A creamy discharge from the nipple is not uncommon. The acute symptoms soon subside and the process enters the subacute stage. Here pain and tenderness have diminished and the swelling of the breast has decreased often leaving a diffuse nodularity. When all acute and subacute signs of inflammation have ceased there remains a discrete, hard, solid, residual mass with attachment to the overlying skin. Nipple retraction may exist. The axillary nodes are enlarged and firm. The breast presents the classical signs of carcinoma and it is only by eliciting the history of the previous inflammatory episode that the correct diagnosis can be established and the patient saved from a radical mastectomy.

Grossly the breast involved by plasma-cell mastitis reveals numerous dilated ducts and minute cysts which under pressure exude thick, creamy material. The fibrous and epithelial elements are indurated with radiating strands of dense, translucent, fibrous, connective tissue. In some portions there may be soft, semi-necrotic, gray areas, and xanthomatous foci. The induration and resistance of the tissue simulate carcinoma, but even in the most dense portions the classical cicatrices and chalky appearance characteristic of carcinoma are not present. In addition the process is diffuse and does not form a definable tumor.

When viewed microscopically, one sees an acute and subacute exudative inflammation with abundant lymphocytes, plasma cells, and leucocytes. The process is diffuse, involving both the glandular and the interstitial tissues. The exudate is particularly prominent about the ducts and acini where the cellular reaction may consist almost entirely of plasma cells. Foreign body giant cells may be encountered. Dilated ducts are filled with, and distended by, desquamated epithelial débris.

The diagnosis is comparatively simple if the patient is seen in the acute or subacute phases. Repeated examinations will determine whether the disease is progressing or regressing and this is the most important single factor in differential diagnosis. Plasma-cell mastitis must be differentiated from inflammatory carcinoma, diffuse duct carcinoma, and

traumatic mastitis. The initial stages of plasma-cell mastitis resemble those in inflammatory carcinoma, however, in the latter, carcinomatous invasion of the subdermal lymphatics gives rise to irregular, ridgelike thickening of the skin not present in plasma-cell mastitis. Diffuse duct carcinoma resembles plasma-cell mastitis, but it is steadily progressive while the other is steadily regressing. Traumatic mastitis is easily differentiated by its history of trauma.

There are two pitfalls in microscopic interpretation, and both apply especially to examination of frozen sections in which fixation is usually inadequate. The epithelial hyperplasia often appears to have invaded structures outside their normal boundaries. Plasma cells may be so large and edematous that they resemble anaplastic malignant epithelial cells. Clinical evidence does not support the idea that plasma-cell mastitis is a premalignant condition. The best treatment is biopsy and, after the diagnosis is established, local excision or simple mastectomy. Irradiation should be used during the acute and subacute stages, followed by surgery in the chronic phase.

A 37 year old woman told of having pain, for a period of two weeks, in the right nipple accompanied by swelling and tenderness of the right breast. Examination disclosed an enlarged breast with a firm, solid, movable mass about 8 cm in diameter attached to the overlying skin. Several enlarged movable lymph nodes were present in the axilla. The diagnosis of diffuse duct carcinoma was made and irradiation was prescribed because of the probability of inflammatory carcinoma. Several days after the completion of treatment rapid regression of the tumor began. This suggested the likelihood of plasma-cell mastitis, a diagnosis confirmed by biopsy. A simple mastectomy was performed.

Almost 7 years later the patient complained of pain, tenderness, and nodularity in the left breast recurring periodically at monthly intervals. Examination of the left breast revealed it to be enlarged, tender, and the seat of diffuse nodularity. A local excision was done 7 years after the onset of symptoms in the left breast. This is believed to be the only recorded instance of involvement of both breasts by plasma-cell mastitis.

C. FREDERICK KITTLE, M.D.

**Multilocal Hematoma of the Mammary Gland**  
(Hématome mammaire à foyers multiples) R. ROUX, A. AMELINE, and P. GAUTHIER VILLARD. *Presse méd*, 1949, No 2 24

The author reports the case of a woman, 52 years of age, who, 2½ years after the menopause, suddenly experienced violent pains in the left breast during the night. After a few hours, blood extravasation appeared on the skin.



Examination revealed a mass at the superior medial quadrant. The blood picture was normal. The mass was excised, and histologic examination revealed numerous hemorrhages in the subcutaneous fat tissue. The pathogenesis of this condition remained unexplained. WERNER M. SOLMITZ, M.D.

**Statistical Studies on the Role of Histology in the Postoperative Prognosis of Mammary Carcinoma** (Précisions statistiques sur le rôle de l'histologie dans le pronostic post-opératoire du cancer du sein) G. GRICOUROFF, M. FAUTREL, J.-M. FAVERGE, and J. ARZUR. *Presse méd.*, 1949, 57: 118

A series of 281 patients with mammary carcinoma who were subjected to operation was divided into four groups according to the degree of malignancy found on histological examination. The mortality rate 5 years after surgery was 25 per cent in degree 1, 50 per cent in degree 2, 66 per cent in degree 3, and 85 per cent in degree 4.

In order to prove that the differences between the four categories were not a matter of chance, and to show the dependability of prognoses based on histological studies, the authors analyzed the figures by means of modern mathematics (the asymptotic method of  $\chi^2$  and the exact method by calculus P).

The same methods were applied to the figures concerning the size of the tumors and the degree of lymph node invasion. WERNER M. SOLMITZ, M.D.

**Edema of the Upper Extremity in Mammary Cancer** (O edema do membro superior no cancro da mama) MARIA FERNANDA MARQUES and SUZANA CÉZAR. *Arg. pat.*, 1948, 20: 1

In a statistical review of 3,491 cases of mammary carcinoma the authors found 275 cases of edema of the upper extremity. Of the 3,491 patients 1,592 were not operated upon, of the 1,899 remaining, 1,115 were operated upon on the service of the Portuguese Institute of Oncology and 784 elsewhere. Among the patients who were operated upon, there were 210 with edema, including 65 operated upon in the service and 145 operated upon elsewhere, the remaining 65 cases of edema occurred in the 1,592 patients who were not operated upon.

According to the present concepts concerning localized edema, the simple fact of obstruction of a vessel, even an important one, does not suffice to produce edema, and various factors relegate vascular obstruction to a secondary place. It seems that the changes in the central or peripheral, and, above all, in the vasomotor nervous system, and the endothelial changes must be conceded first place. Organic debility is perhaps an adjuvant factor of some importance.

It has been noted that the adenopathies which developed after operation were more often accompanied by edema than those which developed with the tumor although the latter were much larger than the former.

The authors report a number of cases. In some patients who were not operated upon, the appear-

ance of the edema coincided with the development of the glandular masses. Among the patients in whom the edema appeared without the presence of palpable glands following operation or not, there were some in whom there was no known or presumable cause for it, and others in whom the edema coincided with the cancerous lymphangitis of the skin of the mammary region after operation or of the breast itself, in the absence of operation. In contrast to the cases in which cutaneous lymphangitis seemed alone to be responsible for the edema, there were others in which lymphangitis associated with axillary and supraclavicular adenopathies had not caused edema.

At the Institute radium has been applied next to the axillary vein after operation since 1937, and this direct irradiation of the vessels without interposition of tissue or other protection except filtration has never caused edema. Roentgen therapy given in varying dosage and with various techniques has never had any influence on the appearance of edema, but has sometimes aided in its disappearance or reduction. Finally, the histologic examination of specimens obtained at operation has not led to any conclusion concerning the relationship between the kind of tumor and the frequency of edema.

From another point of view, a case is reported that shows the connection of edema with intercurrent erysipelas, while other types of intercurrent infection (ulcerated and infected lesions of the breast or axillary space) have not caused edema, and neither have other types of postoperative infection.

The authors believe that they cannot draw any conclusion from their review of this series of cases of edema of the upper extremity in mammary cancer. If in one case the etiology could seemingly be established on some fact or detail, another identical case soon occurred to prove the error of this assumption. RICHARD KEMEL, M.D.

**Adenocarcinoma of the Axillary Lymph Nodes Without Demonstrable Breast Lesion** (Adenocarcinoma en ganglio axilar sin lesión mamaria manifiesta) JUAN WESTERMEYER K. *Rev. méd. Chile*, 1948, 76: 617

The author presents 6 cases (1 personal case and 5 cases collected from the experience of his colleagues) in which an axillary mass was the presenting complaint. Biopsy showed this mass to be a metastatic adenocarcinoma of axillary lymph nodes. No lesion could be detected in the corresponding breast. In one case a benign fibroadenoma was found in the opposite breast.

The 6 patients were women between 38 and 78 years of age. In 3 patients a primary breast lesion developed in from 3 to 20 months following observation of the axillary tumor, and a radical mastectomy was performed. The other 3 patients have gone 8 to 16 months without evidence of a breast lesion, but 2 of them have undergone irradiation.

Although various explanations for the occurrence of a metastatic axillary adenocarcinoma are pre-



sented, the assumption must be that the primary lesion lies in the corresponding breast, and it is believed that radical surgical treatment is in order at the time the axillary tumor is recognized if other tumors capable of producing axillary metastases can be reasonably well excluded

HIRAM T. LANGSTON, M.D.

### The Influence of Pregnancy on Cancer of the Breast

BARNEY BROOKS and JAMES N. PROFFITT *Surgery*, 1949, 25, 1

The question of the influence of pregnancy on cancers of the breast arose because of serious questioning of the senior author's advice that there was no contraindication to pregnancy in a 35-year-old woman who had had a radical breast resection for cancer without metastasis. This questioning prompted a review of the literature and of the experience at the Vanderbilt University Hospital, Nashville, Tennessee, during the past 22 years concerning the effect of pregnancy on existing cancer of the breast, and the production of cancer in the second breast when one had been removed prior to the pregnancy.

From October 1, 1925, to January 1, 1948, 395 patients were operated upon for breast cancer in the Vanderbilt University Hospital. One hundred and twenty-three were less than 46 years of age and were arbitrarily considered to be in the child-bearing age, these were the subjects of this study. Seventy were operated upon more than 5 years previously and 44 less than 5 years previously.

The results following radical amputation on patients observed 5 or more years after operation are shown in Table I.

It is of passing interest that of all patients seen 80 per cent were operable and were subjected to radical mastectomy, and that of this group 40 had either gross or microscopic axillary metastases, while 23 patients had neither gross nor microscopic axillary metastasis.

Six patients, between 21 and 39 years of age, were either pregnant or lactating when the carcinoma was discovered (3 of each). Two had been subjected to radical mastectomy and 4 to simple mastectomy. All had gross axillary metastases. All but 1 of the patient were dead in less than 2 years, the 1 who is living and well has had a 15½ year cure (Geschickter, in 1945, stated that he could find no reported cure of cancer of the breast operated on during pregnancy).

TABLE I

	No of cases	Percentage apparently cured
Group 1 No axillary metastasis	22	73
Group 2 Microscopic metastases	4	50
Group 3 Gross axillary metastases (including 7 simple mastectomies)	41	22 (20% radical mastectomies)
Group 4 Distant metastases	6	0

Since 5 of these 6 patients died within 2 years following the operation, the belief that pregnancy promotes the rapidity of growth of existing mammary cancer is supported.

Five patients became pregnant after radical amputation of a breast for cancer, and these have been followed up from 9 months to 6 years. Four had no axillary metastases, the 1 patient with axillary metastasis died approximately 1 year following operation. None has developed primary or recurrent cancer in the remaining breast.

A study of the influence of pregnancy on the causation of mammary cancer by Miss Lane-Clayton from the records of twelve leading hospitals in Great Britain (1926) has disclosed a definitely greater frequency of breast cancer in women who were never pregnant. Peller, however (1940), found breast cancer equally frequent in women who were never pregnant and in those who had been pregnant, although when only women having borne children were considered the frequency of breast cancers was in inverse proportion to the number of children borne, that is, breast cancer occurred more often in women having 1 pregnancy than in women having borne several children. Kilgore (1929) found that a woman is three or four times more likely to have cancer in a remaining breast than is a woman with two normal breasts. Warren and Gates in an extensive study of multiple primary malignant tumors (1932) found only 47 instances in which there was evidence of the independent origin of cancer in both breasts.

Certainly the evidence shows that following mastectomy the second breast is subject to cancer in the same frequency as is the breast of a normal woman of the same age, and there is some evidence that cancer is more likely to develop in the second breast of a woman than in a breast of a woman who has never had breast cancer. FRANK B. QUEEN, M.D.

### Radical Mastectomy VICTOR RIDDELL. *Brit J Surg*, 1948, 36, 113

This article does not introduce any new concepts in the surgical management of cancer of the breast, nor does it violate any of the principles of surgical pathology upon which radical mastectomy was founded and upon which it has stood the test of time. Emphasis is placed upon several of the factors which influence the prognosis, morbidity, and mortality.

The author obtains a biopsy of a suspicious breast tumor by entering directly into the mass through an incision in the skin immediately over it. The growth is not excised to examine it as this involves the opening up of large veins on the periphery by way of which metastases may be disseminated even if diathermy is used for the excision. The center of a hard growth is almost avascular so that the chances of dissemination are reduced to a minimum by this method.

Diathermy should be used with particular caution. The author believes that its use provides the most common cause for flap necrosis. No doubt it oc-

## SURGERY OF THE THORAX

casasionally interferes with the blood supply of the flaps. If carelessly used for coagulation it can cause tissue necrosis, which in turn produces an exudation of serum and an increased liability to sepsis.

There should be no hesitation in sacrificing the nerve to the latissimus dorsi muscle if there is any question of its impeding the thoroughness of the block dissection of the axilla. There are occasions when there appear to be no enlarged lymph nodes and no visibly malignant tissue, and in these circumstances the nerve to the latissimus dorsi muscle should be isolated and preserved as deliberately as it should be removed in more advanced cases. If the nerve is sacrificed, little or no disability has been noted in these patients as compared with control cases and with the opposite side.

The area of skin available for fashioning the flaps must be planned in advance. A defect remaining at the end of the operation between the edges of the flaps has two disadvantages in that it can heal only by the aid of a skin graft or by granulations and scar tissue which form a patch vulnerable to subsequent postoperative therapy. The more serious disadvantage is that healing is often protracted so that the start of postoperative therapy is delayed to a point where its usefulness is open to question.

The technique of radical mastectomy is reviewed by the author in an attempt to place emphasis on the thoroughness of the procedure rather than on any special variation in the manner of its performance otherwise. The prevention of blood loss is of paramount importance. Of especial interest to American surgeons is the author's insistence that the medial flap should not be elevated until late in the operation. Elevation of the medial flap to the border of the sternum involves division of the branches and tributaries of the internal mammary vessels in three separate situations, first, when the initial incision is made into the subcutaneous tissues, second, as the base of the flap is approached, and, third, when the pectoral muscles are removed. By delaying the elevation of the medial flap until the perforating branches of the internal mammary artery have been secured, bleeding is reduced and the flap can be raised avascularly, time is saved because no vessels in the breast have to be ligated or coagulated, and few if any on the flap, and the vitality and warmth of the flap is preserved until the end of the operation. ORVILLE F. GRIMES, M.D.

### TRACHEA, LUNGS, AND PLEURA

**Thoracoplasty in the Treatment of Giant Tuberculous Cavities** (La toracoplastia en el tratamiento de las cavidades tuberculosas gigantes) JUAN CARLOS BARBERIS *Rev. med. Rosario*, 1948, 38, 657

The author regards the following technical conditions as necessary to obtain a good collapse in giant tuberculous cavities:

1. In each surgical stage no more than three ribs should be resected to avoid shock or acute displacement of the mediastinum.

2. Not more than 2 (exceptionally 3) should be allowed between each operative stage to avoid early ossification which would prevent collapse of the cavity.

3. Resection of the three first ribs, sometimes of the fourth rib, must be complete, the others must be disarticulated posteriorly and resected as far as necessary anteriorly, according to indications.

4. The posterior disarticulation must be performed without transversotomy to avoid elimination of points of insertion of the intertransverse ligaments and muscles which would result in definitive stiffness.

5. Together with resection of the upper ribs, intrapleural pneumolysis must be performed to the apex and a large part of the upper lobe, to facilitate concentric retraction of the lung, in which the latter has not lost its elasticity. Formation of transudate in the created space hours after operation serves to push down the pulmonary stump in cases in which the lung has already lost its elasticity, for this reason, the author has never drained the extrapleural transudate but has relied on its action as a physiologic pleurodesis.

Generally, in a period of 45 days the author performs a subtotal thoracoplasty of eight ribs in three operative stages at intervals of 15 days: first stage, high, suprascapular, second stage, posterior, in the upper interscapulovertebral zone, third stage, anterior, in the parasternal zone, level of the second, third, and fourth ribs, and fourth stage, low posterior, in the lower interscapulovertebral zone.

The author reports 18 cases in which he operated within the past 8 years without having to resort to other means of collapse. The results in 8 patients (44.5 per cent) apparently cured, in 5 patients (27.8 per cent) with a quiescent condition, in 3 patients (16.6 per cent), outcome unknown, in 2 patients (11.1 per cent) who were discharged with collapse of the cavity, in 1 patient (5.6 per cent) with negative results of examination for bacilli, in 1 patient (5.6 per cent) deceased (1 from hemorrhage before the fourth stage was done, the other from acute pneumopathy developing in 3 days, after the thoracoplasty had been done), and in 1 patient (5.6 per cent) operated upon less than a year previously.

RICHARD KEMEL

**Studies in Lung Abscess** Lung Abscess and Bronchial Carcinoma R. C. BROCK *Guy's Rep.*, Lond., 1948, 97, 75

The association of a carcinoma with a lung abscess is sufficiently common to justify a separate consideration of the subject. In a series of 405 lung abscesses, bronchial carcinoma was the cause in 56 instances, or 13.8 per cent. In 30 per cent of 185 patients in this series who were over 45 years of age, the abscesses were associated with a carcinoma.

A lung abscess may be associated with, or precede, a carcinoma in three ways:

1. It may be due to a breakdown of the lung itself (35 cases in this series of 56).

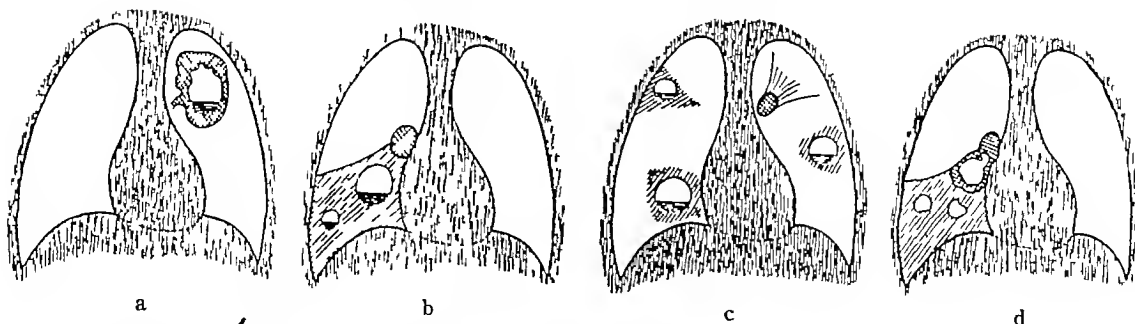


Fig 1 (Brock) Diagrams to illustrate the ways of formation of a lung abscess associated with a primary bronchial carcinoma a, Primary abscess due to breaking down growth b, Secondary abscess occurring in obstructed infected lobe distal to a carcinoma Often more than one ab-

cess is present c, Secondary abscess in various sites caused by spill-over infection from a primary carcinoma in the left upper lobe d, Abscess in close association with a breaking-down growth also causing obstruction and infection of a lobe in which secondary abscesses develop

2 It may arise in an obstructed and infected part of the lung distal to the growth causing obstruction (17 cases)

3 It may be caused by bronchial embolism or spill-over from the primary growth and may be situated in a different lobe from the primary causal growth, or even in the opposite lung (4 cases)

When the abscess forms within the primary growth it may be called "primary", when it is not part of the primary growth it should be described as "secondary"

The primary malignant lung abscess usually represents a circumscribed mass. It is predominantly a squamous cell carcinoma. The size of the abscess cavity in proportion to the size of the whole mass varies considerably, but the thickness of the wall or, more specifically, the irregularity or nodularity of the cavity walls should assume an important role in suggesting the correct etiology. Erosion of the overlying ribs is highly diagnostic of malignancy.

In secondary abscess due to an obstructing bronchial growth, the pathologic picture is principally one of diffuse septic pneumonitis with gross septic bronchiectasis. The demonstrable abscess cavity may actually be a hugely dilated single bronchus.

In the spill-over types, the lung abscess represents an extension to another portion of lung (ipsilateral or even contralateral) of the septic process around a carcinoma, the latter often occurring in a segmental bronchus.

In the 56 cases reviewed, the left upper lobe was the predilected site for malignant abscess.

The onset may be insidious, accompanied by cough and a steady decline in general health, the condition is recognized as a lung abscess principally on its roentgenographic appearance, the septic features of the usual abscess being slight or intermittent. This is often the case in the primary type of malignant abscess.

In the secondary malignant abscess, even though the onset may be insidious, the septic features of the abscess predominate and include copious spu-

tum, often truly foul. Varying amounts of pus and blood may be present in the sputum.

The clinical picture may, of course, be intermediate between these limits. The accurate differentiation of a malignant from a nonmalignant abscess is not easy and is often impossible.

The treatment for malignant abscess is surgical extirpation. External drainage of the abscess is rarely indicated because only rarely can it be a useful palliative approach and it never offers a chance of cure. Occasionally, external drainage may provide the histologic proof of malignancy, and, when this occurs, resection should be undertaken unless a definite contraindication exists, when removal of the lung and the chest wall sinus should be done. A bold approach to the management of a lung abscess suspected of being associated with carcinoma is justified.

This excellent article is illustrated by diagrams, roentgenograms, and photographs of specimens, and is accompanied by 4 case histories illustrating the points under discussion.

HIRAM T. LANGSTON, M.D.

**Ninety Abscesses of the Lung Treated by Bronchial Aspirations** (90 Abscès du poumon traités par bronchoaspirations) J. M. LEMOINE and Y. ROSE *J. fr. méd. chir. thorac.*, 1948, 2, 432

Ninety patients with pulmonary abscesses were treated by bronchial aspiration. Of these, 45 (50%) were regarded as being cured, 21 (33%) benefited, and 24 (27%) not benefited. The procedure is contraindicated in seriously ill patients, those who are markedly debilitated, those with excessive expectoration, and those with prolonged fever.

The average duration of illness was 6 months. Among the 90 patients 75 were men and 15 women. Their ages were between 30 and 60 years. In 83 per cent of the men, the cause was undetermined, in 50 per cent of the women it was traced to surgical intervention, aspirated foreign bodies, or puerperal fever. Sputum production varied between 50 and 600 c.c. per 24 hours. Roentgenologically, 65 of the

patients showed a distinct cavity with surrounding opacity, 10 revealed an isolated cavity without notable density, and 15 revealed merely pulmonary density without cavitation. Eighty-four cases were unilateral, 56 being on the right side and 28 on the left. Forty-six were in the superior lobes (31 right, 15 left), 34 were in the inferior lobes (21 right, 13 left), and 4 in the middle lobes.

Lipiodol bronchograms were not taken because of the danger of exacerbation and the persistence of lipiodol as a hindrance to further roentgenological studies.

Bronchoscopic aspirations varied from 1 to 55 with an average of 10 treatments in the cured and ameliorated cases. In 13 of the 45 cured patients, the roentgenograms following bronchoscopy were normal, in 32 patients slight fibrosis was present.

No apparent correlation was found between the extent of the disease, its duration, the size of the cavity, the fever present, the type and amount of sputum, and the prognosis for recovery when this method of treatment was used.

Before the introduction of penicillin, most of the patients with pulmonary abscess were treated as those in the series presented here, especially when they were not suitable for surgery. Because of the encouraging results obtained in this group there may yet be a place for repeated bronchoscopic aspirations in the treatment of pulmonary abscess.

C FREDERICK KITTLE, M D

**Refinement of Technique in the Cytologic Diagnosis of Tumors of the Bronchus** (*Précisions techniques sur le diagnostic cytologique des tumeurs bronchiques*) JACQUES DELARUE, JEAN PAILLAS, Y BERGEROT-BLONDEL, and GIACOBBI *J fr méd chir thorac*, 1948 2 501

For a period of several months the authors have been systematically applying the cytologic method in the diagnosis of bronchial tumor. This method is attempted only in those cases in which bronchoscopy is negative and the nature of the growth can not be determined by any other method. In their reported material, consisting of 41 cases, are 26 cases diagnosed from a biopsy on specimens procured by bronchoscopy, and 17 cases diagnosed by the method of cytologic examination of the sputum, or of bronchial secretions. The secretions were procured by introducing a sound or canula under bronchoscopic control as far as possible into the involved bronchus, as determined roentgenologically, and procuring the material by scraping the bronchial walls. The sputum was utilized in 4 cases and the bronchial scrapings in 13 cases.

The usual technique on the sputum and secretions was to harden the mucous, mucopurulent, or even bloody material in 30 per cent formalin, imbed it in paraffin, and cut with a microtome. The thin sections were then stained with hematoxylin-eosin and mounted as microscopic slides.

The number of possible tumors which may have been missed by all techniques combined is, of course,

impossible to say because of the brief period of time elapsed, however, the percentages of positive results are not very different from those reported by other authors (Wandall, Herbut and Clerf, and Woolner and Macdonald) who have been working longer with the method and whose results have been verified by the subsequent development of metastasis or by autopsy.

The authors consider that in the light of the improved techniques and better results, the previous attitude of condemnation of cytologic diagnosis of cancer of the bronchus will have to be revised. Two grave disadvantages of the method are admitted. The first is that the method will not succeed in the cases of enclosed tumors of the pulmonary periphery, these tumors are mainly adenomatous cancers and are just the neoplasms which are most amenable to surgical excision. The second disadvantage resides in the fact that the cytologic examination does not always permit of differentiating the histologic type of the cancer, whereas experience has led to the belief that the different types require different modes of treatment. Particularly is this seen in the small cell type of cancer which is more properly included in the sphere of irradiation therapy.

All in all, however, the authors consider that the method of cytologic diagnosis of tumors of the bronchus is an excellent one which should be applied systematically in all cases in which the endoscopic methods have failed.

In the discussion, Métras states his belief that the method of cytologic diagnosis is no more than one of probability, for in the chronic lesions of tuberculosis perfectly superposable histologic appearances are encountered.

Bérard thinks that when hemoptysis and atelectasis are present it would be dangerous to delay the treatment for the purpose of procuring a certain diagnosis, since the case will prove to be one of cancer 9 times out of 10.

Monod asserts that in his experience the only 3 year survivals have been patients who were operated upon without waiting for a certain preoperative diagnosis.

Paillass concludes that, despite the assertions of Métras, the differentiation between cancer and non-cancer by this method should result in very few mistakes. It is true that the polymorphism of certain cancers may provide difficulties, however, this difficulty exists chiefly between the adenomatous cancers and the small cell cancers, never between the small cell cancer and the malpighian carcinoma.

JOHN W BRENNAN, M D

**Bronchogenic Carcinoma of the Middle Lobe and Segmentary Bronchitis** (*Cancer bronchique du lobe moyen et bronchite segmentaire*) E CURTILLET and PORTIER *J fr méd chir thorac*, 1948, 2 422

The authors discuss the importance of suspecting bronchogenic carcinoma in cases of pneumonitis involving the middle lobe of the lung. The symptomatology illustrates the difficulty of deciding

whether or not such a process is a primary inflammation or whether it is secondary to an obstruction of the lobe bronchus by tumor

The authors present the case history of a 58-year-old man whom they followed up for 9 months. A diagnosis of middle lobe bronchiectasis had been made before exploratory thoracotomy was done and endobronchial carcinoma found. The inaccessibility of such tumors to bronchoscopy is discussed as well as the indecisive picture presented by ordinary chest roentgenograms and lipiodol studies. Because of the high incidence of pulmonary carcinoma the authors advise early thoracotomy in instances of pneumonitis which do not respond quite readily to medical therapy.

The surgery which they advise for bronchogenic cancer is that procedure which will completely remove the neoplasm, whether it be lobectomy, double lobectomy, or pneumonectomy.

C. FREDERICK KITTLE, M.D.

**Covering of Lattice Lung and Residual Apical Pleural Cavity by Transplantation of a Tube Pedicle Flap** (Gitterlungenverschluss und Spitzenresthöhlenausheilung durch Rundstiellappendeckung) HELMUT GOEPFEL *Chirurg*, 1948, 19: 458

The author reports 2 cases of extensive lattice lung and residual apical pleural cavity resulting from gunshot wounds which were successfully closed and healed by transplantation of a delayed, caterpillar type, tubed pedicle skin flap. In both cases the defect was located in the right infraclavicular region. The flap was prepared in the left flank, half of the flap being fashioned as a flap covering and half as a tube pedicle. The pedicle end was then transplanted to the dorsum of the left hand as an intermediate step. Before the final transplantation to the lattice lung field, the flap was completely freed from its parent bed and sutured back in place. About 3 weeks later the scar surrounding the area and the surface of the lattice lung was freshened, epithelium and mucous membrane was removed from the surface, and the flap was sutured directly over the new, granulating bed.

Healing in both cases occurred with a minimum of inflammatory reaction. A residual bronchial fistula was closed with the base of the pedicle freed from the hand after about 3 weeks. Later the middle portion of the pedicle was used to provide skin covering for the surface of the residual cavity. In both cases the result was good.

The advantages of the method are: (1) the skin flap is taken from a distant site, so that scar tissue about the site of the defect is avoided; (2) extensive operative procedures near the defect are eliminated; and (3) the disadvantages of muscle transplants are avoided. The author believes that it is better to dress the surface of the cavity with healthy skin than to try to fill the cavity with plastic material. In some cases a small recess into the cavity will remain, but the chronic infectious process will be eliminated.

JOHN L. LINDQUIST, M.D.

**Indications for Pulmonary Resection with Special Reference to Extent of the Operation** EMIL A. NACLERIO *Am J Surg*, 1949, 77: 140

Principles applying to the surgery of extrapulmonary tissues likewise govern the therapy of intrathoracic diseases. In malignancies the entire organ together with its regional lymph nodes and intervening lymphatics is removed. Prompt intervention is an obligatory prerequisite for the optimal treatment of cancer. In consideration of inflammatory processes, surgical extirpation and drainage with as little disturbance of the normal structures as possible should be done.

Removal of the entire lung or a portion is indicated when the tissue is so seriously diseased that its retention will either interfere with the well-being of the patient or cause his death. These indications may be conveniently classified as:

- 1 Primary new growths of the lung
  - a Malignant
    - (1) Carcinoma
    - (2) Sarcoma
  - b Nonmalignant
- 2 Metastatic "solitary new growths"
- 3 Chronic suppurative disease
  - a Bronchiectasis
  - b Lung abscess
  - c Gangrene of the lung
  - d Chronic pulmonary disease with varying degrees of atelectasis, pneumonitis, and abscess formation (which do not clearly fall into the classification of either bronchiectasis or lung abscess)
  - e Chronic nonspecific pneumonitis
- 4 Tuberculosis
- 5 Fungus infections
- 6 Pulmonary cysts
  - a Nonparasitic cysts and cystlike cavities
    - (1) Congenital pulmonary cyst
    - (2) Cystic bronchiectasis
    - (3) Epithelialized cavities following pulmonary suppuration
    - (4) Pneumatocele (localized alveolar or lobular ectasia)
    - (5) Emphysematous bullae
    - (6) Pulmonary blebs
  - b Parasitic cysts
    - (1) Echinococcal (hydatid) cyst
- 7 Arteriovenous fistula
- 8 Traumatic injuries

A brief discussion of each clinical entity is given, emphasis being placed on diagnosis, prognosis, and indications for surgery.

C. FREDERICK KITTLE, M.D.

## HEART AND PERICARDIUM

**The Blalock-Taussig Operation for Morbus Coeruleus** MAURICE CAMPBELL *Guy's Hosp Rep*, Lond, 1948, 97: 1

The steps that led to the development of the Blalock-Taussig operation for cyanotic congenital heart

disease are described. The fundamental requisite for success is that the cyanosis and disability should be mainly due to an inadequate blood flow to the lungs.

The cases of the first 18 patients chosen at Guy's Hospital and operated on by Blalock or by Brock are described.

The main features for which these patients were selected were persistent cyanosis from infancy with polycythemia and clubbing of the fingers and severe disability on walking. On radioscropy the heart showed little or no general enlargement, although most of the patients had some enlargement of the right ventricle, there was no undue prominence in the pulmonary arc and no visible pulsation in the pulmonary branches. The heart was sabot-shaped in less than half of the patients.

Most of them had a systolic murmur in the pulmonary area, often with a slight thrill. The pulmonary second sound was never much increased and was often diminished. None had a diastolic murmur. Also, most of the patients showed a preponderance of the right ventricle in the electrocardiogram with a large pointed P II wave. All were of normal mental development, but most were underweight. Squatting was noted in four-fifths of them, and panting after exertion was nearly as characteristic.

The operation was usually an end-to-side subclavian-pulmonary anastomosis on the side opposite to the aortic arch, this was done on the right side in one-fourth of the cases. The immediate disturbance caused by the operation is less than might be expected, and intravenous fluid is often not required and then only in small amounts. Many of the patients have a pleural effusion that often needs aspiration, but generally only once, other complications are not common.

Three of the 18 patients died, 1 could not be subjected to an anastomosis, and 1 did not benefit much, the remaining 13 patients were greatly benefited almost at once and the improvement has been maintained or increased for the 3 to 6 months that have elapsed since operation.

The color of the patients became nearly normal except for slight cyanosis on a cold day or after vigorous exercise and the capacity of the patients was wonderfully improved so that they could walk some miles and get about normally all day. The polycythemia disappeared quickly, but the clubbing of the fingers more slowly. The arm of which the subclavian artery had been divided gave no trouble.

The heart enlarged a little, as might be expected from the increased work, but generally the enlargement was only slight, and in the few cases in which the increase was moderate it did not appear to be progressive.

In the larger number of cases seen subsequently, Fallot's tetralogy seemed to be the probable diagnosis in about three-quarters of the patients with a congenital heart condition in which cyanosis dated from birth or early in life. In 80 per cent of these patients squatting was a common feature. The age

incidence of these patients is discussed. The ages of the patients and their mortality without operation justify a considerable risk for the improvement that can be obtained from the Blalock-Taussig operation.

An auricular septal defect, combined with some other defect causing cyanosis from birth or soon after, seems to be the most common abnormality contraindicating operation, although Eisenmenger's complex may be more common than would be thought from the paucity of reported cases. The condition of the pulmonary arterial branches in radioscropy is the most essential feature on examination, although the findings can generally be predicted in a patient with a typical history, appearance, and physical signs. In a doubtful case cardiac catheterization and angiocardiology should be decisive.

The article is amply illustrated by photographs, roentgenograms, and numerous tables.

HIRAM T. LANGSTON, M.D.

#### Treatment for Coarctation of the Aorta ROBERT E. GROSS *J Am M Ass*, 1949, 139: 285

The seriousness of the prognosis of coarctation of the aorta is brought out by the fact that only 26 per cent of patients in a postmortem series had lived a long life with little or no incapacitation, 22 per cent died from bacterial endocarditis or aortitis, 23 per cent died of rupture of the aorta, usually with hypertension, and 28 per cent died because of the hypertensive state, most frequently from cardiac failure or intracranial hemorrhage. The average age at death was 35 years.

The diagnosis of coarctation is made from physical observations and roentgenologic data. The pulsations in the lower extremities are greatly diminished or absent, the blood pressure in the arms is usually elevated and is decidedly above that in the legs, in contrast to the usual state of affairs, evidence of collateral circulation about the thorax is often observed, murmurs are variable, the heart is apt to be enlarged but the aortic knob is usually small, and there may be notching or scalloping along the inferior surfaces of the ribs where tortuous and pulsating intercostal arteries have eroded the bone. Angiocardiology with diodrast is most useful for an exact confirmation of the diagnosis and for visualization of the anatomic abnormality.

Operation is performed through the fourth left interspace. Noncrushing clamps are applied above and below the constricted area and the narrowed portion is cut away. End-to-end anastomosis with an everting mattress suture of silk is then carried out.

Among 60 operations for coarctation there were 7 deaths, only 1 of which was directly connected with the aortic abnormality. In 6 cases, exploration only was possible because of the conditions found, i.e., regional inflammatory changes or a very long segment of narrowed aorta, in 2 cases a subclavian-aortic anastomosis was done, and in the remaining cases, end-to-end aortic suture was accomplished. Forty-one patients had complete relief of hyperten-

sion, 3 had fair relief, and only 1 patient obtained no relief

In 1 patient, excision of the coarctation left a long gap which could not be closed by direct apposition of the ends. A 5 cm aortic graft from another person which had been preserved for a period of 30 days was successfully sutured into place and the patient was discharged from the hospital in excellent condition.

The lower age limit for operating on coarctation is probably 6 or 8 years, the upper age limit is difficult to define precisely. Excellent results have been obtained in patients in the late twenties, but greater satisfaction will be obtained in younger subjects.

JESSE E. THOMPSON, M D

**Experimental Reconstruction of Cardiac Valves by Venous and Pericardial Grafts** JOHN Y. TEMPLETON, III, and JOHN H. GIBBON, JR. *Ann Surg*, 1949, 129, 161

A technique has been developed in dogs to allow resection of a portion of the tricuspid valve and its replacement with a graft of vein or pericardium. The venae cavae and azygos vein are clamped temporarily and the right auricle is opened. Under direct vision a leaflet of the tricuspid valve is resected, the auricle is closed, and circulation is re-established. A graft is then prepared, either from a section of pericardium or a segment of azygos vein turned inside out. The circulation is again interrupted and the auricle re-opened. The graft is then inserted and sutured in place with silk stitches. The auricle is closed and circulation re-established.

Grafts were placed into 19 dogs, 7 of which survived from 3 weeks to 7 months after operation. Death in the others was due to ventricular fibrillation or neurologic damage, as a rule. Specimens of the grafts obtained at autopsy after 3 weeks were viable and firmly united to the wall of the heart. Anatomically and functionally the pericardium appeared to be more suitable than a vein as a source for the graft. In 5 control animals a portion of the tricuspid valve was resected and no graft was used. Postoperatively these animals had loud murmurs in contrast to the animals in which grafts had been used, which had only faint murmurs. All the control animals developed marked precordial thrills, 4 of the 7 animals in which grafts had been used developed systolic thrills in 3 weeks or more following operation.

JESSE E. THOMPSON, M D

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The nature of such tumors is in dispute, as shown by a review of the literature. Some 200 cases have been reported, and these tumors have been considered as organizing thrombotic masses, or new growths of fibrous or myxomatous nature. No further conclusive evidence in this regard is given.

The clinical picture is often confusing, but may present itself as simulating mitral stenosis with relentless progression of cardiac failure unaffected by treatment, or it may mimic the embolic picture of bacterial endocarditis.

The absence of evidence of rheumatic fever and the relentless march of cardiac failure could lead to a suspected diagnosis during life. It has been suggested that embolectomy in appropriate cases might give a clue to the presence of this tumor if microscopic examination of the embolus was carried out.

The 4 gross as well as microscopic specimens are represented by photographs and the case histories are briefly given.

HIRAM T. LANGSTON, M D

## ESOPHAGUS AND MEDIASTINUM

**Displacement of the Esophagus into a New Diaphragmatic Orifice in the Repair of Paraesophageal and Esophageal Hiatus Hernia** K. ALVIN MERENDINO, R. L. VARCO, and OWEN H. WANGENSTEEN. *Ann Surg*, 1949, 129, 185

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Hiatus hernia is not an uncommon finding and is more frequent in females than in males. Symptoms vary and are related to the gastrointestinal tract, cardiovascular system, respiratory tract, or any combination of these. Most patients are past 40 years of age and are obese. X-ray examination is the most important single diagnostic aid. There is often no correlation between the size of the hernia and the severity of symptoms, and the hiatus hernia may be only incidental to a more serious lesion.

Medical management should be attempted in practically all cases. Surgical repair is justified after medical measures fail to give relief. The authors report a variation of the conventional method of repair. A transthoracic approach is preferred, although the transabdominal or combined thoracoabdominal approach may be employed. This repair entails displacement of the esophagus anteriorly and to the left, closure of the hiatus posteriorly by suture of the right and left crura of the diaphragm, and suture of the stomach immediately distal to the esophago-gastric junction to the edge of the diaphragm. When the tissues of the right and left crura are not satisfactory for suture, a new hiatus is created by an incision anterolaterally in the diaphragm; the esophagus is placed in the new position, and posterior closure is effected.

Thirteen cases without recurrence are reported. The transthoracic approach was used in 9 cases, the transabdominal approach in 3, and the transabdominothoracic approach in 1 case. Certain advantages and disadvantages of the various approaches are reviewed.

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# **Surgical Treatment of Esophageal Perforations** (Traitement chirurgical des perforations de l'oesophage) HORACIO RESANO *Rev chir*, Par, 1949, 68 1

Ninety per cent of perforating injuries of the esophagus are situated in the cervical portion. Most of them are caused either by foreign bodies or by instrumentation, especially esophagoscopy or attempts at extracting a foreign body.

The clinical symptoms include pain, dysphagia, fever, and subcutaneous edema. However, they are not present in all cases so that the diagnosis is missed frequently. More helpful are the radiological signs: increase of the tracheovertebral distance and a characteristic air bubble in this space (Fig 1).

Some writers recommend medical and antibiotic management and take recourse to surgery only in case of failure of such management. In contradistinction to these men, the author believes that early surgery should be done in every case, even if the diagnosis is not certain. A simple submucous abscess may be visualized with the esophagoscope and opened. In all other cases mediastinotomy should be done.

The esophagus can be approached from in front or from behind the sternomastoid muscle. The author prefers the posterior route because the evacuation and drainage of pus is more effective. The proximity of the thoracic duct does not present a danger. Necrosis of the carotid wall due to pressure of the cigaret drain was never observed by the author.

A transverse incision is made 2 cm above the left clavicle. The external jugular vein is ligated, the tendon of the omohyoideus and the middle cervical fascia are cut, and the esophagus is exposed posteriorly to the sternomastoid muscle and the large cervical vessels. If no perforation or only a very small one is present, a cigaret drain is introduced in the retroesophageal space and removed after 48 hours. If a small abscess is found, the drain is left in place and fixed to the skin with a suture. Large abscesses require bilateral drainage. The surgeon introduces a finger through the incision and passes it behind the esophagus and the great cervical vessels of the opposite side. A counterincision is made at the posterior margin of the right sternomastoid muscle and a curved forceps is introduced through it. Under guidance of the finger the forceps is passed from right to left until it reaches the wound of the operation. Here it grasps a cigaret drain which is passed in the opposite direction from left to right.

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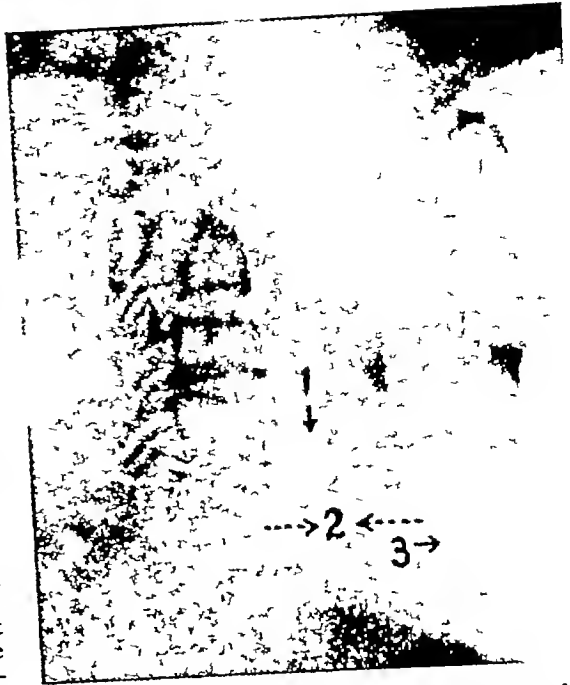


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with pulmonary insufficiency, aneurysms of the aortic arch, and cases of decompensation of the heart. Of the bronchoscopic examinations 210 were done on tuberculous subjects and the remainder were done on patients with cancer and other nontuberculous affections. No consideration was given to the simple elevations of temperature which lasted only for the first night.

Among the nontuberculous patients there were only 2 cases (0.8 per cent) in which the examination was followed by lengthy periods of fever, from 8 to 10 days, and transient roentgenologic modifications which did not last as long as the febrile reaction. The most frequent indication for bronchoscopy in these nontuberculous patients was that of pulmonary suppuration (150), bronchiectasis, chronic abscess, or suppurated cysts. The fact that the results were so uniformly innocuous may perhaps be partially explained on the basis of the preoperative and postoperative administration of penicillin, and on the coincidental bronchial instillations.

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sion, 3 had fair relief, and only 1 patient obtained no relief

In 1 patient, excision of the coarctation left a long gap which could not be closed by direct apposition of the ends. A 5 cm aortic graft from another person which had been preserved for a period of 30 days was successfully sutured into place and the patient was discharged from the hospital in excellent condition.

The lower age limit for operating on coarctation is probably 6 or 8 years, the upper age limit is difficult to define precisely. Excellent results have been obtained in patients in the late twenties, but greater satisfaction will be obtained in younger subjects.

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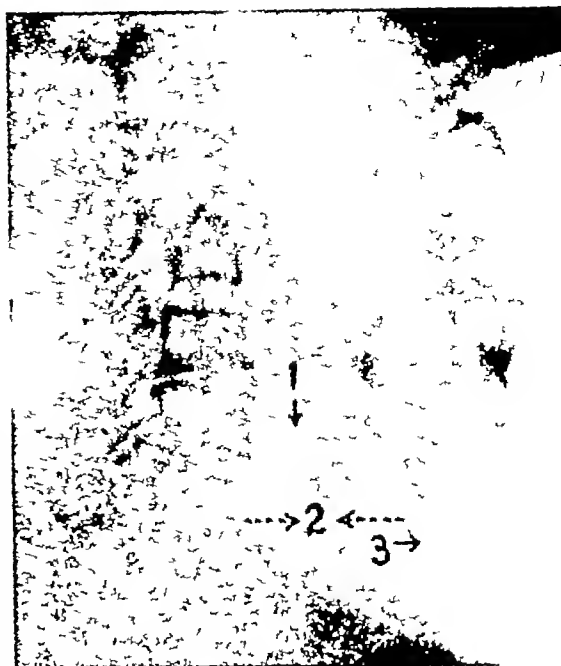


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lasting from 5 to 10 days and then a return to normal, without at any time evidence of alterations in the lungs detectable by roentgenologic methods. In the other cases (9), the febrile attacks were accompanied by evident roentgenologic changes of progressive and enduring character. In 2 instances the examination was followed in a few days by death.

The authors are of the opinion that in these cases of progressive pulmonary tuberculosis with fever, an accelerated sedimentation rate, and roentgenologic evidence of an ulcerative or nodular type of tubercular pulmonary involvement, bronchoscopy should be practiced only for positive and definite indications, and that the patient should be protected by a course of streptomycin. JOHN W. BRENNAN, M.D.

**Anesthesia for Operations for the Relief of Congenital Pulmonary Stenosis** E. H. RINK, P. J. HELLIWELL, and A. M. HUTTON *Guy's Hosp Rep*, Lond., 1948, 97: 48

This report deals in some detail with the anesthetic problems encountered during the performance of the Blalock-Taussig operation. It includes the period of time during which Blalock worked as Associate Surgeon at Guy's Hospital (London) in September, 1947.

The experience obtained from 42 patients is given, minutely and often dramatically. Three of these patients died on the table and 3 others died within 12 hours after the operation. The deaths are given as case reports. Nine of the 42 patients were operated upon by Blalock and the remainder by R. C. Brock.

The anesthetic technique employed is essentially that used and described by Blalock. The premedication given the English patients was heavier, consisting of full basal narcosis by means of nembutal with atropine gr. 1/100 for children. In adults omopon and scopolamine were followed by the intravenous administration of pentothal. Cyclopropane and oxygen with ether added, if indicated, are given in a closed system with carbon dioxide absorption,

through an endotracheal tube placed in a Butin anesthetized larynx. The principal deviation from the technique used by Blalock was the introduction of curare to obtain control of the respiratory efforts, particularly in young patients.

Some specific details of the anesthetic apparatus are given and illustrated by photographs.

The experiences with 3 cases of pulmonary valvulotomy are also given.

HIRAM T. LANOSTON, M.D.

**Exploratory Thoracotomy in the Management of Pleural Empyema** PAUL W. SANGER *J Thorac Surg*, 1948, 17: 756

The incidence of empyema secondary to lobar and lobular pneumonia is now less frequent than empyema secondary to ruptured bronchiectatic abscess, infected hemothorax, ruptured subdiaphragmatic abscess, traumatic empyema, ruptured pulmonary abscess, cancerous or noncancerous, and as a consequence of inadequate surgery for postpneumonic empyema.

After intelligent conservative measures have failed, exploratory thoracotomy is the treatment of choice in present-day pleural empyema. If these cavities are not explored, the likely consequences of a long morbidity, superimposed on the inconvenience of a drainage tube or sinus tract, must be accepted. The compressed lung may never completely re-expand unless decortication is done. This radical attack is justified only after the preoperative studies for the underlying disease have been exhaustive, the hematocrit reading is 50 or above, ample blood is available for the operation, penicillin or streptomycin can be given preoperatively and postoperatively, and a competent anesthetist trained in endotracheal anesthesia is assured.

Representative case reports are given in an attempt to establish the indications for thoracic exploration, which in reality is conservative, by reducing the morbidity and preventing economic and psychological bankruptcy.

SAMUEL KAHN, M.D.

# SURGERY OF THE ABDOMEN

## ABDOMINAL WALL AND PERITONEUM

**Strangulated Femoral Hernia Relationship of the Contents of the Hernial Sac to the Clinical Manifestations and Prognosis** J. PARRAN JARBOE and JOSEPH H. PRATT *Am J Surg*, 1949, 77 172

By careful review of the clinical manifestations exhibited in 104 cases of strangulated femoral hernia it is obvious that acute strangulating types of small intestinal obstruction produce a very dramatic onset. The rapid progression of symptoms and signs indicates the rate of pathologic degeneration within the hernial sac. Therefore, when a segment or loop of the small intestine is strangulated in the femoral ring, the clinical picture presented is one of acute intestinal obstruction with such various degrees of prostration and shock that the femoral hernial process is often unheeded.

When abdominal or pelvic structures other than portions of small intestine are strangulated, the primary symptoms and signs usually indicate acute femoral herniation, whereas late manifestations may be referable to the structures involved. However, in all cases of strangulated femoral hernia the character and severity of the initial clinical symptoms and signs indicate the grave seriousness of the disease. Immediate cognizance of these manifestations should assure earlier surgical treatment and a more favorable prognosis.

It is acknowledged that numerous factors contribute to the high fatality rate associated with strangulated femoral hernia. Many of these contributory elements are individual responsibilities that offer few prospects for improvement of this situation unless the layman is re-educated to recognize the manifestations of impending strangulation. Too often the liability for fatalities is attributed to the advanced age of the patients without sufficient consideration and recognition of other probable causes for failure.

It has been demonstrated in the 104 cases of strangulated femoral hernia studied that age alone is not ample justification for the rendering of an unfavorable prognosis. It is the authors' observation and conclusion that the prognosis should be determined after evaluation of the pathologic condition of the strangulated viscera when they are visualized and treated at operation. In cases of strangulation of parts of the small intestine, when surgery has been delayed and irreversible pathologic changes have taken place, the prognosis is very grave for a person of any age. Since physical resistance in the aged is materially lowered, such persons are benefited most by early surgical treatment, but the prognosis should be influenced more by the condition of the strangulated viscera than by the factor of age alone.

The grave seriousness of strangulated femoral hernia involving a segment or loop of small intestine has been discussed. If the clinical evidence is considered and interpreted as being directly indicative of the degree of strangulating obstruction, perhaps many operations may be performed earlier before irreversible pathologic changes occur.

An intimate relationship has been found to exist between the character of the contents of the hernial sac and the clinical manifestations. Careful evaluation of these components is essential for the rendering of a dependable prognosis. It is hoped that adequate realization and a more comprehensive understanding of the serious problems presented by strangulated femoral hernia will result in benefits for everyone concerned.

**Treatment of Acute Peritonitis** W. A. ALTEMEIER  
*J Am M Ass*, 1949, 139 347

There are two types of septic peritonitis: a primary type which usually occurs in children and is caused by the pneumococcus or a hemolytic streptococcus, and a secondary type having a polymicrobial causation and arising from perforation or leakage of an intra-abdominal viscus. The commonest factor in the secondary type is an infected appendix.

There is still no specific treatment for acute septic peritonitis, and successful management is dependent on good surgical intervention aided by early and correct diagnosis, chemotherapy, and adequate preoperative and postoperative care.

The author reviews 598 cases of acute septic peritonitis secondary to acute appendicitis, perforated peptic ulcers, and penetrating wounds of the abdomen in which the patients received chemotherapy in addition to other measures. A comparison of the results obtained in 685 similar cases treated without chemotherapy with those in cases in which chemotherapy was used reveals that the mortality has been reduced approximately 60 per cent recently and that this reduction is apparently due to the effects of chemotherapy.

Since most cases of acute septic peritonitis are secondary to lesions of the alimentary tract, it is the practice at Cincinnati General Hospital to operate as soon as the diagnosis is made. In the neglected, or moribund patients, surgery has been postponed and conservative therapy used until localization or improvement might occur. Among 258 patients with complicated acute appendicitis, 167 had peritonitis and 53 had appendical abscess. All but 10 patients were operated upon with a postoperative mortality of 4.8 per cent. Likewise, in a series of 179 patients with perforated peptic ulcers and peritonitis, treated in the same period, 169 underwent operation with closure of the perforation, and 10 did not, because of their moribund state in 8 instances, and the prolonged period of elapsed time since per-

foration in 2 cases The postoperative mortality was 7.6 per cent

Patients with appendical abscesses generally have been treated conservatively unless signs of infection did not diminish within from 24 to 48 hours, in which case plans for operation were made The mortality among the 13 patients who were treated by incision and drainage without appendectomy was 15.3 per cent, and among 35 patients who underwent appendectomy with drainage, 5.7 per cent Intra-abdominal abscesses other than appendical abscesses have been incised and drained as soon as their presence has been determined and localization has occurred

In cases of perforated peptic ulcer and penetrating wounds of the abdomen, the peritoneal cavity is not drained If the retroperitoneal tissues are contaminated, drainage is established through a stab wound in the flank Drainage was used in 204 of 248 patients operated upon for appendical peritonitis or abscess Careful removal of excessive exudate by suction has been done as part of the operation

The author recommends the following chemotherapy for effective treatment of acute secondary peritonitis the parenteral administration of penicillin and sulfadiazine, the combined use of penicillin, streptomycin, and sulfadiazine, or the injection of large doses of penicillin When several drugs are used, the dose of each should be therapeutically effective The dose of penicillin is 100,000 units given at 2 or 3 hour intervals In severe infections the dose may be 500,000 units or more every 2 or 3 hours Intraperitoneal chemotherapy is not used

When penicillin and sulfadiazine were used postoperatively in patients with perforated peptic ulcer the postoperative febrile period was 6.3 days, whereas it was 8.0 days when penicillin alone was used, and 12.4 days when only sulfadiazine was given The over-all mortality in patients with perforated peptic ulcer improved to 9.3 per cent when chemotherapy was used, as compared to 26.6 per cent in earlier patients treated without chemotherapy In peritonitis or abscess secondary to appendicitis, the mortality was reduced to 4.9 per cent when chemotherapy was used as compared to 14.5 per cent in earlier cases

Secondary peritonitis is a synergistic infection produced by the accumulative action of various bacteria which singly have a low virulence From 3 to 7 different species of bacteria can usually be cultured from any given case Penicillin in large doses is probably the most effective single agent available in the treatment of peritonitis even though most of the bacteria concerned are gram-negative Penicillin does not effect *Escherichia coli* and this organism is not truly pathogenic in the majority of instances

In patients treated with penicillin there is a lower incidence of cellulitis and necrotizing infection in the abdominal wound than in patients receiving no chemotherapy

Sulfadiazine or sulfamerazine are valuable adjuncts in the treatment of peritonitis and their

effect is considerably enhanced when used in combination with penicillin

Streptomycin is not as effective as penicillin Its greatest value is in the treatment of early spreading peritonitis and it is of questionable value in localized peritoneal suppuration or severe established peritonitis The authors use it in combination with penicillin and sulfadiazine and in cases that have failed to respond to penicillin alone or to penicillin and sulfadiazine  
FREDERICK W PRESTON, M.D

## GASTROINTESTINAL TRACT

**Pseudoulcerative Gastritis** (La gastrite pseudoulcerosa) AUGUSTO PICCO *Arch ital chir*, 1948  
70 382

The author describes 6 cases of chronic gastritis with symptoms of gastroduodenal ulcer, but no evidence of ulcer in the resected portion of the stomach

The differential diagnosis between pseudoulcerative gastritis and round ulcer is difficult even with gastric analysis and x-ray examination

In 5 cases microscopy showed a follicular hypertrophic gastritis, while in the sixth case follicular atrophic gastritis was observed

The author describes two different types of inflammation One involves the mucosa, and corresponds to the classical type of inflammation, with parvicellular (small cell) infiltration and the formation of lymphatic nodes and follicles The other type involves the mesenchymal tissue and is the type of serous inflammation with profound edema and primary fibrosclerosis of the connective tissue This is caused by primary alterations of the capillary walls due to penetration of toxic substances through the mucosa rendered permeable by the inflammation

In these cases medical treatment, which should always be tried, usually produces only a slight improvement over prolonged periods

Usually surgery must be resorted to and then cure will be obtained only after ample gastric resection

LUCIAN J FRONDOTI, M.D

**Hypertrophy of the Pylorus in an Adult with Massive Eosinophil Infiltration and Giant-Cell Reaction** H J BARRIE and J C ANDERSON *Lancet*, Lond, 1948, 2 1007

The authors reported the rare and interesting single case of a 27 year old woman with a 2 weeks' history of constant circumumbilical pain intense enough to keep her awake at night, and of pain and a feeling of distention between the breasts immediately after taking food Vomiting after every meal had relieved this pain Four years previously the patient had had a similar but less severe episode associated with melena which lasted a fortnight Eggs, pastry, and bacon had caused indigestion between these two attacks There was no personal or familial history of asthma or urticaria Physical examination revealed a furred tongue, tachycardia of 130 beats per minute, and slight tenderness to palpation in the epigastrium and the right iliac fossa

The barium meal showed a smooth filling defect involving the greater curvature of the prepylorus with a small residue in the stomach after 6 hours. The blood count showed a hemoglobin of 120 per cent, 6,300,000 red blood cells per cubic millimeter, a color index of 1, 17,000 white blood cells per cubic millimeter with 18 per cent of eosinophils. Two weeks later the white blood cell count numbered 11,800 per cubic millimeter with 31 per cent of eosinophils.

A partial gastrectomy with an anterior gastroenterostomy and an entero-anastomosis was performed. The surgical specimen showed concentric hypertrophy of the muscular coat of the stomach, pylorus, and duodenum, with massive eosinophile infiltration of the pylorus and peculiar para-arterial giant-cell follicles.

The authors believe that this is an example of true organic intestinal allergic reaction. This patient did not tolerate certain foods well, she had constant blood eosinophilia and a localized tissue eosinophilia of the pylorus, and there were giant-cell follicles in the pylorus which closely resembled follicles found in the heart muscle of patients who have become sensitive to neoarsphenamine.

Barrie and Anderson demonstrated the possibility that organic changes in the stomach may be caused by allergic reactions. The authors have been unable to find a similar published report.

ROBERT TURELL, M D

**Diagnosis of Gastric Neoplasms** H MARVIN POLLARD, HENRY C BRYANT, MALCOLM BLOCK, and WINSTON C HALL. *J Am M Ass*, 1949, 139 71

Improvement in the end result of gastric care can be expected only from earlier diagnosis of the lesions. In the cytologic examination of gastric secretions, a higher percentage of negative results occur because of (1) rapid deterioration of cells in the gastric fluid unless immediate fixation is done, (2) the absence of exfoliation in scirrhous carcinomas, and (3) the frequent presence of swallowed foreign cells from the nasal, pharyngeal, tracheal, and esophageal mucosæ. Since 1947 the authors had studied 326 gastric aspirations done on 278 patients. This group was studied because they all had gastrointestinal complaints. The technique was to aspirate a fasting specimen, and to add to the specimen an equal volume of 95 per cent alcohol. The sediment, after centrifugation, was smeared and fixed, and the usual solutions were used for staining and preparation. All slides were studied by the same pathologist, who estimated that positive slides can be evaluated quickly, while approximately 20 minutes were necessary before discarding a negative preparation. The most dependable sign of malignancy, invasion of the surrounding tissues, is not available in this type of examination.

The material studied was divided into four general categories.

In the first group of patients, in whom there was no clinical evidence of neoplasm, 86 per cent of the

aspirations were thought to contain no malignant cells, 10 per cent were indefinite, and 4 per cent were falsely reported as positive for carcinoma.

In the second group, 43 patients showed no histologic evidence of neoplasm. In this group, only normal cells were found in 72 per cent, in 9 per cent the cells were indefinite, while in 10 per cent it was believed that malignant cells were identified.

In the third group, 20 patients had a final clinical diagnosis of gastric carcinoma, but there was no histologic confirmation. No malignant cells were found in the gastric contents in 60 per cent (12), while a positive report was made in 40 per cent (8).

In the fourth group, in which 41 persons were proved histologically to have gastric carcinoma, no recognized malignant cells were seen in 22 cases (53 per cent), and 5 cases (12 per cent) were indefinite. Malignant cells were found in 14 cases (35 per cent).

In the total study, 59 per cent of the aspirations reported as positive were confirmed by clinical and histologic study. On the other hand, when the aspiration report was negative, results in 85 per cent of aspirations coincided with the clinical and histologic study. In all the cases with a final diagnosis of carcinoma, the result of the aspiration technique was correct in 36 per cent. On some occasions, the cytologic study was an indication for exhaustive clinical study. Final conclusions cannot be drawn. There are several factors of importance: (1) the experience of the pathologist with this method, (2) the difficulty of obtaining good smears because of obstruction, and (3) the number of aspirations done in an individual case.

At the present time this method should not be used as an exclusive basis for either a positive diagnosis or a positive exclusion of gastric neoplasm.

ROBERT E FLORES, M D

**Benign Tumors of the Stomach. A Case of Lipoma Submucosa Ventriculi Simulating Cancer of the Stomach** HENNING PAABY. *Acta chir scand*, 1949, 97 381

The author reports a case of large, submucous lipoma of the stomach, simulating cancer of the stomach. It was removed by resection.

The frequency of benign tumors of the stomach is stated very differently by the various authors. In 13 per cent of a material of operations comprising 2,195 cases of tumor of the stomach, the tumor was found to be benign. The occurrence of these tumors is more frequent than generally supposed.

The classification of these tumors varies. The tumors are divided, according to their histological structure, by Minnes and Geschickter into the following three main groups: (1) epithelial—comprising adenomas, adenopapillomas, fibroadenomas, and others, (2) mesenchymal—comprising leiomyomas, fibromas, lipomas, angiomas, and others, and (3) the pseudoneoplastic—comprising, among others, dermoid cysts, and blood cysts.

The etiology of the benign tumors is unknown. Achylia is of very frequent occurrence in the epithel-

lial tumors Haring, in a work on the connection between pernicious anemia and polypous tumors of the stomach, demonstrated that from 10 to 14 per cent of the patients with polypi of the stomach suffer from pernicious anemia, and stressed the importance of undertaking an examination of the blood in these patients as well as an x-ray examination of the stomach in all patients with pernicious anemia. The significance of the benign tumors of the stomach is undoubtedly first and foremost their tendency toward malignant degeneration. The tendency of the benign tumors to give clinical symptoms will, as a rule, depend on their size, as the great majority of the small tumors give no, or only vague, symptoms. The symptom of most frequent occurrence is anemia, caused by hemorrhage. Another symptom of fairly frequent occurrence—and rather a characteristic one—is acute stenosis. Such attacks occur most frequently in association with small stalklike tumors localized near the pylorus.

An important diagnostic aid is the x-ray examination, as the tumors often display characteristic signs. It is difficult to diagnose the small polypous tumors roentgenologically, but in most cases they are best seen in examination of the mucous membrane with a small quantity of contrast medium and with compression. They will then appear in the form of scattered, roundish rarefactions. In some cases the tumor forms a well defined defective filling, surrounded by a natural relief of mucous membrane. As a rule, peristalsis is normal, however, it is not normal if the tumor is ulcerated. Recesses are of fairly rare occurrence and are never associated with spasms. When a recess occurs—corresponding to an ulceration of the tumor—the usual convergence of folds of the mucous membrane will, as a rule, be absent, and the recess will often be large, of a punched appearance, with smooth walls, and without mounded edges.

The treatment of benign tumors of the stomach will always be operative, partly because of the risk of malignant degeneration and partly because of the difficult diagnosis in connection with the frequently severe symptoms.

CHARLES BARON, M D

**Neurofibroma** EBEN ALEXANDER, JR., and ROBERT M JANES *Ann Surg*, 1949, 129 267

Hourglass neurofibroma, often referred to as perineural fibroblastoma, is sometimes found in the thoracic spinal canal and thoracic cage. The tumor is benign. Roentgenologically, it may erode the adjacent ribs and vertebrae.

This tumor is often mistakenly diagnosed as lung carcinoma. Radiation therapy produces no good results. This serves to emphasize the fact that a tumor should not be irradiated without pathological proof as to its malignancy.

The authors report a case of neurofibroma that was at first diagnosed as bronchogenic carcinoma. It was given a trial course of irradiation with no response, and subsequently operation was done with complete relief of the symptomatology and physical findings.

MAURICE D SACHS, M D

**Mechanism of the Postgastrectomy Syndrome**  
DAVID ADLERSBERG and ERNST HAMMERSCHLAG  
*J Am M Ass*, 1949, 139 429

The authors state that at present partial gastrectomy is the method of choice in the surgical treatment of peptic ulcer. While the results are generally good, a certain number of patients (from 6 to 38%) present a group of symptoms termed the postgastrectomy syndrome.

The symptoms may be divided into "early" and "late" postprandial symptoms. The early symptoms are epigastric pressure, nausea, fullness, eructation and belching, dizziness, and occasional vomiting. These early symptoms are attributed to mechanical factors of the small stomach with its rapid filling, rapid emptying, and distention of the jejunum with subsequent mesenteric irritation. The late symptoms are headache, fatigue, weakness, perspiration, palpitation, dizziness, shortness of breath, and occasionally precordial pressure. It is demonstrated that these symptoms are due to hypoglycemia secondary to an exaggerated postprandial hyperglycemia. This may result from an increased insulin sensitivity. A combination of these mechanical and chemical factors, together with distinct psychoneurotic disturbances with a tendency toward fixation and overemphasis of symptoms, causes this syndrome.

Opinion concerning prophylaxis is divided, however, agreement prevails in regard to treatment. Early symptoms are treated by frequent and small feedings. The late postprandial symptoms are favorably affected by a high protein, high fat diet, with moderate amounts of carbohydrate. The slow and gradual release of carbohydrate from protein results in a moderate elevation of the blood sugar level and so prevents the secondary hypoglycemia.

ELY ELLIOTT LAZARUS, M D

**Immediate and Late Results in the Treatment of Perforated Gastroduodenal Ulcer** (Esiti prossimi e remoti della cura dell'ulcera gastro-duodenale perforata) GIUSEPPE SPADARO *Gior Ital chir*, 1948, 4 603

The author reviews 100 consecutive cases of perforated gastroduodenal ulcer at Pelligrini Hospital in Naples. Of these, 64 were gastric and 36 duodenal. The over-all mortality was 18 per cent. However, in the period from 1934 to 1940, there were 15 deaths in 49 cases, a mortality of 30.6 per cent, while in the period from 1941 to 1947 there were 3 deaths in 51 cases, a mortality of 5.8 per cent, these figures show a marked improvement. This is attributed to better technique, antibiotics, and earlier diagnosis and treatment. The postoperative mortality was minimal following simple closure of the perforation and after resection. It was highest when gastroenterostomy was performed. The best results followed simple closure when other factors were equal. Eight patients were subjected to resection with 1 death (12.5 per cent).

As to the late results, the author differentiates between acute and chronic ulcers. In acute ulcers



simple closure is followed by a definite cure in the majority of cases. In chronic ulcers simple closure results in cure in 50 per cent of the cases. Gastric resection gives a very high percentage of cures, while gastroenterostomy gives the poorest results.

As a result of this review the author recommends the following:

1. Acute ulcers should be treated by simple closure, regardless of the interval before operation.

2. Chronic ulcers when seen within 6 hours of perforation, and when the general condition permits, should be treated by gastric resection. If they are seen after 6 hours, or if the condition of the patient is precarious or there is evidence of peritonitis, simple closure should be done.

3. In cases in which operative intervention is not advisable one may resort to constant or intermittent suction as recommended by Bedford and Turner.

The author concludes by stating that the surgeon should never open an abdomen with a pre-established program but that the opened abdomen should dictate to the surgeon the procedure to be followed.

LUCIAN J. FRONZUTI, M.D.

#### Experimental Research on the Behavior of the Duodenal Stump Following Exclusion Resection (Ricerche sperimentali sul comportamento del moncone duodenale nella resezione escludente) L. VERNETTI *Arch Ital chir*, 1949, 71: 3

The author discusses the advantages of removing the mucosa from the antral portion of the stomach when performing the exclusion operation of Finsterer. He then describes experiments performed on dogs and dissections performed on cadavers. These were performed to determine the relative value of the methods used to remove the mucosa.

In the first group of dogs, he dissected the mucosa down to, or beyond, the pylorus, then ligated it as far down as possible and excised the proximal portion. In another group he dissected the mucosa as far as possible and then excised it without ligating it. In a third group he made a circular incision proximal to the pylorus, a longitudinal incision over the anterior portion down to the duodenum, and then coagulated the mucosa under direct visualization with the electric cautery. The dogs were sacrificed at different intervals. On gross examination there was not much difference. However, microscopic studies revealed that the best healing took place when the mucosa was excised and not ligated. In dogs in which the mucosa was ligated, a collection of sanguineous fluid was found between the ligature and the sutured seromuscular walls which, it was believed, might endanger the suture line and cause a leak. The use of the cautery caused inflammatory and hemorrhagic reactions which also endangered the ability of the suture line to hold.

The dissections on some cadavers were performed so as to isolate the mucosa distally without entering the lumen. In other cadavers a circular incision was made through all layers, then a longitudinal incision, perpendicular to the first incision and over the an-

terior surface of the antropyloric region, was made to expose the mucosa and thereby allow its dissection under direct visualization. In others the mucosa was removed with a cutting spoon according to the method of Burkle. The author believes there is no difficulty in dissecting the mucosa down to the pylorus, regardless of how it is done. However, if the mucosa is to be dissected beyond the pylorus and in the first portion of the duodenum it becomes difficult. With use of the longitudinal incision, dissection is much easier as then the mucosa can be separated under direct vision. The use of the cutting spoon or curette was not satisfactory as all of the mucosa was not removed.

LUCIAN J. FRONZUTI, M.D.

#### Surgical Treatment of Polyps of the Large Intestine

RICHARD B. CATTELL, *Am J Surg*, 1948, 76: 733

Cattell stated that in spite of the fact that now colonic malignant lesions come to resection about 2 months earlier than they did 10 years ago, and in spite of improvements in surgical procedures, the results observed 5 years or more after resection have not been improved appreciably. The 5-year survivals have remained in the vicinity of 50 per cent. He believes that the greatest opportunity in the future for the improvement of results lies in the discovery and the elimination of benign polyps which he regards as premalignant lesions.

The incidence of colonic polyps has varied from 2 to 20 per cent in reported series. The incidence of polyps in patients with proctologic symptoms who are given a proper proctologic survey varies from 5 to 10 per cent. It is assumed that at least 3 per cent of adult patients have benign polyps. Since only one-third of these patients with benign polyps have

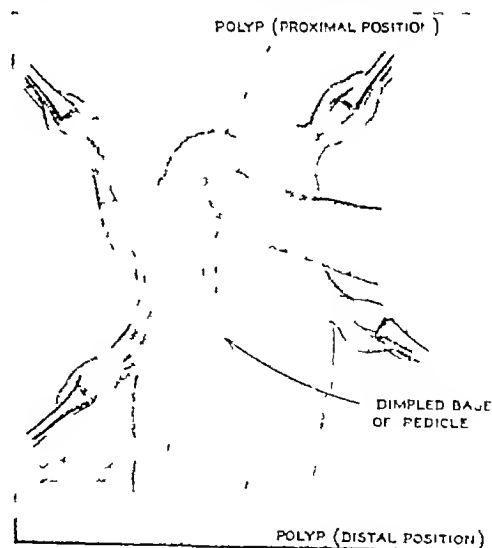


Fig 1 (Cattell). The sigmoid has been freed and the polyp located. The diagram shows polyp being displaced proximally with a dimple appearing at its attachment.





able, and the polyps may be difficult to localize at the time of operation. The bowel is adequately prepared and slightly soluble sulfonamides are utilized. Spinal or general anesthesia with curare produces satisfactory operative conditions. A complete abdominal exploration is carried out. All segments of the colon are carefully explored. The segment of polyp-containing bowel is well mobilized by dividing the parietal attachment so that it may be delivered outside of the abdomen. This maneuver affords facility in palpation and makes colotomy safer. Palpation is best done with the finger passed longitudinally along the bowel and pressing back against the mesentery. The polyp-bearing segment of the bowel may be held by 4 clamps or traction sutures in the epiploic appendages (Fig 1). Frequently the pedicle of the polyp can be felt if the attachment of the pedicle is on the antimesenteric wall. When it is displaced, a dimple will appear (Fig 1).

In the absence of induration at the base, pedunculated polyps may be removed as illustrated in Figure 2. The excised specimen is examined microscopically before closure of the intestinal wounds. If induration at the base of the polyp is present or if the polyp is large and spreading, an intestinal resection with end-to-end anastomosis as illustrated in Figure 3, is indicated.

Seventy-two of the 78 patients who were treated by colotomy had polyps in the descending and sigmoid colon. In 1941, there were 2 deaths following colotomy which gave a mortality rate of 2.6 per cent, no mortality has occurred since 1941.

One-fourth of the patients who have had colotomy with removal of polyps have shown early malignant changes in the periphery of the pedunculated polyps, these changes were undetected in the frozen sections but were discovered in the permanent histologic sections. At the present time, Cattell believes that in the absence of malignant involvement of the base, local excision of the polyp will result in cure. He realizes that longer follow-up studies may change his present attitude.

Congenital polyposis continues to be a serious problem as judged by the author's experience with 23 such cases. Because of the occurrence of malignancy following subtotal colectomy with ileoproctostomy, Cattell believes that the ideal treatment is a 2-stage procedure consisting of permanent ileostomy and total colectomy including abdominoperineal resection.

ROBERT TURELL, M D

**Involvement of the Ileum in Chronic Ulcerative Colitis** FRED J MCCREADY, J ARNOLD BARGEN, MALCOLM B DOCKERTY, and JOHN M WAUGH. *N England J M*, 1949, 240: 119.

The ileocecal valve does not limit the progress of the lesions of ulcerative colitis into the terminal ileum. In 103 cases studied, the incidence of ileal involvement was 28 per cent. Reports in the literature vary from 13 to 39 per cent.

In the majority of cases the ileum was completely and diffusely involved in ulcerative changes similar

to those found in the colon. Occasionally, separate ulcers appear with intervening portions of the small intestine remaining essentially normal. The inflammatory reaction was much milder and far less advanced than that seen in the diseased colon. The average length of the segment of ileum affected varied from 4 to 45 cm with an average of 20 cm. The pathology was essentially denudation and ulceration.

Roentgenologic evidence of ileal involvement was found in 50 per cent of the cases in which barium enema studies were carried out.

Perforation of the ileal ulcers with generalized peritonitis was a very serious complication that occurred in 17 per cent of the cases. Obstruction of the small bowel due to stenosis of the lumen was not observed in any of the cases.

The duration of the disease showed no definite relation to the incidence of ileal involvement. Ileal involvement is not necessarily a terminal event of an intractable colitis as assumed by many authors.

Ileostomy for chronic ulcerative colitis performed through a segment of ileum that is the site of ulcerative inflammatory changes will probably produce a poor operative result. Perhaps this is one of the important considerations responsible for the high mortality associated with ileostomy in the treatment of this disease. ELY ELLIOTT LAZARUS, M D

**Ulcerative Colitis** LELAND S MCKITTRICK and FRANCIS D MOORE. *J Am M Ass*, 1949, 139: 201.

The problems encountered in patients with ulcerative colitis present a real challenge to both internist and surgeon. It should be recognized by physician and surgeon alike that the patient with ulcerative colitis is a strongly dependent person and that a filial devotion to the physician or surgeon may result during the treatment. Psychiatrists have clarified this point. They have brought into focus the finding that the patient with ulcerative colitis often has lost a parent, sibling, friend, or mate on whom he formerly was dependent, an event immediately preceding the onset of symptoms. This sets the stage for a physician-patient relationship of extraordinary importance in the surgical care of the disease. Recognition and acceptance of this responsibility by the surgeon permits the patient to develop dependence and affords him the relationship so essential to complete adjustment.

It is the objective of surgical management to return a patient with ulcerative colitis to society and capable of becoming a useful member of his family and community. Since ileostomy is the operation performed on a great percentage of these patients the question arises as to whether a patient with an ileostomy can adjust himself to a happy existence. Questionnaires were sent to 110 patients who left the hospital with an ileostomy, and replies were received from all patients or their families. Five patients had died natural deaths from other diseases, one patient died 2 days after an overdose of a barbiturate. Of the 104 patients whose condition was

known at the time of writing, 50 were males and 54 were females. Eighty-four per cent of these patients considered themselves to be in good health. Of the remaining 16 patients, 4 are crippled by other conditions, and 3 undoubtedly have active disease of the colon or some abnormality of the stoma which should be corrected surgically, of the 9 patients who did not become adjusted to their ileostomy, it is felt that 5 may be greatly helped by change of appliance or ileostomy outlet.

Ninety-seven per cent of the patients are working as housewives or in schools, or are gainfully employed. There is a wide variation in the types of occupation—mill workers, truck drivers, a college professor, school teachers, dentists, physicians, medical secretaries, salesgirls. Seventy-five per cent of patients felt that their earning or working capacity had not been lessened by the ileostomy. Sixty-seven per cent believed their social life to be satisfactory and not adversely affected by ileostomy. Of those who felt some limitations, 13 referred particularly to problems arising when spending the night with friends or going on camping trips, or to activities in which the lack of facilities or too intimate contact with others prevented proper attention to the ileostomy. There is, nonetheless, a surprising freedom on the part of these patients to enjoy most activities, including athletics. Twice as many of these patients are married as are single, 23 patients were married subsequent to the operation. Five patients have gone through 2 or more pregnancies subsequent to ileostomy. An understanding husband or wife, and the responsibility and satisfaction of children are undoubtedly important stabilizing factors in the lives of these patients.

Several case histories are given to illustrate the problems of ileostomy as seen by the patient. Some of these histories reflect adjustment to a new mode of life and a relatively happy existence while others indicate a morbid depression resulting from the difficulties associated with ileostomy. Its greatest difficulty applies to young unmarried girls who contemplate marriage. HAROLD LAUFMAN, M D

**Idiopathic Ulcerative Colitis** SIDNEY A PORTIS J  
*Am M Ass*, 1949, 139 208

For those clinicians who raise a quizzical eyebrow whenever psychosomatic aspects of certain diseases are mentioned, this masterful article combines in a lucid and logical manner the anatomy, clinical picture, and psychiatric aspects of ulcerative colitis. Based on the proposition that emotional stimuli are transmitted over the vagus and sacropelvic nerves, the thesis is set forth that the effect of overstimulation of these nerves results in physiologic imbalance. The vagus nerve causes contraction and peristalsis of the small intestine and relaxation of the ileocecal valve as well as increased motility of the colon up to and including the transverse colon. The sacropelvic nerve has the same physiologic effect on the distal part of the colon as the vagus nerve has on the ileocecal portion.

Ulcerative colitis in its early stage is limited to that part of the colon innervated by the sacropelvic nerves. This would indicate that the altered emotional stimuli are transmitted principally over the sacropelvic nerves at the outset. It is postulated that in the early stages a protective mechanism exists in the mucous lining of that portion of the colon innervated by the vagus nerve, while the portion innervated by the sacropelvic nerves is more susceptible. After the disease progresses beyond the splenic flexure into the transverse colon, vagal influence with decreased protection may play a similar role. Recent reports that bilateral vagotomy produces definite improvement in the clinical picture of ulcerative colitis add weight to the assumption that the titer of pancreatic enzymes is a factor in this disease. Improvement following this procedure is probably due to the slowing down of peristalsis in the small intestine and first part of the colon. Neither of these portions of the gastrointestinal tract is involved in the early picture of this disease.

The early proctoscopic picture of the involved mucous membrane is similar in appearance to that of the skin about an ileostomy. This led the author to assume that increased concentration of enzyme was an important factor which produced digestion in both conditions. Liquefaction or hydrolysis of mucin is produced by mucolytic enzyme lysozyme, which is normally present in the intestinal tract and the concentration of which may change in gastrointestinal disorders. An increased concentration of lysozyme may mean lysis of mucus, and therefore an increased attack by enzymes on unprotected mucosa.

Apparently in ulcerative colitis the emotional stimuli transmitted to the rectum and sigmoid by the sacropelvic nerves produce more lysozyme than is normal for the mucous membrane of the rectum and sigmoid, and the mucous protection of the sigmoid and rectum is definitely lowered by this mucolytic enzyme. The lowered resistance of the mucous lining may allow tryptic digestion and invasion by bacteria apparently innocuous to a normally protected mucous lining. The increased peristalsis of the small intestine and colon would throw more tryptic enzyme down on an unprotected mucous membrane. Ulceration is the result of enzyme digestion. The disease process, therefore, is comparable to peptic ulcer except that it is diffuse rather than isolated. Evidence is accumulating to the effect that disturbed emotional reactions can result in ulcerative colitis.

Several case histories are reviewed to illustrate psychological disturbances which lead to abnormal bowel habits. Once the disease of ulcerative colitis is diagnosed, psychiatric management is imperative. However, psychiatric treatment should not be allowed without rigid medical control. The disease is too treacherous to be handled by the psychiatrist alone. No psychiatrist can control emotional problems 24 hours a day. Therefore, the combined man-

## SURGERY OF THE ABDOMEN

agement of medical and psychiatric care is set forth as the only safe treatment.

Treatment should be directed at the eradication of the emotional stimuli, paralysis of the sacropelvic parasympathetic nerves with atropine sulfate, the abolition of influences on the hypothalamic region by the use of barbiturates, the binding of enzymes by wetting agents such as sodium alkyl sulfate, and the administration of sulfonamide drugs cautiously and only for limited periods.

HAROLD LAUFMAN, M D

**Note on the Treatment of Hemorrhoids after a Few Accidents Following Sclerosing Injections** (Note sur le traitement des hémorroïdes à propos de quelques accidents des injections sclérosantes) G ROUHIER and H FUCS *Mém Acad chir*, Par, 1948, 74 649

The authors condemn the sclerosing treatment of hemorrhoids. They report 3 cases in which severe ischio-rectal abscess, necrosis, and a fissure developed in spite of the fact that the injections were given by an expert.

The authors believe that the dangerous sclerosing injections are so popular among medical men and patients precisely because the surgical treatment is improperly carried out in most hands. The authors, who have given up the Whitehead type of excision because of the high incidence of stricture, advocate a safe and simple surgical treatment. They recommend low spinal anesthesia. The first step consists in dilating the anus. This phase of the operation alone takes at least from 15 to 20 minutes and is done with the Trelat speculum. The authors point out that all instruments are rough when they are in rough hands. One must avoid tearing the anorectal mucosa. In male patients the dilatation is carried out in the transverse and oblique diameters to avoid traumatizing the posterior urethra which may cause post-operative acute urinary retention.

After the dilatation has been completed, the hemorrhoids can easily be visualized and can be collected in three or four groups. The base of each group is transfixed and tied twice with No. 1 chromic catgut. The protruding part above the ligature is excised by a live cautery. It is an important point that no gauze and no drain be put in the anus. Purgatives and enemas are used the day before surgery and opiates are then prescribed. The first bowel movement usually takes place on the sixth post-operative day. The patient is discharged on the eighth postoperative day with the instruction to take daily hot sitz baths.

GERARD GAGNON, M D

**Polypoid Lesions of the Colon and Rectum** ROBERT A SCARBOROUGH and RUSSELL R KLEIN *Am J Surg*, 1948, 76 723

The authors have divided polyps of the colorectum into premalignant lesions, which comprise 95 per cent of the cases, and into nonpremalignant lesions, which comprise 5 per cent of the cases. The nonpremalignant lesions include fibromas, myomas,

endometriomas, hemangiomas, granulomas, lymphoid polyps, and lymphomas. The premalignant lesions include inflammatory hyperplasias, hyperplasias, adenomas, and papillary adenomas.

The inflammatory hyperplasias, or the so-called pseudopolyps, is frequently seen in patients with inactive ulcerative colonic disease. The clinical significance of this lesion resides in its ability to undergo malignant degeneration.

The mucosal inflammatory lesions are seen as multiple, pale, flattened elevations of a few millimeters in size. They are most frequently encountered in the vicinity of a carcinoma.

Adenomas vary from tiny sessile lesions to large pedunculated tumors, and may be single or multiple. Some pathologists diagnose any adenomatous polyp as grade 1 adenocarcinoma. Other pathologists diagnose malignancy on the basis of the variation in the staining properties of the cells, ballooning of the crypts, or frequency of the mitotic figures. The authors believe that such diagnoses may lead to unnecessary radical operations or a false sense of security in the safety of local excision. They believe that invasion through the basement membrane or muscularis mucosae should constitute the basic evidence of malignancy. In the presence of invasion the lesion should be called frank carcinoma and treated as such. In the absence of microscopic evidence of invasion, local excision or destruction of the polyp constitutes good therapy.

Papillary (villous) adenomas are regarded as a distinctive type of adenomatous polyp. They are extremely soft and spongy, being comprised of innumerable confluent, pliable, papillary stalks. They are rarely pedunculated but usually have a broad based attachment to the mucosa, sometimes the entire circumference of the bowel is involved for a considerable distance.

Malignant degeneration of the adenomas was found in 18 of the authors' 60 patients (30 per cent). Malignancy was demonstrated by multiple biopsies in 8 of these 18 patients. In 4 of the remaining 10 patients, malignancy was found in the surgical specimens after complete local removal. In the remaining 6 patients malignancy was suspected on the basis of induration within the soft, spongy lesion and this was confirmed histologically following radical resection. The occurrence of malignant transformation deep in the base of papillary adenomas without surface evidence of malignancy calls for complete excision or removal by means of a high frequency snare. The specimens so obtained should be scrutinized carefully for malignant foci.

In the authors' series of 458 patients, 64 per cent showed single polyps, 31 per cent had from 2 to 10 polyps, and 5 per cent exhibited diffuse polyposis of the colon. Regardless of the symptoms, every patient with a polyp found on sigmoidoscopy was accorded a competent roentgenologic examination of the colon including air contrast studies in a search for other polypoid lesions that might be situated above the region of the sigmoidoscope.

The age of the patients ranged from 5 days to 94 years. A striking infrequency of polyps in the second decade of life was observed in this series of patients.

Treatment of polyps should aim at removal of the lesion and the preservation of the specimen for microscopic examination. Tiny sessile lesions may be destroyed *in situ* by means of ball-tipped electrodes, but it should be remembered that such procedures preclude microscopy and thus may result in failure to recognize an early carcinoma. The authors have observed a poorly differentiated invasive carcinoma in a nonulcerated polyp 4 mm in diameter. Larger sessile polyps are removed with a rigid wire diathermy loop in a suitable state for microscopy. Pedunculated polyps are extirpated by means of a high frequency snare. In this series, 211 polyps in 112 patients had been destroyed by electrodesiccation through a proctoscope, while 326 polyps in 182 patients had been removed by means of a snare followed by microscopic studies of the specimens. Microscopy revealed definite malignant degeneration in 13 patients, 9 of whom had undergone a radical resection with the finding of carcinoma in the perirectal tissue or regional lymph nodes. In 4 patients local excision of long-pediced adenomatous polyps containing small foci of malignancy had been effected. In one instance local recurrence was evident after 8 months. The remaining 3 patients have shown no recurrence in less than 2 years.

Single, grossly benign polyps situated above the reach of the sigmoidoscope were removed by colotomy in 37 patients, and histologic examination revealed malignant degeneration in 12 of them. Six of these 12 polyps had been removed by local excision without recurrence of carcinoma in a period ranging from a few months to several years following operation. The remaining 6 patients had been subjected to radical segmental intestinal resection with removal of the regional lymph nodes. The major portion of the bodies of 2 of these polyps was the seat of malignant degeneration. Although no invasion of the pedicle of any of these 6 polyps was discernible, 3 showed metastatic carcinoma in the regional lymph nodes. All 6 patients have remained well for a period of observation ranging from 1 to 8 years.

Four patients showed 2 separate polyps situated from 4 to 12 inches apart. In 1 patient both polyps were benign and were excised locally by colotomy. In the remaining 3 patients both polyps were malignant and were treated by radical resection of the segment of colon containing both polyps. In 1 of these 3 patients metastasis to the regional lymph nodes had occurred.

The authors have grouped their 31 patients with diffuse polyposis of the colon into those with diffuse adenomatous polyps and those with pseudopolyposis secondary to chronic ulcerative colitis. Among the 16 patients with diffuse adenomatous polyps there were 6 whose ages ranged from 3 to 6 years. In 2 of the latter colectomy with ileoproctostomy had been performed, similar therapy had been recommended to, but had not yet been accepted by, the parents of

the remaining 4 children. The ages of the other 10 patients ranged from 18 to 51 years. Seven of this group showed malignant degeneration, with multiple carcinomas in 5 patients. They were treated by total colectomy and permanent ileostomy. One of these patients died of recurrent carcinoma, the remaining 6 have been free of recurrence for 1 to 15 years following operation. In 2 patients without carcinoma of the rectum, colectomy and ileoproctostomy were performed following extirpation of the rectal polyps. One of these patients had required frequent electrodesiccation of new rectal polyps for more than 10 years.

Pseudopolyposis secondary to chronic ulcerative colitis was encountered in 15 patients, 4 of these patients had carcinoma, of whom 3 were inoperable. All of these patients had been subjected to total colectomy with permanent ileostomy.

One patient with chronic ulcerative colitis and polyposis extending from the splenic flexure to the rectum was treated by resection of the involved bowel with preservation of sphincteric control by pulling the transverse colon through the anal canal according to the technique of Babcock and Bacon.

The authors concurred that bleeding may occur in diverticulitis, but stated that in their experience bleeding was usually due to a coexisting adenomatous polyp. During the course of 2 years they removed polyps in 16 patients in whom rectal bleeding had been attributed to diverticulitis. No bleeding had occurred postoperatively although the diverticular disease remained unchanged. The authors believe that patients with diverticulitis and persistent bleeding which originates above the reach of the sigmoidoscope have sufficient indication for exploratory laparotomy and a thorough search for a probable polyp.

The authors also stress the proposition that extirpation of neoplastic lesions, benign or malignant, of the colon does not conclude the surgeon's responsibility, and, therefore they advocate periodic re-examinations.

ROBERT TURELL, M D

**The Importance of the Level of the Lesion in the Prognosis and Treatment of Carcinoma of the Rectum and Low Sigmoid Colon** JOHN M. WAUGH and JOHN W. KIRKLIN *Ann Surg*, 1949, 129: 22

From the files of the Mayo Clinic were selected the records of all patients who, in the 10-year period from 1931 through 1940, had undergone combined abdominoperineal resection for adenocarcinoma of the rectum and sigmoid colon and who had survived operation. All patients with metastatic growths in the liver or other distant sites, and, thus, those in whom the resection was purely palliative, were eliminated. The records of 453 patients were thus obtained. On careful review of the record of each patient, it was found that 65 cases were not suitable for inclusion in this study.

Three hundred and eighty-eight cases remained for study. Data were available in each case from procto-

scopic examination, digital examination of the rectum, from the surgeon's notes, and from the pathologic examination as to the approximate level of the lesion. In general, the data from these various sources agreed.

The lesions were classified according to the distance from the anal margin to the lower edge of the lesion. It is freely acknowledged that this is not a truly precise method of locating the lesions, but it has two advantages over a seemingly more precise method, namely, the measurement of this distance in formalin-preserved surgical specimens. In the first place (as noted previously) it is the most important preoperative method of estimating the level of the lesion, and in the second place there is considerable shrinkage in preserved specimens, and thus an accurate idea of the level of the lesion *in vivo* may not be obtained from a study of the preserved specimens.

It appears that the patients whose lesions lie within approximately 5 cm of the anal margin have a poorer prognosis than those whose lesions lie above this level, both groups being treated by combined abdominoperineal resection. The patients having lesions approximately 11 cm or more above the anal margin have a prognosis which is slightly better than that of the over-all group, but when there is nodal involvement the persons with high-lying lesions would seem to have a definitely better prognosis than those with either low-lying lesions or with lesions of which the lower edge ranges from 6 to 10 cm from the anal margin.

To obtain a more homogeneous group for analysis, the 248 cases in this series in which the lesions showed grade 2 (Broders) malignancy were analyzed. The data showed the same general trend as those of the entire group, but the differences were more clear-cut. The authors believe that this group represents more accurately the true state of affairs, since the lesions were histologically similar throughout the group. It was again seen that patients whose lesions were within 5 cm of the anal margin had a poorer prognosis than those with lesions lying higher up, and that those with lesions lying 6 to 10 cm removed from the anal margin had a poorer prognosis than those with lesions 11 cm or more removed from this point. Again, when only lesions with nodal involvement were considered, a location 11 cm or more removed from the anal margin allowed a much more favorable prognosis than did a lower location. In the group with grade 2 lesions without nodal involvement, the patients with low-lying lesions again appeared to have a prognosis less favorable than those with growths 6 cm or more above the anal margin.

To obtain some further information on the critical levels, as regards prognosis, the data were again analyzed, but this time the cases were put into groups at somewhat different levels.

These data again served to emphasize the relatively poor prognosis in patients with very low-lying rectal carcinomas. Thus, persons with lesions lying within 2 cm of the anal margin had, in the over-all group, a prognosis which was less favorable than

those with growths at any other level. In those with growths above this point, the prognosis gradually improved as the higher levels of the rectum were reached. It was interesting to note, in addition, that in cases with nodal involvement, the group with lesions lying 3 to 6 cm up from the anal margin had the poorest prognosis while that with lesions within 2 cm of the anal margin had only a slightly better one. The prognosis of lesions above 11 cm again was superior to that of lesions at any other level. Except for patients with lesions within 2 cm of the anal margin, in whom the prognosis was poor, patients without nodal involvement showed no significant improvement in prognosis as the higher levels were reached.

The data were similarly analyzed for grade 2 lesions only. This more homogeneous group serves to substantiate the tendencies indicated by the over-all group thus analyzed.

The failure of combined abdominoperineal resection to effect as high a survival rate in patients with low-lying lesions may well be due to its failure to cope with certain routes of lymphatic spread of the low-lying lesions. Without going into needless detail, it may be mentioned that there are, at least in theory and probably in fact, three routes of lymphatic spread in the lesions under consideration. These are, of course, (1) upward, alongside the superior hemorrhoidal and inferior mesenteric vessels, (2) laterally, along the lymphatic pathways accompanying the middle hemorrhoidal vessels and lying along the levator ani muscles, and (3) inferiorly, along lymphatics destined eventually to accompany the inferior hemorrhoidal vessels and to drain, in occasional instances, to the superficial inguinal lymph nodes.

In summary, it is nearly certain that lateral spread does occur occasionally in those far-advanced cases in which there is blockage of the superior zone of spread. It is further very probable, from the data recorded in the literature, that the spread also occurs fairly often in less extensive lesions, the lower margins of which are within 5 or 6 cm of the anal margin as estimated by proctoscopic examination, and that in point of fact in such instances, this spread, along with that in the superior zone, is the normal route of lymphatic metastasis and not an abnormal one taken only when the so-called normal routes are plugged with malignant deposits.

**A Discussion on Radical Excision of Carcinoma of the Rectum with Conservation of the Sphincters** G. GREY TURNER, CHARLES A. PANNETT, and O. V. LLOYD-DAVIES. *Proc. R. Soc. M., Lond.*, 1948, 41: 813.

The guiding principle in operating for cancer must always be to remove the *whole* of the affected part with a wide area of healthy tissue and the path of probable malignant invasion. It is desirable to preserve the rectal sphincters whenever this can be done.

Two types of operation "practiced very infrequently during the past 35 years" for the conserva-

tion of the rectal sphincter in carcinoma of the rectum are described by TURNER. With either the lower or posterior resection, or the anterior operation (perhaps better named "anterior resection with restoration of continuity and preservation of the sphincters") encouragingly successful long term results have been obtained, although only about 2 per cent of the patients have been considered suitable for these so-called conservative methods.

To justify consideration for these methods the growths should be small and not larger than 3.0 cm across, they should be freely movable from side to side and should move up and down when the patient strains, and there must be no evidence of dissemination. The methods are valuable also for the occasional large nonmalignant papillomatous lesions in which the circumference of the bowel is involved. Details of the operative procedures are presented. Temporary colostomy is utilized when needed. Preservation of the sphincteric apparatus must not be done unless it be combined with sufficiently radical removal of the cancer, of course.

Seventeen patients were subjected to posterior resection with preservation of the sphincters. Three were "simple" resections and 14 were for malignancies. There was no mortality, no immediate complications, and no permanent fistula or serious stricture. All of the patients had satisfactory rectal function and control. Of the 14 with malignant conditions 6 died with recurrence or dissemination within 3 years. One died without recurrence 2 years and 10 months after operation, and the 7 others either died without recurrence or were alive and well for more than 5 years after the operation.

PANNETT reviewed the errors now apparent in the Miles classic observations (of 1903) demonstrating spread of cancer downward and laterally into the ischio-rectal space, in postmortem examination of advanced cases of rectal carcinoma.

Westhues (1934), in painstaking dissection of 74 operative specimens, demonstrated that the spread of cancer of the rectum is mainly upward into the glands around the superior hemorrhoidal vessels. In only 1 specimen was there an extension 1.0 cm below the margin of the growth as seen by the naked eye. The spread in the wall of the bowel upward was a little more extensive, in the tissue behind the rectum extension occurred up to 10.0 cm, or, exceptionally, up to 12.0 cm. Lateral spread did not occur. These observations show that wide removal of tissue laterally and below the growth of the rectum as advocated by Miles is unnecessary.

In a malignancy of the rectum the growth itself should be removed with 2 centimeters of normal rectum below its margin, also 22.0 cm of rectum above the upper margin because here there may be undisclosed polypi, and all tissue behind the bowel surrounding the superior hemorrhoidal vessels upward for a distance of 12.0 cm.

LOYD DAVIES states that since the advent of the sulfonamides, and particularly sulfasuxidine and sulfathalidine, there has been a renewal of attempts at

restorative resections for cancer of the rectum and rectosigmoid.

The operative mortality in 24 abdominoanal and abdominosacral and in 30 intraperitoneal cases of resection (total 64) was 5.5 per cent. Half of these are too recent for follow-up purposes.

Following 19 radical Hartmann operations there were 6 local recurrences, this local recurrence rate of 22.6 per cent is a serious matter. Lloyd-Davies believes a local recurrence rate of 24.6 per cent is too big a price to pay for the avoidance of a permanent colostomy (the final figure may be worse since half of the patients are yet to complete the 5-year course).

Secondary excision has been done for some of these recurrences but this is always troublesome since the normal tissue planes no longer exist. In the total of 65 cases there were 16 recurrences to date (24.6%).

Lloyd-Davies believes that there should be adequate removal of tissue and division of the bowel and its mesentery at least 2 inches below the tumor, and that especial care must be taken to avoid the implantation of cancer cells. The follow up should be very close, which means rectal examination by palpation and sigmoidoscopy every 3 months and later every 6 months, and then yearly for the rest of the patient's life.

FRANK B. QUEEN, M.D.

#### Surgical Treatment of Cancer of the Rectum and Colon (Tratamento cirurgico do cancer retocólico) WALTER GENTILE DE MELLO *Rev. brasil. cir.*, 1948, 17, 37

A historical review of the evolution of the surgical treatment of cancer of the rectum, rectosigmoid junction, and sigmoid is offered by the author.

The Miles operation, a milestone in the history of the radical treatment of the region under discussion, has recently found a competitor in form of the anterior resection, which can be performed (1) without a colostomy, (2) with a colostomy in one stage, or (3) following a defunctioning colostomy. Best results are obtained when the anterior resection is performed 14 cm above the anus or higher.

The proctosigmoidectomy with preservation of the sphincter is also widely discussed.

The simultaneous resection of other abdominal viscera involved in the malignant process is being advocated by Brunschwig, and is opening a new horizon in the concept of operability of cancer of the colon, rectosigmoid, or rectum. Four such operations performed by Brunschwig and witnessed by the author are described and illustrated.

JOSEPH K. NARAT, M.D.

#### Melanopithelioma of the Anus and Rectum. FREDERICK W. BRAASTAD, MALCOLM B. DOCKERTY, and CLAUDE F. DIXON. *Surgery*, 1949, 25, 82

Melanopithelioma of the anus and rectum comprises approximately 0.25 per cent of anorectal malignant neoplasms of all types and about 1 per cent of all epitheliomatous lesions of this location. Its superficial position affords opportunity for early diagnosis, but, for the same reason, spread by the lymph



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phatics and blood vessels of both portal and peripheral systems is also manifested at an early date.

Up until April, 1947, 10 patients with this condition (including the authors'), had been seen at the Mayo Clinic.

The sex was noted in 86 of the 94 cases reported in the literature, 55 patients were men and 31 were women, a ratio of 1.8 to 1.

The age of the patients was noted in 84 instances. Seventy-six per cent of the patients were between the ages of 40 and 70, the youngest patient being 22 years and the oldest 78.

In 68 cases a sufficient description was given so that the height of the lesion could be fairly estimated. In 65 of the 68 cases the tumor was situated at, or in the vicinity of, the anorectal junction, or else in the anus itself.

These growths apparently do not tend to involve any other quadrant of the anus or rectum in preference to others. In 50 cases in which the involved wall was mentioned, the anterior wall was chiefly affected in 11 cases, the posterior wall in 19 cases, and the lateral walls (left or right) in 20 cases.

The tumors are generally single, although 14 of the 94 lesions were described as being multiple. They tend to be polypoid and to protrude into the lumen of the anus or rectum. In 19 of the 94 cases a definite pedicle was noted. The caliber of the intestinal tube is generally little affected. Ulceration has been noted occasionally.

The size of these neoplasms varied from that of small milium nodules to that of fist-sized masses. They were generally fairly small when diagnosed, probably because their low position in the rectum resulted in the early production of symptoms.

The consistency of these growths was seldom mentioned in the case reports.

Most of the patients considered their trouble to be of only a few months' duration. In the last 30 cases described, the average duration of symptoms had diagnosis was 9.2 months, in 2 cases symptoms had been present for 4 years or more and in 1 case for 2 years.

The chief complaints were those associated with a tumor in the lower part of the rectum or anal canal, namely, anal pain, stool urgency and frequency, tenesmus, "full sensation" in the rectum, or rectal discharge.

In 2 of the 94 cases the presenting symptom was enlargement of an inguinal node, and in 5 cases there were either no symptoms or only general complaints such as poor appetite, loss of weight, and so forth. Constipation was complained of in only 5 of the 94 cases.

Only occasionally did the patient show cachexia, hepatomegaly, or other signs of metastasis upon diagnosis of the rectal lesion. In a few cases the tumor had spread to involve the inguinal nodes, which were palpable clinically at the time of the initial examination.

Local examination made digitally or proctoscopically is, of course, the best means of diagnosis, and

this type of examination is seldom neglected because the patients have definite rectal symptoms. The usual diagnosis is rectal polyp, rectal polyp with malignant changes, or carcinoma, until biopsy or microscopic study of the excised lesion establishes its true nature.

Of the 94 patients, 72 (76.6 per cent) underwent surgical treatment. In 61 of these a definitive procedure, that is, removal of the tumor, was done, in the other 11 patients operated upon, either no attempt was made to remove the growth because of distant metastasis or local extension, or else the description of the operation failed to mention the type of procedure carried out. In 34 instances the operation consisted of more or less limited local removal of the growth, such as local excision, cutting of the tumor from its pedicle, cautery excision or removal of the tumor and a small part of the anus with preservation of the sphincter. In 23 cases a radical excision of the rectum was performed, consisting generally of a combined abdominoperineal operation in either one or two stages. In 6 of the former and in 2 of the latter group, roentgen or radium therapy was used in addition. Finally, in 4 cases rectal extirpation was combined with excision of the inguinal lymph nodes.

Seven of the 72 patients operated upon died immediately after operation, of the 65 who survived, 53 have been followed up. Of the 53, 36 succumbed between 1 month and 6 years postoperatively, with an average survival period of 15 months. Seventeen were living, but 9 of these 17 had a local recurrence or distant metastasis from 2 months to 3½ years postoperatively. Thus, only 8 patients were known to be living and clinically free of the disease. It is obvious that only 3 of them were followed up for such a length of time that they could be called "cured."

### LIVER, GALL BLADDER, PANCREAS AND SPLEEN

Biliary Peritonitis (Peritonitis biliar) ORLANDO F.  
LONGO *Sem med*, B. Air, 1949, 56: 103

An early interventionist himself, the author quotes Whipple on the advantages of early removal of the gall bladder while the patient is in good physical condition and before the processes of infection and their septic sequelae have had the opportunity to complicate the work of the surgeon. A number of case histories are appended. They are illustrative of the various types of biliary peritonitis (according to the classification of Niemeyer) with perforation into the free peritoneal cavity—perforations into pockets produced by the agglutinative defenses of the surrounding structures and perforations into the neighboring hollow organs.

The majority of cases of biliary peritonitis result from disease of the gall bladder or bile passages. In 1 case of free biliary peritonitis the photomicrograph of a portion of the removed gall bladder revealed that the sinuses of Rokitsansky-Aschoff were



penetrating through the muscularis under the serosa where they seemed to be the source of the free perforation. In some cases such perforation was suspected but could not be demonstrated. Cholangiography during the operation is recommended in order to detect residual stones in the bile passages or other conditions which might result in hypertension of the bile within the biliary system and subsequent rupture of the gall bladder or bile canal. In extensive gangrene of the gall bladder, the bladder must be removed, however, in other cases of severe cholecystitis it is advised to leave the bladder *in situ* with drainage to the outside in order to forestall the development of this condition, the gall bladder being removed later on.

Leakage through the intact, although possibly altered, walls of the gall bladder or choledochus, and particularly seepage from the bed of the removed bladder, as well as abscess of the subhepatic pockets are quite as fatal as general peritonitis. Brunschwig is quoted with regard to the many ways in which biliary peritonitis can result from faults or accidents of the operations for cholecystic and bile duct conditions.

The importance of abdominal puncture is cited and illustrated, together with the evil consequences which may result from the neglect of this diagnostic procedure.

JOHN W. BRENNAN, M.D.

**Liver Abscesses, 44 Observations with Analyses and Statistics** (Supuraciones hepáticas, 44 observaciones. Análisis y estadística) HECTOR CARDEZA  
*An. Fac. med. Montev., 1948, p. 749*

Of 44 patients with liver abscesses, 37 (84.5%) were men and 7 (15.5%) were women. In 36 patients, (82% of the entire group) amebiasis was responsible for the condition, causing abscesses alone in 32 instances, and abscesses and hepatitis in 4. Hydatidiform cysts with secondary suppuration are not included in the author's material. In the remaining 8 cases, the infection originated in the portal system or in the appendix. In 50 per cent of all the cases the condition developed between the ages of 20 and 40 years.

Fourteen per cent of the patients with amebic abscesses and 75 per cent of those with pyogenic abscesses died, 15.5 per cent of the entire group had multiple abscesses, with a mortality of 57 per cent. Single abscesses were present in 84.5 per cent of the entire material, with a mortality of 19 per cent. Of 38 patients with liver abscesses who were operated upon, 8 died.

In 32 cases the abscesses developed in the right lobe, in 5 in the left, and in 7 in both lobes.

The acute development was much more frequent than the chronic type.

Pain, fever, and hepatomegaly were the most frequent manifestations. Leucocytosis was found in the great majority of cases but should not be considered as an infallible index of suppuration. A moderate anemia was usually present. A limitation of the movements of the diaphragm, and its elevation were

the most important roentgenologic findings. Vomiting was relatively rare but loss of appetite was frequent. Intestinal disturbances were recorded in 44 per cent of the entire group of patients. In 50 per cent of the entire group there was a partial dullness over the right lower lobe of the right lung, and diminution of the fremitus and respiratory sounds.

While an enlargement of the left lobe of the liver in patients with an abscess of the right lobe is relatively rare, suppurating hydatidiform cyst is usually accompanied by a compensatory hypertrophy of the left lobe of the liver. This observation is of importance for the differential diagnosis.

Rectal examination should be done in each case because it may reveal the primary specific lesion. Examination of the feces may demonstrate the presence of amebas.

The differential diagnosis should include the following conditions: primary cancer of the liver, cirrhosis, cysts of the liver or the pancreas, perinephritis, subphrenic abscess, cholecystitis, pleurisy, and pulmonary lesions.

In 38 patients surgical treatment was instituted, 6 were treated conservatively. The medical treatment consisted of the administration of antibiotics and emetine with due attention to correction of dehydration and malnutrition. The surgical treatment consisted of a diagnostic aspiration followed by incision and drainage. In infections caused by amebas, emetine was given preoperatively and postoperatively. The operations were performed in the majority of cases under block, and local or general anesthesia. Spinal anesthesia was used only in 4 cases. In 27 patients the abdominal, and in 8 the thoracic, approach was employed.

As a rule, amebic infection causes a single liver abscess, if the lesions are multiple, their number does not exceed 2 or 3. On the other hand, pyogenic lesions following angiocholitis or portal thrombosis are usually multiple, invading one or both lobes of the liver.

Complications were noticed in 35 per cent of the entire group, the most frequent being pleuropulmonary lesions, subphrenic abscess, hepatitis, and cardiovascular disorders.

JOSEPH K. NARAT, M.D.

**Primary Cancer of the Liver** Hepatoma (Le cancer primitif du foie hépatome) J. IFFRÈN  
*Acta chir. belg., 1948, No. 8, 509*

Primary cancers of the liver are rare occurrences. They represent only 1.24 per cent of all malignancies of the liver. They are about twice as frequent in men as in women.

The author reviews the world literature on the subject and reports in detail on 70 cases, 10 of which had not been published previously. It is interesting to note that among these 70 cases there were 8 in children under 13 years, 2 being under 1 year of age.

As to the pathologic anatomy, most of the tumors are true carcinomas originating from the parenchymatous cells of the liver. According to their manner of proliferation and the amount of connective tissue

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stroma, they are classified by most authors in three groups: alveolar, trabecular, and mixed hepatomas. The alveolar form simulates the structure of the normal liver, whereas in the trabecular form the cells grow in bands, not separated by connective tissue.

Some authors use a different classification, they distinguish between malignant adenomas which are surrounded by a capsule, primary carcinomas which infiltrate the parenchyma without forming a capsule, and the carcinomas which occur in connection with, or as a sequel of, cirrhosis.

The tumors may invade the neighboring organs by contiguity. Infiltration of the hilar lymph nodes occurs late, if ever, and metastases to distant organs are extremely rare.

Other malignant liver tumors occurring as primary growths are cholangiomas and, quite rarely, sarcomas and endotheliomas.

As to prognosis and treatment, the author does not share the pessimistic attitude of earlier surgeons; he shows that early and thorough extirpation gives encouraging results, provided that no ascites is present, and that the surface of the liver appears smooth rather than nodular (which would indicate multiple intrahepatic metastases). According to various French and American statistics, from 25 to 50 per cent of the surgical patients survived for more than 2 years without signs of recurrences or metastases.

WERNER M. SOLOMITZ, M.D.

**Recurrences after Cholecystectomy** (Récidives après cholécystectomie) PIERRE MALLET GUY *Bruxelles méd.*, 1948, 28: 2603

Cholecystectomy, performed indiscriminately in the treatment of gall bladder syndromes, is followed by recurrences in 30 per cent of the cases according to internists.

The author speaks only of the problem of true recurrences of pain and jaundice that occur or recur after the cholecystectomy. Since they are refractory to medical treatment, a second operation is necessary.

In certain cases, the recurrence is obviously due to faulty surgical technique with injury to the common duct.

More often the second operation reveals an obstruction unknown at the time of the first operation, such as a small calculus in the common duct, chronic pancreatitis exerting pressure on the common duct, or narrowing of the sphincter. The most common cause of recurrence after cholecystectomy, however, is dyskinesia of the sphincter of Oddi. This dyskinesia may be primary or associated with obvious anatomical lesions which alone are discovered at the first operation. It is also the author's opinion that the dyskinesia antedates the operation.

The diagnosis of dyskinesia is very difficult and more often is impossible, even during operation for recurrence, if the surgeon merely explores the common duct. In these cases the surgeon has the feeling that the operation was futile. The author believes

that the positive diagnosis of dyskinesia can be established only by roentgenographic and manometric studies of the common duct during the operation.

The author uses for roentgenographic study the method as described by Mirizzi of Cordoba, Argentina. He thinks, however, that this alone is not sufficient and has added the manometric studies. These two studies, according to the author, should be done routinely in all biliary surgery. The operation is prolonged but 10 minutes.

The author, using this technique, has performed 770 operations. Thirty-seven of the patients had had previous simple cholecystectomy. The causes of recurrence of symptoms in these 37 cases were anatomical factors alone in 9 cases, or 25 per cent—calculus (5), growth (1), and chronic pancreatitis (2), functional factors only (dyskinesia) in 19 cases, or 53 per cent—hypertonicity of Oddi's sphincter (8), and hypotonicity of Oddi's sphincter (11), and both anatomical and functional factors in 8 cases, or 22 per cent.

In 1 case it was possible to confirm the integrity of the biliary tree from the anatomical and functional standpoints. The recurrence was attributed to a psychic factor.

Hypertonicity of the sphincter of Oddi was treated by vagotomy and transduodenal sphincterotomy. Unilateral splanchnicectomy was the treatment of choice for hypotonicity of the sphincter.

GERARD GAGNON, M.D.

**Further Experiences with Injured Bile Ducts** FRANK H. LAHEY *N. England J. M.*, 1949, 240: 161

Early in 1923 the author became interested in the problem of injuries to the bile ducts, and his first paper on this subject dealt with the results which had been obtained by the complete transplantation of external fistulas in cases in which the common and hepatic ducts had been so injured and severed that all, or practically all, of the bile was being discharged externally. This operation was first proposed and employed by Hugh Williams at the Massachusetts General Hospital, in Boston.

Since that time there has been continued interest in the problem of the management of patients with strictures of the common duct and defects in the common and hepatic ducts from excising sections of them.

Two hundred and twenty-seven patients were operated upon for benign strictures of the bile ducts. There were 27 hospital deaths in the entire series, an over-all mortality of 11.9 per cent. In 139 of these patients, the operations have been performed since 1943, with 12 deaths, a mortality for this period of 8.6 per cent. In this experience nearly every known type of surgical approach to the problem has been employed. Richard B. Cattell and the author have now developed a method that offers the best prospect of a lasting, satisfactory result in cases in which it can be employed. A report of this method will be published later in a journal devoted entirely to surgery, but it is described in the latter part of the

present article in enough detail so that any surgeon who may care to use it may do so. These strictures have varied greatly in character. The number of previous operations these patients had undergone before coming to the Lahey Clinic, varied, likewise, the measures employed in the attempt to restore the flow of bile into the intestinal tract. The lesions have been complicated and, in many cases, unsatisfactory to deal with. However, when one realizes that portal cirrhosis or failing liver function (which is due to the biliary back pressure from stricture and the superimposed cholangitis so frequently associated with this lesion) will eventually result in death in all these cases unless something is done, it can be understood that however unsatisfactory many of these cases may be, one must still endeavor to handle them surgically. This is done in an attempt to restore some of the patients to complete health, and to prolong the lives of others, making an unsatisfactory state a little more satisfactory than it would otherwise be.

In seeking for a method that offers more satisfactory prospects of restoring the excised or damaged common and hepatic ducts to normal, and thus the discharge of bile in the duodenum by a normal channel, two factors are of importance. One, outstandingly, is the necessity for preservation and function of the sphincter of Oddi. It is only by the preservation of this apparatus that one can be assured of the absence of ascending infection, chills, and jaundice, and their effect upon the liver itself. The other requirement is that permanent restoration of the main bile channels can be accomplished only by direct end-to-end anastomosis of the injured or severed duct so that there is accurate mucosa-to-mucosa approximation, as is necessary in restoration of any of the mucous membrane-lined structures in the body that convey either fluid or liquid.

In the course of a large experience with mobilization of the duodenum and demonstration of the lower end of the common duct where it passes through the head of the pancreas and into the duodenum, in connection with the surgical treatment of duodenal ulcers adherent to the bile ducts, it has been learned to mobilize the duodenum by mobilizing its external wall, and to demonstrate the portion of the common duct behind the duodenum and within the pancreas by splitting the pancreas about the common duct. By so doing, attention was directed to the possibility of mobilizing this portion of the common duct which, by its location within the head of the pancreas and behind the duodenum, is usually protected from injury no matter how many operations are done for repairs on cut or crushed ducts.

It was through familiarity with this procedure and with Cattell's experience with resections of the pancreas that the author became interested in so mobilizing the duodenum and so visualizing the lower end of the common duct behind the duodenum and in the head of the pancreas that when an adequate amount of hepatic duct stump remains, as it usually does, direct end-to-end anastomosis could be accomplished.

In doing these end-to-end anastomoses, all sorts of unsatisfactory conditions are bound to arise. An occasional condition for which the author knows of nothing that can be done, is that in which the lower end of the duct can be found but is of such small, atrophic character that it is impossible (even after it has been mobilized) to dilate it to a size adequate for the introduction of a T tube of satisfactory caliber. In still other cases there will be so much destruction and scarring of the pancreas, the common duct, and the region about the duodenum that it will—very rarely indeed, but occasionally—be impossible to find enough duct, even though it is completely mobilized, to get the ends together. Still another complication, which has been the most trying one, is the fact that often repeated, unsuccessful attempts at repair will have so destroyed the common hepatic duct that there will only be the separated intrahepatic right and left ducts. Cattell has even been able to anastomose successfully the left hepatic duct when it was impossible to find the right duct because of the depth of scarred duct within the liver. In such cases atrophy of the right lobe and enlargement of the left have taken place, with adequate maintenance of liver function. Still another complication in these trying operations has been opening of the portal vein in the course of searching for either the lower end of the duct or the end of the hepatic duct within the hilus of the liver. In these cases such bleeding has been successfully controlled by suture of the portal vein, but this has resulted in the necessity of terminating, at least temporarily, further search for the duct.

Experiences in the surgical management of 227 patients with benign strictures of or injuries to the bile ducts are presented. The development of the different methods employed since 1923 is outlined, and the disadvantages of all these measures are discussed. A new plan, which has been employed for a minimum of 5 years in 43 cases, results in preservation of the sphincter of Oddi and direct mucosa to mucosa anastomosis when it can be employed and offers, it is believed, both the most logical approach to the surgical management of this up to now discouraging lesion and the best prospect of the permanent discharge of bile from the liver into the duodenum without complications that are involved in other procedures.

JOHN E. KIRKPATRICK, M.D.

**Venous Block of the Spleen and Splenomegalic Inhibition of the Bone Marrow** (Venöse Blockade der Milz und splenomegale Markhemmung). *Str Greif and F. Spath*. *Wsen med Wschr*, 1949, 99, 3.

The authors describe 2 cases of splenic vein thrombosis in women of 16 and 44 years, respectively, in whom the leucocyte and platelet counts presented great variations which occurred during periods in which there was no gastrointestinal bleeding. In the first patient the leucocyte count ranged from 17,049 to 21,179 and the platelet count from 386,000 to 94,615, in the second patient the leucocyte count

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ranged from 16,400 to 2,946 and the platelet count from 369,000 to 93,250. In both patients leucocytosis was associated with thrombocytosis, and leucopenia with thrombopenia. Splenectomy was performed.

While before this operation the bone marrow had been normal except for irritation of its red portion in the second patient, after the operation the red marrow in both patients showed considerable division and irritation and the white marrow was myelocytic, there was an increase in the megakaryocytes. Several months later the bone marrows were normal.

In both cases the adrenalin test performed before and after splenectomy showed the same changes in the blood pictures, thus, this test as an aid in the differential diagnosis of the splenomegalies is of doubtful value, but it reduced the size of the spleens which revealed that the splenomegaly was due to stasis and not to sclerosis.

In the first case the cause of the condition could not be ascertained. In the second case the cause was a hypernephroma which had developed in the ventral direction and compressed the splenic vein.

The variations in the leucocyte and platelet counts could be explained as follows:

Under normal conditions the blood from the spleen reaches the general circulation by passing through the liver where the substances secreted by the spleen which inhibit the bone marrow are neutralized or weakened. But a collateral circulation had formed in both cases and allowed the blood of the spleen to enter the general circulation directly without passing through the liver. Since an antagonistic influence between the spleen and bone marrow can be accepted, it is reasonable to think that the direct passage of splenic blood into the general

circulation would allow the substances which inhibit the bone marrow to act more intensely than under normal conditions.

The alternation between leucocytosis-thrombocytosis and leucopenia-thrombopenia, especially in the second case, was probably due to the changes in pressure exerted by the tumor on the splenic vein so that its blood reached the bone marrow sometimes over the portal system and sometimes over the newly formed collateral vessels, and in this manner the splenopathic inhibition of the bone marrow was decreased or increased.

RICHARD KEMEL, M D

## MISCELLANEOUS

**Retroperitoneal Lymphangioma with Fistula in the Colon Demonstrated by Roentgenography**  
(Tumeur kystique rétro-péritonéale [lymphangiome] fistulisée dans le colon avec mise en évidence radiologique de la communication) A. LEMAIRE, H. REDON, and G. LEDOUX-LEBARD. *Mém Acad chir*, Par, 1948 74 645

The authors present a case of a female under observation for an undiagnosed mass in the upper left quadrant of the abdomen. After a fall on the street, she suffered rather vague abdominal discomfort and, later, diarrhea of brown foul material. The physician noted that the mass disappeared. Roentgenography showed a fistula between the transverse colon and the retroperitoneal mass.

At operation the mass was excised, and splenectomy and partial colectomy were done. The final diagnosis was lymphangioma of the retroperitoneal space.

It is the first time, in the opinion of the authors, that a retroperitoneal cystic lymphangioma has been known to rupture into the gastrointestinal tract.

GERARD GAGNON, M D

# GYNECOLOGY

## UTERUS

**The Roentgenogram in Uterine Malformation— with Respect to Function** (Das Roentgenbild bei Missbildung des Uterus—mit Hinblick auf seine Funktion) E. PHILIPP *Geburtsh & Frauenh*, 1948, 8 731

By the use of hystero-grams the author made a study of uterine malformations demonstrable by this roentgenographic means. The various abnormalities are classified into three groups: (1) uteri with a more or less divided cavity (uterus septus, uterus subseptus, and uterus arcuatus), (2) uteri with two horns (uterus bicornis), and (3) uteri which roentgenologically may appear to be unicornate but may actually have an atretic horn of a bicornate uterus. Each group is considered with reference to its likelihood of causing primary sterility, of causing abortion, and of permitting birth of a full term child.

The various types of septate uteri are the most frequently found anomalies. Recognition depends to a great extent on x-ray examination. Primary sterility is not unusual and abortion often results should implantation occur. Delivery of a full term fetus is apt to be complicated and therefore dangerous for the child. Uterus bicornis presents similar and more serious difficulties. A unicornate uterus or a bicornate uterus with an atretic horn presents a gloomy prognosis so far as childbearing is concerned.

WARREN R. LANG, M.D.

**Wide Conization of the Cervix** ROBERT J. CROSSEN *Am J Obst*, 1949, 57 187

The author presents an analysis of 1,021 cases of cervicitis. All patients were treated by wide conization of the cervix, and it was possible to follow 634 of the patients for 2 to 14 years. The infected portion of the cervix was removed by conization with use of the modified Crossen electrode. A wide conization was accomplished which allowed for removal of all infected tissue. Spot coagulation was applied to all bleeding areas, and the vaginal mucosa was inverted into the canal by the use of a modified Sturm-dorf suture.

Postoperative bleeding was not bothersome and occurred to a slight degree in only 11 cases. In 10 cases a single tamponade was required to stop the bleeding, and in 1 case bleeding was stopped by curettage.

Although the external os was routinely left undisturbed, stricture of the cervical canal developed in only 16 patients, who were treated in the office by dilatation, only 3 required hospitalization.

Ninety-one per cent of the patients were completely cured of the cervicitis by this method. Additional cures were obtained by secondary treatment (14 patients required reoperation, and 67 required additional minor treatment).

Sixty-three of the patients had subsequent deliveries at or near term, of these, 40 were first deliveries, following the conization. This method of treatment does not interfere with childbirth. It often removes a sterility factor, and women of childbearing age should not be denied the benefits of treatment.

Cancer was discovered in 16 cases (lesions of the cervix in 8 cases and lesions of the endometrium in 8). Curettage is routine before wide conization. Fifteen patients had further treatment for cancer and are alive and well, 1 patient who refused further treatment is dead.

None of the patients who submitted to conization has developed cancer during this period of observation.

JOHN R. WOLFF, M.D.

**Malignant Tumors of the Uterine Fundus Subsequent to Irradiation for Benign Pelvic Conditions** HAROLD SPEERT and THOMAS C. PFINGTAL *Am J Obst*, 1949, 57 261

Exposure of the female genital organs to roentgen rays or radium may not be as innocuous as it has long been believed to be.

At the Roosevelt Hospital, in New York, a survey of the 270 patients who have been treated for malignant tumors of the uterine fundus revealed that at least 21 have had previous pelvic irradiation for benign conditions.

Sixteen of these patients were treated with radium, 4 were treated with roentgen rays, and 1 patient was treated with both. The radium was applied in the uterine cavity in all but one case. The radium dosage varied from 350 to 1,500 mgm/hr. The average time interval between radiotherapy and the recognition of the malignancy was 8 years, with a variation of from 8 months to 19 years. Uterine myoma was the indication for therapy in 7 cases and the curettings showed an endometrial hyperplasia in at least 6 instances.

Eleven of the subsequent lesions were adenocarcinomas, 3 were adenocarcinomas, and 6 contained sarcomatous elements.

The incidence of cancer of the uterine fundus among patients who had previously received pelvic irradiation for benign conditions was 8 per cent.

In contrast, 0.3 per cent of patients with carcinoma of the cervix had received previous pelvic irradiation. The incidence of sarcoma in this group was five times that of sarcoma among all the malignant uterine tumors. The possible carcinogenic effect of radiant energy upon the human uterine fundus is suggested.

JOHN R. WOLFF, M.D.

**Cancer of the Uterine Cervix (Cancer cervico uterino)** ALFREDO BERNAL *Bol Soc chilena obst gín*, 1948, 13 171

In the Gynecologic Service of the San Borja Hospital from 1942 to 1948, a slightly modified Wertheim

## GYNECOLOGY

operation was used in 27 patients, usually under spinal anesthesia, and all but 3 were then sent to the Radium Institute to continue their treatment. The patients had not been well selected since several presented grade 2 and 3 lesions.

The most frequent complications were bladder paralysis (observed in 10 patients and due to trauma during the operation), and cystitis (caused by the indwelling catheter which was left in place for 24 hours to avoid repeated catheterization. Abscess of the cellular tissue occurred in 3 patients, acute bronchitis in 2, pneumonia in 3, and vesicovaginal fistula in 2. There were 2 deaths: one from pneumonia on the twenty-first day after the intervention, the other from postoperative eventration on the third day.

Some years ago the operation of Wertheim was relegated to second place because its mortality was rather high and radium therapy gave equal or superior results, but it is now again in favor because of the failures and complications of radium therapy and because of the excellent results obtained from improvement in the surgical technique, selection, and preparation of patients, and the use of antibiotics. The primary mortality of the two methods is now about the same.

In the selection of patients for operation preference must go to those under 50, of low body weight, and in good general condition, having a lesion in the first stage or going into the second stage. Nephritis and processes causing persistent leucopenia are contraindications for surgery. Spinal anesthesia is best, although good results have been obtained with ether also despite a greater number of postoperative complications. Preoperative and postoperative treatment is as important as the operation itself, preoperative and postoperative transfusions and drop transfusion during the operation, penicillin for 24 hours before and 48 hours after the intervention, and sulfonamides when penicillin is not available. The patient must be hospitalized 4 days before operation for thorough preparation.

Under these conditions the mortality should not exceed 2 or 3 per cent, and it may be further decreased to reach that of radium therapy for several reasons. Once the cervix is removed there is no possibility of recurrence, and the danger of metastasis is also eliminated. Extirpation of the pelvic lymph nodes is safer and more radical than their irradiation, and experimental work has demonstrated that the radiations do not reach the high pelvic lymph nodes.

Therefore there is the possibility that radium therapy does not provide a perfect cure. On the other hand, it sometimes causes considerable vaginal atresia and ureteral strictures. The fistulas, hepatitis, cystitis, rectosigmoiditis, and other less important complications lead the author to think that it is best to continue operating on these patients, in doubt, and experimental work has demonstrated that the radiations do not reach the high pelvic lymph nodes. Wertheim's operation is not a dangerous intervention.

**The Value of Postoperative Irradiation of Cancer of the Uterus** (Ueber den Wert der postoperativen Nachbestrahlung des Uteruskarzinoms) HEINZ KIRCHHOFF *Geburtsh & Frauenh*, 1949, 9 17

There is no unanimity of opinion as to the value of postoperative x-ray treatment of cancer of the body and cervix of the uterus. The opponents maintain that the inflammatory processes in the operative region diminish the radiosensitivity of the cancer cells and increase that of normal tissues, and that irradiation lowers the resistance of the body.

From a review of all available statistics, Schinz found that a 5 year cure was recorded in 41 per cent of patients who underwent operation without postoperative treatment, while of those who were irradiated after the operation, 53 per cent remained cured after 5 years, however, the patients in these 2 groups were not always treated at the same time so that a comparison is subject to criticism. For instance, such factors as changes in the surgical technique and indications for the operation, the performance of the operations by different surgeons, postwar conditions affecting nutrition, etc., may influence the results. Furthermore, the selection of material for irradiation is an important factor. Some surgeons leave the ovaries *in situ*, in young patients. The obscure relation between the genesis of cancer and endocrine factors may cloud the results of irradiation in such instances.

The author presents a plea for careful statistics over a period of 10 years, in order to form a definite opinion as to the value of postoperative x-ray treatment of cancer of the uterus.

JOSEPH K. NARAT, M.D.

**ADNEXAL AND PERIUTERINE CONDITIONS**  
**Gynandroblastoma of the Ovary** JOHN E. HOBBS  
*Am J Obst*, 1949, 57 85

An 18 year old girl was operated upon by the author for the removal of a large ovarian tumor which contained both masculinizing and feminizing morphologic structures. This rare tumor was named gynandroblastoma by Robert Meyer in 1930, and, to date, 21 such cases have been reported.

The clinical features of the present case suggest the hormonal effects of androgens and estrogens. The primary tumor showed a predominance of androgens from a biologic consideration, since there was masculinization and defeminization. Amenorrhea, hirsutism, and hypertrophy of the clitoris were present. A study of 17-ketosteroid excretion has not been of value.

After removal of the tumor, and even though it has repeatedly recurred, there has been no biologic or histologic evidence of androgen elaboration, while there has been clinical evidence of estrogen production.

Three further operations were necessary because of recurrence of the tumor. X-ray therapy undoubtedly slowed the growth of the tumor, but was not lethal even in large concentration.

RICHARD KEMEL, M.D.

Histologically, this type of tumor lacks most of the criteria for malignancy, yet it is recurrent and locally invasive

JOHN R. WOLFF, M.D.

### MISCELLANEOUS

**Vascular Congestion and Hyperemia** HOWARD C. TAYLOR, JR. *Am J Obst*, 1949, 57, 211

Every part of the reproductive tract is subject to characteristic disturbances in vascular function, manifesting themselves in the form of arterial dilatation, venous engorgement, and probably local increase in extravascular tissue fluids. This vascular disorder results in pain in the breasts, ovaries, and parametrium, hypersecretion from the cervix, and menstrual anomalies.

Independent observers have believed that for each organ of the reproductive tract there could be distinguished an early phase of congestion leading to a later one of fibrous tissue. That such a pathologic process should result under conditions of prolonged vascular stasis is entirely possible.

Since manifestations of the syndrome of congestion fibrosis in one segment of the reproductive tract are commonly found associated with signs and symptoms of the disorder elsewhere, this process must be regarded as one which is often generalized throughout the reproductive system.

Patients having symptoms of congestion of the genital tract are found characteristically to suffer from emotional instability, radiating neuralgic pains, and symptoms such as palpitation and indigestion. These associated nervous phenomena indicate a strong autonomic factor in the syndrome.

JOHN R. WOLFF, M.D.

**Surgical Treatment of Genital Prolapse** (Tratamento cirúrgico do prolapso genital) F. VÍCTOR RODRIGUES. *An. Brasil. gín.*, 1948, 26, 365

At present surgical treatment is the only logical treatment of genital prolapse. The contraindications are solely cachexia, terminal disease, and such an advanced age that the survival will probably not compensate the patient for the trouble of the operation. The correction of other associated defects (colpocele, rectocele, enterocele, and urethrocele) and observance of the principle of interposition are absolutely indispensable in order to obtain satisfactory and definitive results.

From December 15, 1938 to July 31, 1948, the author has operated in 82 cases of prolapse, including 1 urethrocyстоcele, 2 cystoceles without uterine prolapse, 25 partial prolapses, and 54 total prolapses. The associated lesions comprised 1 each of vesicovaginal fistula, rectal prolapse, and total perineal rupture, 4 enteroceles, and 8 rectoceles. Fothergill's operation was used in 53 cases, Mayo's vaginal hysterectomy in 17, Halban's operation in 6, Bissell's operation in 2, and the operation of Le Fort, that of Spalding Richardson, and the interposition of Schauta Wertheim Watkins in 1 case each. Inhalation anesthesia was used in 6, and

local anesthesia in 76 cases. There were 4 postoperative local infections, 2 being pyometria, there were no deaths and, so far as is known, no recurrences.

The immediate results of operation were very satisfactory. Late results were observed in a patient who previously had undergone a Fothergill operation and was submitted to abdominal hysterectomy for fibroma: the uterus was found to be firmly anchored by fibrous adhesions to the anterior part of the pelvis and to be in anteversion. The cases of postoperative infection occurred before the advent of modern chemotherapy. Recovery after operation was usually uneventful.

The author is firmly convinced of the enormous advantages of local infiltration anesthesia, for which he uses a 1 per cent solution of novocain with adrenalin; he uses it in all cases in which there is no contraindication, the most common of which is hypertension. It facilitates dissection and decreases bleeding, leaving a clear field of operation. It constitutes one of the greatest advances made in the surgery of prolapse and reduces the risk practically to nil so that help can be extended to patients of the most advanced age in whom the anesthetic risk is much more to be feared than the operative risk.

Fothergill's operation has been performed under local anesthesia without any inconvenience in many patients between 70 and 80 years of age, and vaginal hysterectomy has been done in several patients over 60 and some over 70.

Of the numerous operations recommended, the author prefers those of Fothergill and of Mayo. With the discriminating use of these two methods it is possible to correct and cure all genital prolapses and to avoid recurrences. The question is which of the two methods should be used in a given case. The fact that the prolapse is total constitutes no contraindication for Fothergill's operation. The decision depends upon the condition of the uterus. Whether the uterus be very large or very small, if it presents greater possibilities of cancer because of age and associated conditions, it should be extirpated by the Mayo method. In young women who desire children, the condition of the uterus is taken into consideration and an effort is made to preserve it by using the Fothergill method. The presence of enterocele or hernia of the pouch of Douglas suggests the advisability of hysterectomy, which will facilitate correction of the defect. Fothergill's operation offers no disadvantages except perhaps that it is not the best method to use for patients with a rather small uterus.

The abdominal route is unjustifiable for the surgical treatment of prolapse. The damaged structures which require repair are all found below the peritoneum and, in case it is necessary to remove the uterus, prolapse of this organ facilitates its extirpation by the low route.

RICHARD KEUFL, M.D.



**The Significance of Abnormal Menopausal Vaginal Smears** H B DAVIDSON, E L HECHT, and R. L. WINSTON *Am J Obst*, 1949, 57 370

In a study of 378 apparently well women of menopausal age, the vaginal smears of 12 (3.16 per cent) presented a disturbing picture. In this group the smears had a marked resemblance to those in cases of proved cancer.

The cells vary in shape and form, and in many instances tend to form dense groups with considerable overlapping and overcrowding. In some cells the nuclei are large in relation to the size of the cell. These nuclei are bizarre in shape and often hyperchromatic. Nucleoli are often conspicuous. Vacuolization of the cytoplasm is often clearly evident. Elongation of the cells is frequent.

Such cellular patterns ordinarily satisfy the criteria for malignancy in the vaginal smear, yet biopsies have repeatedly been negative. Clinical examination has failed to detect any sign of malignant disease.

Are such smears indicative of latent cancer, or are they merely benign findings of no apparent significance? The interpretations of such smears must be made by only adequately trained personnel. Only a vast experience over a long period of time will prove whether or not these smears indicate the presence of true cancer.

JOHN R. WOLFF, M D

**The Modifications of the Rectal Mucosa in Cancer of the Uterine Cervix** (Sulle modificazioni della mucosa rettale nel cancro del collo dell'utero) PAOLO BORTOLUCCI *Riv ital gsn*, 1948, 31 412

The material studied consisted of 61 cases of cancer of the uterine cervix. Of these, 18 cases were grouped, by the usual methods of classification, as belonging to grade 1, and 6 of these were classed, according to the subdivision of grade 1 as proposed

by Schmitz, as being in the initial stage, 26 were classed as of grade 2, 15 of grade 3, and 2 of grade 4. The rectoscopic findings of those in grade 1 consisted of localized edema and vascular dilatation in the lowermost section of the rectal mucosa. The findings of those in grade 2 consisted, as a rule, of a more marked edema and vascular ectasis than those seen in grade 1, and these were accompanied by bullae and hemorrhagic patches. The section of the rectal mucosa which was involved was the middle region of the rectum and particularly the valve of Koblrausch. In the grade 3 cases the entire extent of the rectal mucosa was apt to be involved, the changes were even more pronounced than in the two previous groups, and the mucosa was covered by a whitish exudate on the anterior surface in the region of the middle valve (Koblrausch). In the more advanced cases of this group there could be observed an extensive infiltration of the rectal wall, partially or totally encircling the bowel.

In the 2 patients with grade 4 cancer, who, of course, were inoperable, the findings rectoscopically were those of marked thickening of the mucosa, notable congestion of the blood vessels, and patches of ulceration. In some places the mucosa in these advanced cases was smooth, elevated, and thickened with complete disappearance of the normally observed plicae.

The author believes that since the malignant process in the cervix usually tends to disseminate backward toward the rectum even sooner than forward toward the bladder, rectoscopy will afford more valuable information concerning the stage of development and spread of the neoplastic process and its eventual operability than will cystoscopy. It will be of some value even in the inoperable cases (grades 3 and 4) in adjudging the efficacy of, and the best manner of applying, irradiation therapy.

JOHN W. BRENNAN, M D



# OBSTETRICS

## PREGNANCY AND ITS COMPLICATIONS

**Conservative Treatment of Placenta Previa** W G MILLS *Brit M J*, 1948, 2 896

The difference of opinion in regard to the management of placenta previa hinges mainly on the optimum timing of intervention. Although it is almost standard practice to actively intervene in the presence of placenta previa, some evidence is accumulating to indicate that this is not always necessary, and certainly (in some cases) not advisable.

Recent literature is reviewed and statistics are presented with regard to the fetal and maternal loss under both types of management. One hundred patients were treated conservatively. When bleeding occurred before the thirty-seventh week, the cervix was examined with a speculum and the patient was then treated expectantly. After the thirty-seventh week, depending on the size of the baby, the patient had a sterile pelvic examination, at which time the type of delivery was selected. As a rule, if the placental margin was at the rim of the cervix, or across the opening of the cervix, cesarean section was then the method of choice. If the placenta was higher than this, vaginal delivery was attempted.

The maternal mortality was apparently not increased by conservative management, and in no case was there a death or near death. The fetal loss was 16.5 per cent, which is not great if one considers other series in which the loss ran as high as 54 per cent. The disadvantages of this type of treatment can readily be seen since the mother must be confined to the hospital or to her home for a considerable period of time and may, from time to time, have repeated hemorrhages requiring transfusion. The main advantage would seem to be the improved fetal prognosis, due largely to the increase in size and maturity of the infant. Obviously, this type of management can be carried out only when suitable hospital facilities, including a blood bank, are available.

JAMES F DONNELLY, M D

**Facts Pertinent to a Rational Concept of Abruptio Placentae** R A BARTHOLOMEW, E D COLVIN, W H GRIMES, JR, and JOHN S FISH. *Am J Obst*, 1949, 57 69

That abruptio placentae is a manifestation of toxemia of pregnancy and, as such, is a phenomenon which may occur in any case of severe toxemia and interrupt the pregnancy before the convulsive stage is demonstrated by clinical and pathologic evidence.

The signs and symptoms of toxemia often precede abruptio placentae. Abruptio placentae and toxemia occasionally occur simultaneously, the findings at autopsy are often identical. Acute and subacute hemorrhagic placental infarction is present in both.

The sequence of events, initiated by a spasmogenic factor (pituitary and/or renal) on the sphincters of

the placental veins is that of (1) obstruction to the outflow of fetal blood from a dependent unit of placenta, (2) distention, thrombosis, or rupture of the villous vessels with resulting enlargement and crowding of villi, (3) diminution of maternal blood and absence of fetal blood supply to villi from crowding and thrombosis, and (4) dissemination of the poisonous products of the resulting placental necrosis with the development of signs and symptoms of toxemia. True toxemia may be gradual, through stages of mild, moderate, and severe, or may be fulminating. Severe toxemia may terminate in (a) abruptio placentae, (b) eclampsia, and (c) eclampsia. Occasionally abruptio placentae and eclampsia occur together.

Renal and vascular disease are not true toxemias but are predisposing causes probably through a spasmogenic factor which may cause overaction of the sphincters of the placental veins with resulting placental infarction.

JOHN R WOLFF, M D

**Pregnancy and Hodgkin's Disease** S CHARLES KASDON *Am J Obst*, 1949, 57 282

Since Hodgkin's disease as a complication of pregnancy is uncommon (1 case in 6,000 pregnancies), a rational basis for the management of this problem is decidedly difficult. Three such cases seen at the Tumor Clinic of the Boston Dispensary, Boston, Massachusetts, together with 29 previously reported cases are analyzed.

Hodgkin's lymphogranulomatosis does not grossly affect ovulation, fertility, incidence of spontaneous abortion, antepartum, intrapartum, or postpartum hemorrhage. Similarly, the pregnancy does not appear to influence the course of this disease. The obstetric aspects of gestation, parturition, and the puerperium are not affected by coincidental Hodgkin's disease.

Three reports have appeared in the literature of infants with Hodgkin's disease who were born of mothers possessing this condition. Although this incidence is low, the possibility of placental transmission of the disease must be remembered. There is no report of injury to the shielded fetus from roentgen radiation used in the treatment of Hodgkin's disease.

Interruption of pregnancy during the course of Hodgkin's disease is not indicated from the evidence at hand.

JOHN R WOLFF, M D

**Pregnancy Complicated by Diabetes Mellitus** II H FOURACRE BARNES and M E MORGANS *Brit M J*, 1949, 1 51

Fifty-eight pregnancies in 45 patients with complicating diabetes mellitus were observed during a period of 20 years in the University College Hospital. These cases are reviewed and compared with concepts developed by a review of the literature.

In the majority of patients carbohydrate tolerance diminished as pregnancy progressed, but in some it increased prior to delivery and it was thought that estrogens given therapeutically may have been a factor in this improvement.

The authors support the view that hydramnios is more common in these patients, 29 per cent of their patients showed this phenomenon. Hypoglycemia and coma were more common in early pregnancy while ketosis and diabetic coma were more common in late pregnancy. They confirm the belief that toxemias are more common in diabetic patients, but state that the increased rate depends upon what statistics are used in making the comparison.

The danger to the mother is not great if adequate diabetic management is instituted, and the diabetes does not seem to become more severe if it is well treated.

The authors discuss the cause of the high fetal mortality. They disagree somewhat with current views, and it is their belief that the causative factor may be in the maternal anterior pituitary gland. The abortion rate was no higher in their patients than in other patients.

Babies of diabetic mothers are larger than normal, but those born to these mothers in the prediabetic state are also large, therefore, it is believed that the condition is not due to hyperglycemia but to the abnormal hormone picture with high serum gonadotropin, low serum estrin, and diminished pregnandial excretion. They suggest there may be an excess of growth hormone present.

BYFORD F. HESKETT, M.D.

## LABOR AND ITS COMPLICATIONS

**Investigations on Prolonged Pregnancy (Untersuchungen ueber den Partus serotinus)** MIES REEN KOLA. *Acta obst. gyn. scand.*, 1948, 28 Supp. 3

The author reports his studies on all cases of partus serotinus (prolonged pregnancy) occurring at the University Clinic of the Public Hospital in Helsinki during the period from 1917 to 1944. Included in the series were women whose pregnancies had lasted more than 300 days counting from the first day of the last menses. Women who had irregular menses before pregnancy and who were not exactly certain of the last period were also included. There were 507 primiparas and 379 multiparas, but the latter included only those observed from 1930 to 1944. The weight or length of the infant was not used as a criterion of postmaturity.

In comparison with the other parturients, the menarche occurred late and the menstrual cycle tended to be irregular. Oligomenorrhea was not a statistically significant finding, however. The body build of the patients often approached the infantile variety, with a small pelvis and most frequently of the generally contracted variety. There was no unusual incidence of toxemia in the group studied.

The average infant weight was high, however, the lower limit was not significantly greater than

the lower limit of normal infants. The same observation applied to the length. There was no correlation between the duration of pregnancy and the weight or length of the infant. The placental weight followed a similar pattern.

Labor was often prolonged. This was particularly noticeable in the first stage, less so in the second. Rupture of the amniotic sac occurred later than usual. Abnormal positions and presentations were found infrequently and operative delivery (instrumental or by cesarean section) was resorted to on relatively few occasions.

The infant prognosis was directly related to the factor of operative intervention. There was some evidence that some babies died from unknown causes before birth. In fact, about 0.6 per cent of the deaths were thought to be the result of the prolonged pregnancy itself. The author describes 2 cases personally followed up by him during pregnancy in which the infants born were below the average in weight.

The author concludes that one of the principal factors in the etiology of prolonged pregnancy is a weakness of the genital constitution as manifested by either primiparas or individuals with infantilism. Many causes, however, are as yet undetermined.

WARREN R. LANG, M.D.

**Internal Podalic Version and Extraction** HENRY W. ERVING. *Am. J. Obst.*, 1949, 57: 333

Although internal podalic version and extraction is an obstetric procedure hallowed by time, its value is often overlooked. This may be due to the consternation and controversy which has been caused by the proponents of routine version.

In three and one-half years, internal podalic version and extraction was utilized to deliver 534 babies (frequency of 4.1 per cent) at the Elizabeth Steel McGee Hospital, in Pittsburgh. The majority of these patients were of private status and all were delivered by or under the supervision of obstetricians.

The main indications were inertia, failure of descent, transverse arrest, and persistent occipitoposterior position. Prophylactic version was done mainly for the second twin, and in multiparas with completely dilated cervixes, having poor pains and with the head of the fetus high in the pelvis.

In almost one-half of the cases the membranes were ruptured from one-half hour to 5 days prior to delivery. Premature rupture of the membranes does not contraindicate a version. The tonus of the uterine musculature and displacement of the head are the important criteria.

There was 1 maternal death (without autopsy), the uterus was ruptured in 1 instance, third degree lacerations of the perineum occurred seven times, and physiologic retraction rings were noted 26 times.

Gentleness and the rigid adherence to contraindications will prevent complications. These latter are marked cephalopelvic disproportion, true constriction ring dystocia, a dry uterus molded about the child, incomplete dilatation and effacement of the cervix, previous section or myomectomy, placenta

previa, an inexperienced anesthetist, and insufficient help

The gross infant mortality was 5.8 per cent, corrected 2.6 per cent. Forceps to the aftercoming head along with routine episiotomy are recommended. An android pelvis is dangerous with regard to infant mortality.

Internal podalic version and extraction is an important method of handling a difficult obstetrical situation and more men should be adequately trained in the performance of this procedure.

JOHN R. WOLFF, M.D.

**Management of Occipitoposterior Position** GER-  
ALD W. GUSTAFSON *J Am M Ass*, 1949, 139  
280

The author divides occipitoposterior positions into three groups as far as management is concerned. In the largest group, which comprises some 70 per cent of the total, rotation will occur spontaneously after engagement, and with comparative ease in delivery either spontaneously or with low or midforceps. This group, he believes, can be increased by conservative management.

The second group is small and comprises those cases in which some pelvic contraction or disproportion is usually present so that even after hours of labor, engagement does not occur. In some of these cases engagement occurs after the second stage of labor is reached and they can then be classified in the first group, still others may be classified in the third group, and in some abdominal delivery will be necessary.

The third group comprises those cases in which engagement occurs, but there is failure of rotation in the so called persistent occipitoposterior position. It is in the handling of these cases that there is the greatest difference of opinion regarding their management, and this group may be large or small, depending on whether the operator is radical or conservative.

Various types of delivery are employed, viz., the Barton forceps, Kielland forceps, version extraction, Bill's modified Scanzoni maneuver, key and lock forceps rotation, and manual rotation.

The cause of occipitoposterior position is discussed, and the author states that many times the position occurs in borderline pelvis, especially of the android type with a narrow fore pelvis, or in those with inlet, midplane, or outlet contraction. The position is common with the syndrome of dystrophy dystocia, and it is frequently observed in the anthropoid pelvis. Other factors may be traumatic contractions, tumors, poor uterine action, and increased pelvic inclination.

The incidence of occipitoposterior position varies with many factors—especially the time of examination of the patient, and whether labor is early or late, as in many cases the position is rectified after the onset of good labor. The author reports an incidence of 3.6 per cent of persistent occipitoposterior positions. An additional 17 patients had cesarean sections. Labor was frequently prolonged, and in some cases

irregular pains preceded the labor. In many cases rupture of the membranes occurred.

Watchful expectancy with careful examination of the pelvis, including x-ray pelvimetry, is stressed. It is believed that the diagnosis of station is of utmost importance in the management of this condition.

Proper sedation and hydration is discussed. The author believes that a longer second stage of labor is permissible in patients with this complication. If interference is indicated by the condition of the baby when the head is at -1 station, he believes version to be safer than forceps.

The technique of manual rotation is discussed. The author favors this method of rotation and applies forceps in the anterior position following rotation.

BYFORD F. HESKITT, M.D.

**Cesarean Section in Dublin** J. K. TEFNEY *Irish J M Sc*, 1948, Ser. 6, 755

The author presents considerable statistical information with regard to cesarean section as it is practiced in Dublin, Ireland. The analysis is based on 45 annual reports of the Coombe, National Maternity, and Rotunda Hospitals. A total of 108,140 patients were delivered in these hospitals during the years from 1932 to 1946, inclusive. In this group, 2,273 cesarean sections were performed, of which 1,415 were primary sections and 858 were repeat sections. The incidence of section was 2.1 per cent and the maternal mortality was 2.7 per cent, with a fetal mortality of 11.4 per cent. Various techniques of operation were carried out, although operation on the lower uterine segment was performed in 77 per cent of the cases.

There were 61 maternal deaths, 17 of which were due to infection, 8 deaths were ascribed to hemorrhage and shock, 9 to toxemia, 10 to pulmonary complications, 2 to anesthesia, 11 to heart disease, 3 to tuberculosis, and 3 to other causes. Brief case histories of the maternal deaths are presented, and the author concludes from his analysis of these that the mortality rates could be greatly reduced.

Careful prenatal care should result in early recognition of the need of cesarean operation and immediate hospitalization. A careful review of the indications and contraindications should be considered in each case prior to the operation. This should include the proper selection of the anesthetic agent, or, as the author has put it so well, "the anesthetist." From a technical point of view, the wider use of a low segment operation, early ambulation, and the modern techniques of combating shock, hemorrhage, and infection, should result in lower mortality rate.

It was difficult, from the table, to determine the exact cause of fetal mortality, since in nearly all cases the fetal death was attributed to a maternal disease and it was impossible to separate such causes as asphyxia from prematurity, since there was no indication as to the size of the baby. In addition to special pediatric care, the means of reducing fetal mortality associated with cesarean section are the same as

those used for the mother The indications for cesarean section are listed and cases are divided into primary and repeat sections

	Primary Per cent	Repeat Per cent
Disproportion	52.6	87
Placenta previa	12.5	0.6
Toxemia of pregnancy	11.0	0.9
Functional disorders of uterine action	6.2	1.6
Tumors and other causes of obstruction	3.8	1.7
Maternal and fetal distress	2.9	
Heart disease	2.9	1.3
Ruptured uterus	2.0	1.9
Age	2.0	
Previous gynecological operations	1.6	
Abnormal presentation	1.5	
Miscellaneous	1.0	4.5

The remaining cesarean sections not listed among the repeat sections were probably indicated on the basis of a previous section

An urgent appeal to reduce the incidence of cesarean section is made to the obstetrician as well as to the general practitioner, in view of the fact that the maternal mortality varies between 1 and 7 per cent, and the fetal mortality between 5 and 20 per cent. The author considers that the most important factor in reduction of the mortality rate was well expressed by Bourne when he said "As time passes (in the acquisition of experience) the actual operation, while always able to hold our attention, gradually begins to take second place in the general survey and treatment of the case. One of the characteristics of the mature and experienced surgeon is the greater importance which he attaches to the preparatory consideration of the diagnosis and to the choice of the particular operation which will be most calculated to ensure the maximum benefit to the patient, both immediately and in the more distant future."

The author concludes, from the analysis of these statistics, that (1) premature induction of labor be given a trial in selected cases of contracted pelvis, (2) that test labor be conducted only under hospital conditions, (3) that a conservative method of management of placenta previa be followed, (4) the employment of cesarean section in toxemia should be considered only in cases which do not respond to conservative therapy, (5) that most patients with heart disease withstand pregnancy and labor without difficulty, (6) that obstructing tumors should be displaced or removed, and (7) that manual correction of abnormal cephalic presentation and other vaginal procedures should be used for abnormal cephalic positions

JAMES F. DONNELLY, M.D.

## PUERPERIUM AND ITS COMPLICATIONS

The Third Stage of Labor A Plea for Manual Removal of the Placenta ROBERT A. CACCIARELLI  
*Am J Obst*, 1949, 57, 351

The third stage of labor has repeatedly been the subject of much discussion and dissension, yet it is

the least understood, the most ill-managed, and the most tampered with stage. The persistence of postpartum hemorrhage is due to mismanagement of the third stage, and most deaths are preventable.

Immediate manual removal of the placenta makes the operator the master of the third stage and not merely a timid observer. This immediate surgical management of the third stage of labor, done under aseptic conditions in the already anesthetized patient, has reduced the incidence of postpartum hemorrhage, kept blood loss at a minimum, and has enabled careful exploration of the uterus.

A total of 1,625 cases were managed in this radical fashion without mortality. There was a morbidity of 4.6 per cent, although in no instance did the procedure itself appear to be responsible for the morbidity. Inversion of the uterus did not occur and uterine tamponade to control bleeding was necessary in only 3 cases. None of the patients required blood transfusions for postpartum hemorrhage.

The procedure of manual removal of the placenta has been unfairly condemned because the unfavorable results have been measured by the worst emergencies for which it is undertaken. It is still notoriously bad when performed upon the shocked and exsanguinated patient. In the hands of men properly trained, immediate routine manual removal of the placenta in an anesthetized patient is a safe practice.

JOHN R. WOLFF, M.D.

Chronic Appendicitis in the Puerperal State (L'appendicite cronica nello stato puerperale) FULVIO CONCETTI *Riv ostet gin*, 1947, 2, 390

An analysis of 33 cases of appendicitis during pregnancy and the puerperium, of which 31 were of the chronic or interval type, indicates that acute appendicitis is exceedingly rare during the postpartum period, and that the chronic appendix which may become manifest is the result of hormonal and mechanical factors operating upon a pre-existing inflammation. The re-exacerbation of such chronically affected appendices was found to occur with greatest frequency in the second month of pregnancy and in primiparous women.

EDITH B. FARNSWORTH, M.D.

## NEWBORN

Hemolytic Disease of Newborn P. L. MOLLISON and MARIE CUTBUSH *Brit M J*, 1949, 1, 123

This article deals primarily with the criteria for determining the severity of hemolytic disease of the newborn at birth. The authors state that the presence of the disease at birth can be determined by the Coombs test but that other criteria are needed to determine its severity and whether treatment is needed.

Various tests were performed, some on normal infants, for comparison. Cord blood was collected at birth, and venous blood was tested several hours after birth. In some infants the cord was clamped immediately at birth and in others it was left untied for 5 minutes. Capillary samples of blood were taken

on the first day of life along with simultaneous venous samples. Venous pressures were measured and bilirubin values determined.

The authors believe that the various types of hemolytic disease of the newborn, from congenital anemia through icterus gravis to hydrops fetalis, blend so gradually that other criteria are needed for early diagnosis and treatment.

In their opinion, diagnosis of the severity of the disease by antibody titre is not too reliable. They do believe, however, that accurate hemoglobin determinations in cord blood offers a satisfactory criterion of the severity, and that knowledge of this value enables one, within limits, to give a reliable prognosis. Infants with a hemoglobin value of 0.8 gm per cent or less are likely to die within 24 hours of birth. These infants often show a raised venous pressure and probably die from cardiac failure. Infants with 14.5 gm per cent or over are likely to recover without treatment.

The hemoglobin values determined after birth are more difficult to interpret because of the placental transfer of blood, and the large capillary and venous differences in the newborn.

Cord plasma bilirubin determinations alone are of little value, but when compared to cord hemoglobin tests a better index to the severity of the disease is obtained.

Nucleated red cells were present in all moderately severe cases and were a striking feature of the fatal cases, while in mild cases these forms were within normal limits.

The amount of free Rh antibody in the infant's circulation, and the strength of the Coombs test are of very limited value in determining the severity of the disease. The form of Rh antibody predominating in the mother's serum and the antibody titre show some correlation with the severity of the hemolytic process in the infant.

The authors' findings emphasize the importance of determining the hemoglobin and bilirubin values of cord blood as a means of grading cases of hemolytic disease of the newborn. It is not only a help in deciding on the correct treatment, but is of value as a method of comparing one series with another.

BYFORD F. HESKETT, M.D.

#### Results of Therapy of Erythroblastosis with Exchange Transfusions. ALEXANDER S. WIENER and IRVING B. WEXLER. *Blood*, 1949, 4: 1.

In previous articles, the authors described the method of treatment of erythroblastosis fetalis with exchange transfusion, and presented a few illustrative cases in detail. The purpose of the present article is to summarize their results in the first 28 cases.

The rationale of this method of treatment is outlined as follows:

According to the authors' concept of the pathogenesis of the disease, in a typical case, the Rh positive erythroblastic baby is born with its red cells coated with univalent Rh antibodies derived

from the mother during intrauterine life by transplacental filtration. In some cases, it is possible that the Rh antibodies of the "bivalent" type (agglutinins) may be milked into the fetal circulation by the uterine contractions during labor. These antibodies may cause the infants' red cells to hemolyze or clump. Simple Rh negative blood transfusions suffice in the hemolytic anemia which develops from hemolyses. Clumping, on the other hand, may be more dangerous to vital organs and, in these, simple transfusions are not enough. Intravascular clumping, when it occurs, probably starts after birth, usually when the conglutinin content of the blood rises, and may be considered to be reversible at first (cludged blood). The authors believe that if the infant's blood can be drawn off early and replaced by Rh blood of a compatible blood group, this clumping can be aborted, because type Rh cells cannot be clumped by Rh antibodies in the baby's body.

The bleeding and infusion must be done simultaneously. As the exchange progresses, it becomes less efficient because more of the donor's blood is drawn off and less of the infant's. Various amounts of blood were used. With 500 c.c. of blood, 87 per cent of the baby's blood was withdrawn. With 1,000 c.c., 98 per cent replacement was effected.

The Rh should be determined on all pregnant women. If the patient is Rh negative, the husband, children, and husband's family should be tested. The maternal serum should be tested for presence of antibodies or their titre during pregnancy by the saline agglutination and albumin plasma conglutination techniques.

Women showing no sensitization are allowed to go to term, mildly sensitized women are allowed to go to term, and the infant is watched for evidence of anemia, jaundice, or signs of erythroblastosis. Moderately sensitized women are delivered 2 weeks early and the babies are immediately treated by exchange transfusion of 500 c.c., more severely sensitized women may be delivered even earlier, the babies being treated with 1,000 c.c. of blood. In severely sensitized women the babies rarely reach viability.

The authors discuss the Rh typing and antibody tests in great detail. The agglutination method, the albumin plasma conglutination method, and the blocking technique are described.

What the authors describe is a simple technique of exchange transfusions has been devised. They do not wait for tests on the baby's blood but take samples for later testing unless the father is heterozygous, in which case they wait for tests. A 20 gauge needle in the sphenous vein at the ankle is used for the infusion, and a 3 way stop cock allows for changing the speed of the infusion and also for the giving of medication directly into the cannula. First 0.2 c.c. (200 units) of heparin is injected and repeated after 250 c.c. of blood have been given in the 500 c.c. transfusion, or after 500 c.c. of blood have been injected when an 1,000 c.c. exchange transfusion is given.

## OBSTETRICS

TABLE I—MATERNAL MORTALITY

Deaths	Patients	Mortality rate per 10,000
Hospital and outside deliveries	Obst admissions	14
Hospital deliveries	Hospital deliveries	15
Hospital deliveries	Hospital live births	16
All except abortions, ectopic pregnancies and chorion-epithelioma	All admissions except abortions, ectopic pregnancies, and chorionepithelioma	17
All except abortions, ectopic pregnancies and chorion-epithelioma	All deliveries	19
All except abortions (Margaret Hague Hospital)	Live births	22
All deaths (New York Lying-In Hospital)	All admissions	29
All deaths (Chicago Lying-In Hospital)	All patients	32
International list of causes of death	Live births	32
All deaths	Live births	38

About 15 minutes are allowed for the infusion of citrated blood, and 50 c.c. are infused before bleeding is started. This is accomplished by exposing the radial artery at the wrist and cutting a flap from its wall. Blood is collected in 1 oz. medicine glasses which are emptied into a graduated bottle.

The infusion is always kept about 50 c.c. ahead of the bleeding. From 50 to 75 c.c. more blood is infused than is withdrawn.

A 10 c.c. syringe of 10 per cent calcium gluconate is kept on hand at all times, and if signs and symptoms of hypocalcemia develop, 5 c.c. are given slowly, usually, for transfusions of 500 c.c. of blood or less, this is not needed unless the procedure is carried out too fast. Penicillin was given to prevent infection.

The cases are reviewed in detail. Of the 28 cases, 16 were very severe, 6 were moderately severe, and 6 were mild. Only 7 infants succumbed. The authors favor fresh blood as compared to bank blood.

It is believed that the most reliable index of severity of the disease is provided by antibody titrations of the maternal univalent Rh antibodies as well as by tests for the presence of univalent antibodies in the infant's blood.

BYFORD F. HESKETT, M.D.

## MISCELLANEOUS

**Maternal Mortality: An Analysis of the 10 Year Period from 1937 Through 1946 at the Cincinnati General Hospital.** R. D. BRYANT and N. S. ASHLEY. *West J Surg*, 1948, 56: 611.

The authors point out that there is no standard definition of maternal mortality, nor is there any standard method of reporting maternal mortality rates. They have defined maternal mortality as (1) deaths during pregnancy and labor from any cause whatsoever, (2) deaths during the puerperium (the puerperium is considered as the 6 weeks following the day of delivery) from any cause whatsoever, (3) deaths any time after delivery due directly to complications or sequela of pregnancy or delivery, and continuously present since then, (4) deaths due to chorionepithelioma of uterine origin. As is well known, the bureau of census figures are based on the

number of maternal deaths in relation to total live births. In reporting mortality rates, other clinics use a variety of different methods for determination of the rate.

The latest statistics reveal a significantly higher maternal mortality among negroes, and that nearly all of the deaths occurred among patients, white or colored, who had had poor or no prenatal care. The article is accompanied by an interesting table showing the difference in mortality rate per 10,000 cases, and calculated in a variety of different ways that have been reported in the past literature.

This table clearly reflects the fact that many current reports are not comparable and that there is a striking need for some standard method of reporting maternal mortality. In regard to the preventability of maternal deaths, the authors are of the belief that whereas one could discuss the overall preventability of any group of complications, such standards applied to a single patient are not sufficiently reliable to be significant.

JAMES F. DONNELLY, M.D.

# GENITOURINARY SURGERY

## ADRENAL, KIDNEY AND URETER

**Device for Obstructing the Urinary Flow in Intravenous Urography (Urografia a deflusso ostacolato)** G ZACCONE and L CONZI *Radiol med*, Milano, 1948, 34 548

The authors propose the use of a small distensible balloon attached to a common catheter and a simple manometer which, when introduced into the bladder and inflated, serves to obstruct the flow of urine into the bladder. They suggest that the first films be made 3 or 4 minutes after the cessation of injection, and that the balloon then be inflated to a pressure between 40 and 50 mm of mercury. The air required is found to vary from 400 to 800 c.c. The procedure is better tolerated by the patients than the usual external compression, and it results in a more detailed and dependable visualization.

EDITH B FARNSWORTH, M D

**Double Formations of the Pelves of the Kidneys and the Ureters. Embryology, Occurrence, and Clinical Significance** BENGT NORDMARK *Acta radiol*, Stockh., 1948, 30 267

The author examined 4,774 urograms taken in the 5-year period from 1942 through 1946. In this group he found 201 cases of double kidney pelvis, a percentage of 4.2. In 138 of these cases there was also a double formation of the ureter, a percentage of 2.8.

Of the 201 cases of double formation of the kidney pelvis, 46 were bilateral and 155 unilateral. Of the 138 cases of double formation of the ureter, 19 were bilateral and 119 unilateral.

When the different kinds of double formations of the ureter were arranged in order according to their occurrence, the following figures were obtained:

1. Cases with unilateral incomplete division of the ureter, 60 (1.3 per cent)

2. Cases with unilateral complete division of the ureter, 59 (1.3 per cent)

3. Cases with bilateral complete division of the ureter, 11 (0.2 per cent)

4. Cases with bilateral incomplete division of the ureter, 5 (0.1 per cent)

5. Cases with complete division of the ureter on one side and incomplete division on the other, 3 (0.06 per cent)

Of the 201 patients with double formation of the pelvis, 98 were women and 103 men. Of the 155 unilateral cases of double formation of the kidney pelvis, 62 were on the right and 93 on the left side. There was no evidence of any family connection in these cases of malformation.

The author reports the statistics of other investigators and outlines the embryologic theories causing reduplications. Most of the writers believe that these malformations are of clinical significance.

Of the 201 case analyses, 48 showed symptoms of cystitis or pyelitis and, further, 15 showed a renal calculus with a calculus in the ureter in conjunction with double formation of the kidney pelvis or of the ureter. However, also 13 cases of calculus of the kidney or of the ureter on the side on which the kidney was not affected by any malformation were found. The author suggests that the reason so many cases show symptoms of disease, lies in the type of material.

Most of the patients on whom such a thorough and costly examination as a urogram is carried out, show symptoms in the urinary passages. This also means that these malformations are not quite so common as an investigation of this kind seems to indicate. The author believes that from the view point of therapy, it is very important to know whether or not a double kidney is present, and he presents 5 cases in which this knowledge was of paramount importance.

ROBERT O BEADLES, M D

**A Case of Chyluria of the Right Kidney (Un caso de quiluria de riñón derecho)** JAVIER HÚDER *Arch españ urol*, 1948, 5 99

A typical case of chyluria is here reported, although operation had not yet been done, in order to present its odd history and the characteristic roentgen picture of this rare condition. About 10 years ago the patient, a 43 year old single woman who had never been outside of Spain, except one time when she went to Bordeaux in France, was laparotomized through a supraumbilical, midline incision for an acute condition of the abdomen. A year later her appendix was removed through a right lower abdominal incision. Six years later the patient suffered from headaches and noted that the urine looked dirty. The milky, grayish color was shown to be due to the presence of chyle. This chylous discharge showed a close relationship to the recumbent body posture. The urine was practically clear during the day but developed the opalescence during the night—usually after midnight.

Cystoscopy disclosed the milky, chylous fluid coming from the right ureter, and ascending pyelography disclosed the characteristic lymphatic reflux.

The author surmises that the condition has something to do with the cicatricial developments following one or the other of the abdominal operations. Probably the supraumbilical incision marked the origin of the condition interfering with the lateral flow and directing it against the hilus portion of the kidney.

A further report on this case will be made when the patient makes up her mind to be operated upon, which decision the author surmises will not be too far distant in the future.

JOHN W BRENAN, M D



**Pararenal Sympathicoblastoma in Children Under 5 Years of Age** (*Sympatricoblastomi pararenali in bambini sotto i cinque anni*) **GIORGIO DE MAIO**  
*Urologia*, 1948, 15 393

Four cases of pararenal sympathicoblastoma in children under 5 years of age are reported by the author. In 3 cases the preoperative diagnosis was pararenal tumor and in 1 case that of kidney tumor was made. The patients' ages ranged from 15 months to 4½ years.

The tumors were malignant, had a dysontogenetic etiology and showed a neuroblastic evolution. In the histologic examination it was possible to distinguish three varieties: sympathogoniomas, neuroblastomas, and ganglioneuromas.

The tumors occur more frequently in the female than in the male sex. All 4 patients in the cases reported by the author were girls.

The tumors vary in size, have either a smooth or a nodular surface and a fibrous capsule, and may be adherent to the spine and the paravertebral tissues.

Pain in the affected hypochondrium or the flank is followed sooner or later by pallor, other signs of cachexia, and visceral or osseous metastases.

The discovery of a tumor on palpation, and also ascending and descending pyelography help to establish the diagnosis. Malignant lymphogranulomas, tumors of the liver, and splenomegaly should be considered in the differential diagnosis. A tumor of the suprarenal gland cannot be excluded with certainty before the operation.

The prognosis is poor and seems to have no relation to the degree of maturity of the tumor.

Either the transperitoneal or the lumbar route is used for exploration and for removal of the tumor if possible.

Postoperative irradiation may prolong life.

**JOSEPH K. NARAT, M.D.**

**Results of Surgical Treatment of Unilateral Nephropathy in Hypertension** (*Résultats du traitement chirurgical des néphropathies unilatérales dans l'hypertension*) **J. CIBERT, M. REVOL, and S. KANTOR**  
*J urol méd*, Par, 1948, 54 538

The authors discuss the cases of a series of 20 hypertensive patients in whom surgery of the kidney was performed for various lesions. Eighteen of the patients underwent nephrectomy, 1 decapsulation, and 1 pyelotomy for a kidney stone. The renal pathology included hydronephrosis, tuberculosis, lithiasis, nephrosclerosis, and hypoplasia of the kidney.

Sixteen of the patients showed a definite, some of them a spectacular, decrease of the hypertension. Even in those in whom the blood pressure decreased only a little or not at all, the other symptoms such as headache, asthenia, and visual disturbances cleared up more or less.

It is important to select judiciously those patients who are likely to benefit from the operation. Strictly unilateral severe nephropathies are comparatively rare. Only persons under 50 years of age with hyper-

tension of relatively recent origin can be expected to show amelioration or, in rare instances, complete cure.  
**WERNER M. SOLMITZ, M.D.**

**The Remaining Kidney in Tuberculous Cystitis after Nephrectomy** (*Le rein restant dans la cystite tuberculeuse après néphrectomie*) **GEORGES MAYOR**  
*J urol méd*, Par, 1948, 54 513

The author studied a series of 164 cases of tuberculous cystitis after nephrectomy and its influence on the remaining kidney. The cases were collected partly from the literature and partly from the hospitals at Paris and Lyon, France, and at Bern and Zurich, Switzerland.

The relations between renal and vesical tuberculosis are little known at present. It has been proved experimentally that the introduction of Koch bacilli into the bladder has never produced tuberculous cystitis. Hence, it can be concluded that infection does not occur from contaminated urine. In most cases, infection of the bladder takes place by way of the lymphatics along the ureter from the tuberculous kidney. The initial lesions are always situated at the ureteral orifice. Hematogenous infection occurs in rare cases only, if at all.

After nephrectomy the cystitis may clear up completely, or reinfection may occur, either from the remaining kidney, a focus in the prostate, or from the stump of the amputated ureter. Recurrences of an apparently healed tuberculous cystitis may also be caused by an intercurrent nonspecific infection of the bladder.

Retrograde infection of the remaining kidney can occur only when the intramural portion of the ureter becomes involved. The ureter runs obliquely through the bladder wall to the base of the trigonum. As a result, in normal cases the internal os is closed in increased vesical pressure like a valve, and no reflux can take place. Intramural tuberculous ureteritis, however, leads to diminution of the tonus, sclerosis, and insufficiency, or, in rarer cases, to stenosis of the intramural ureter. Clinical symptoms of insufficiency are pollakiuria, pyuria, and pains in the lumbar region of the remaining kidney, especially when the bladder is full and during micturition. Cystoscopy reveals a wide open orifice of pale color, diminished tonus, and poor peristalsis. Often specific lesions or scars can be seen on cystoscopic examination. The amount and intensity of reflux can be verified by cystography or intravenous urography. The insufficiency of the orifice combined with the diminished tonus leads to gradual dilatation of the ureter, which may reach enormous dimensions. The pathological reflux is aggravated by spasms of the vesical sphincter and difficulties of urination. In men, tuberculous prostatitis and urethritis are additional factors which maintain the cystitis, ureteritis, and retrograde infection of the remaining kidney.

Various pathologic conditions of the remaining kidney may result. Hydronephrosis and gradual destruction of the renal parenchyma are due to the reflux and increased intraureteral pressure. Whether



tuberculosis of the remaining kidney is hematogenous or due to the reflux from a tuberculous bladder is still an open question. Unjudicious ureteral catheterism may also play a causative role. Since all tuberculous bladders are secondarily infected, ascendant pyelonephritis and purulent nephritis are frequent complications. Other complications include prostatitis, epididymitis, lithiasis of the kidney or bladder, and incontinence.

Medical treatment has only a temporary effect, if any. Vesical instillations give relief for some time but do not influence the specific lesions. Streptomycin had been applied only in 1 case, without success. Surgical treatment in the area of the ureter includes meatotomy, dilatation of the stenosed ureter (3 cases), permanent ureteral catheterism (3 cases), and ureterotomy followed by retrograde catheterism (2 cases with poor result). Surgery of the bladder includes simple cystostomy (8 cases), plastic operations (which are rejected by the author as too dangerous), and ureterocystoneostomy, which was done in 1 case with excellent success. Resection of the neck of the bladder, either for stenosis or spasm, was done in 17 patients. Ten of these had good results, 4 fair results, and 3 poor results.

Implantation of the ureter in the colon was done in 18 cases for various indications. Most of the patients died of ascendant pyelonephritis and uremia within 2 years. External ureterostomy is much safer than this dangerous operation. Elimination of the bladder gives prompt relief of the pains, cures the cystitis, and abolishes the danger of reflux with all its sequelae. The late results in 99 patients were good in 69, fair in 7, and poor in 23.

Nephrostomy is done in pyonephrosis only, as a rule. In 7 of 13 patients, the results were good. In 4 additional patients nephrostomy was followed by implantation of the ureter in the sigmoid with good results.

WERNER M. SOLMITZ, M.D.

**Case of Hematuria** HAMILTON W. MCKAY, H. HAYNES BAIRD, and KENNETH M. LYNCH, JR. *J Urol*, Balt., 1949, 61: 1.

The authors report in detail 2 cases of vascular lesions of the renal papillae, and present their conclusions, based on experience in these 2 cases, and a review of the literature.

The first case was that of a 39 year old negro who, in 1944, had gross hematuria which persisted for several days and for which he received no therapy. Three months prior to admission to the hospital, on February 18, 1947, the hematuria recurred. After it had been determined that he was bleeding from the left kidney, the left renal pelvis was irrigated with 1 per cent silver nitrate without beneficial results. Complete urological and hematological studies failed to reveal the etiology of the hematuria. After an interval of 3 months, and a 10 to 15 pound weight loss, he was hospitalized. Except for grossly bloody urine, no abnormalities were found on a complete survey. A nephrectomy was performed. The pathologist reported that the kidney was normal ex-

cept for the tip of one pyramid in which there was a collection of dilated veins with hemorrhage into the surrounding tissue. Microscopically, rupture of a dilated vein into the pelvis of the kidney was noted.

The second case was that of a 67 year old white housewife who, on retrograde pyelography, presented a picture similar to that in Case 1, with gross hematuria and right hydronephrosis, and moderate left hydronephrosis. Because of the persistent hematuria and bizarre left renal shadow, a nephrectomy was performed. The pathological report read in part: "At the lower pole is encountered a pyramid, the apex of which contains numerous small foci of hemorrhage and from which a small amount of sanguineous fluid can be expressed. The mucosa of the adjacent calyx is somewhat hemorrhagic and appears to be ulcerated. Histological sections through these areas show an extensive inflammatory infiltration in the medullary and peripelvic portion. In one area the histologic findings are suggestive of a direct continuity between a moderate sized vein and a markedly inflamed portion of the calyx with extensive necrosis of the peripelvic tissue and massive hemorrhage. Focal, partially necrotizing pyelonephritis in isolated calyces with massive hemorrhage."

In their review of the literature, the authors found 21 cases in which similar lesions were classified as varicosities, and 92 other cases which were classified as angioma of the kidney, chronic papillitis, chronic hemorrhagic papillitis, or chronic inflammatory and vascular changes in the papillae. Of the 92 cases, only 15 were believed to have contributed to the literature on the subject. The cases were classified in two groups, one group including the cases of vascular irregularities—either renal varix or angioma—the other, those which showed lesions interpreted as inflammatory in nature.

The authors propose that the lesion in their first case be called a hamartoma—"the congenital overdevelopment of some tissue element which belongs at the site at which it is found." The second group of cases have been combined under a diagnosis of hemorrhagic papillitis. Isolation of a bacterial agent was unsuccessful. However, in many of the cases reported by others the condition was apparently pyelitis due to the colon bacillus with ulceration into a sizable vessel.

In cases in which the bleeding is persistent, serious and unilateral nephrectomy is recommended after conservative attempts have failed.

PETER L. SCARDINO, M.D.

## BLADDER, URETHRA, AND PENIS

**Occlusion of Vesical Orifice after Suprapubic Prostatectomy** ALBERT E. GOLDSTEIN and SEYMOUR W. RUBIN. *J Urol*, Balt., 1948, 60: 499.

Complete occlusion of the vesical orifice following suprapubic prostatectomy is a very rare complication. Only 26 cases have been recorded in the English and American literature, including the 3 cases reported by the authors.

All of the reported cases have the occluding diaphragm of mucosa at the vesicoprostatic juncture. When the suprapubic sinus persists, occlusion below should be suspected. Persistent instrumentation in the presence of such an occlusion at the vesical orifice may result in serious complications.

The treatment of occlusion at the vesical orifice consists of suprapubic cystotomy and excision of the diaphragmatic obstruction over a urethral sound. The prognosis is excellent. Complete occlusion following operation may be prevented by careful excision of mucosal tags and ledges and by the use of an indwelling catheter.

FREDERICK A. LLOYD, M.D.

**Cystitis Glandularis** HANS R. SAUER and MICHAEL S. BLICK *J. Urol.*, Balt., 1948, 60: 446

Cystitis glandularis is of fairly uncommon occurrence and the difficulties encountered in the diagnosis of this lesion have been adequately described by various authors. Because of its often confusing cystoscopic and microscopic appearance, the condition may easily be mistaken for carcinoma, and prolonged observation is necessary in some cases before the true nature of the lesion can be recognized.

Following a study of 7 cases, the authors have come to the conclusion that cystitis glandularis should be considered a separate clinical entity. Its recognition may be difficult in some instances, yet there are certain findings which seem to be pathognomonic.

Cystitis glandularis need not impair the patient's well-being to any great extent. Although cystoscopy revealed quite extensive lesions, and although the patients were suffering from a chronic condition with symptoms of varying severity and duration, it was noted that their general health remained unimpaired by the disease. As a rule the symptoms of the disease were not characteristic. Dysuria, always in combination with frequency, was the most common complaint. Intermittent hematuria was the next frequent symptom, and in 1 patient the persistent elimination of clear and tenacious mucus was the only complaint. Since hematuria, frequency, and dysuria are known to occur as a result of various urological disorders, not too much diagnostic significance can be attributed to their occurrence. It appears likely that they are caused by superimposed infection rather than by the disease itself. In contrast, constant elimination of clear mucus during and/or after urination is of diagnostic importance because it indicates the presence of mucus-producing glands in the genitourinary tract. However, since mucin may be secreted in such small quantities that its elimination may occur unnoticed by the patient, it is advisable to carry out mucin tests whenever glandular cystitis is suspected.

The vesical neck and trigone, as well as the lower posterior and lower lateral walls, are the site of predilection, yet other parts of the bladder may occasionally be affected by the disease. It was noted that the lesions remained localized to the areas

where they were originally observed, and neither progression nor regression took place throughout the period of observation.

It is generally agreed that cystitis glandularis remains more or less confined to the bladder proper. The absence of changes in the prostate and seminal vesicles, as determined on rectal examination, was also conspicuous.

Cystoscopic examination represents the most valuable procedure in the diagnosis of glandular cystitis. In the cases observed the bladder capacity was not significantly reduced and the instrumentation was not unduly painful, although some of the lesions had assumed considerable proportions.

The cystoscopic picture of cystitis glandularis appears to be characterized by two distinctive types of lesions. The first consists of mammillated bleblike structures which are separated by deep ridges. Although the lesion resembles bullous edema at first sight, it differs because the bleblike elevations are fleshy in appearance and lack transparency.

The second type is characterized by the formation of fleshy villouslike proliferations. While the first type may give the impression of tumor growth underneath the mucosa, the second may very easily be mistaken for tumor originating in the mucosa itself. However, it is characteristic for both forms that the transition from diseased to apparently unaffected bladder mucosa is usually quite abrupt.

Although the afore-mentioned factors are of considerable diagnostic value, the final confirmation of the diagnosis rests on the histologic findings. The microscopic appearance of this condition may closely resemble either squamous cell carcinoma or adenocarcinoma.

The treatment of cystitis glandularis should be conservative. Active bleeding from a small area can be arrested by electrocoagulation. If infection is present, its source, if determined, should be eliminated. In other cases, it should be treated with urinary antiseptics.

FREDERICK A. LLOYD, M.D.

**Gangrene of the Penis** (Gangrenas del pene) JORGE LOCKHART *An. Fac. med. Montev.*, 1948, p. 957

The male urethra forms three angles: (1) the inferior angle, created by the intracavernous diaphragm, (2) the middle or cavernous angle, at the site of separation of the corpora cavernosa where they lose their connection with the pubic bone, and (3) the superior angle, where the pendulous portion begins.

Periurethritis at the level of the third angle has the greatest tendency to produce gangrene of the penis. In a lesser degree, the second angle shows a similar tendency.

Gangrene of the penis shows a multiplicity of clinical forms, the most frequent one being the spontaneous or fulminating form described by Fournier.

The gangrene may be superficial or deep, and it may take an acute or chronic course. Gangrene is always preceded by a pregangrenous lesion such as an erosion or balanoposthitis.

There is a definite histopathologic, etiologic, and evolutionary parallelism between the cutaneous gangrene and certain forms of phagedenic conditions.

Phimosis creates optimal conditions for the development of a gangrene by favoring inflammatory processes within the balanopreputial cavity.

Infection is the most important factor in the etiology of the gangrene of the penis, but chemical factors, such as the local application of kerosene, have also been mentioned in the literature.

Postoperative progressive cutaneous gangrene, similar to conditions of the abdominal wall described by Meleney, has been observed by the author.

In 2 instances the author saw a dissecting pericavernitis of gangrenous type.

The glans penis is the most frequent site of gangrene which rapidly invades deeper tissues. In the anatomic sense the glans is quite independent from the rest of the organ, a fact which allows the performance of its amputation.

An inflammatory phimosis, responsible for a grave general condition, is strongly suggestive of gangrene of the penis and demands an immediate dorsal split or circumcision.

Gangrene of the penis, whatever clinical form it assumes, has a great tendency to limit itself spontaneously, and already in early stages forms a line of demarcation. Therefore, although the results are mutilating, the prognosis for life is good.

As to the treatment, exposure to air, associated with the local and general administration of anti-infectious remedies, is sufficient to lead the evolution of the process toward a cure. If the lesion is extensive, its borders should be excised with electrosurgery.

JOSEPH K. NARAT, M.D.

## GENITAL ORGANS

**Carcinoma Cells in Prostatic Secretions** DONALD D. ALBERS, JOHN R. McDONALD, and GERSHOM J. THOMPSON *J. Am. Med. Ass.*, 1949, 139: 299.

This study was conducted to demonstrate that carcinoma of the prostate can be diagnosed by examination of the prostatic secretions. Other information sought for concerned the accuracy of this test in regard to prostatic carcinoma in general and well differentiated prostatic carcinoma in particular, the criteria for the diagnosis based on a study of the prostatic secretions, the diagnosis of prostatic malignancy before it is clinically evident, and the components of prostatic secretions which might be confused with malignant cells.

Prostatic secretions were obtained by the customary method of prostatic massage, and a drop of secretion was placed near the end of each slide. This was spread in a circular manner with an applicator. Before drying, the slides were immersed in an alcohol-ether mixture (equal parts of 95 per cent alcohol and ether) in Coplin jars. An attempt was made to prepare at least four slides for each patient. These slides were left in the fixative for not less than 30 minutes.

The slides were passed through three strengths of alcohol (80, 70, and 50 per cent) and then through tap water. They were then either allowed to dry or started on the rest of the straining procedure immediately. The technique used was a routine hematoxylin-eosin method with certain shortcuts, but any routine hematoxylin-eosin technique should be satisfactory after some experience has been obtained.

All slides from each patient were examined at 100 power, the mechanical stage being used to assure complete coverage. Any suspicious cell was examined under 430 power for identification and, when considered worthy, was marked with ink for further reference. In general, it took from 20 to 30 minutes to cover four slides adequately, particularly if no malignant cells were seen. When malignant cells were present, they were usually found on the first slide and sometimes the diagnosis could be made in a few seconds.

Initially, in order that an acquaintance with the prostatic epithelial cells in secretions of both benign and malignant prostates might be obtained, smears were made by expressing, on slides, pieces of prostatic tissue removed at transurethral resection and studied. In all, about 30 slides were studied, the findings revealed benign conditions and the four grades of cancer of the prostate (Broders' classification). Then the prostatic secretions from two series of cases were studied. Series 1 consisted of 100 patients with clinically benign prostatic hypertrophy, all scheduled for transurethral resection, and series 2 comprised 41 patients with clinically malignant disease of the prostate, most of whom had obstructive symptoms and were scheduled for operation. Only one specimen was taken in each case.

The benign secretions contained few cells except when prostatitis was present.

Malignant secretions contained benign cellular components in variable amounts, but usually the amount of prostatic epithelium was increased. In this study, every secretion called "positive" for carcinoma cells contained clusters of malignant cells. In poorly differentiated carcinomas, single carcinoma cells were also plentiful. In the well differentiated carcinomas, the cells were not very typical and the presence of clusters of cells were considered essential for the diagnosis.

Confusing components of prostatic secretion were many, and the time spent in distinguishing them from malignant cells varied. The nuclei of squamous and transitional epithelial cells are large, and when the cytoplasm stains poorly these cells appear to have large nuclei and to lack cytoplasm. The nuclei may even contain pale nucleoli, but usually the similarity of these nuclei to those of other typically squamous cells and the lack of hyperchromicity were revealing.

A very confusing cell-like structure was found when spermatozoa were seen in the smears. These structures appeared to consist of homogeneous dark blue nuclei with very eosinophile cytoplasm. Even nucleoli were apparent at times. These cell-like

## GENITOURINARY SURGERY

structures were easily recognized most of the time, but their recognition was considerably difficult until experience was gained.

In the secretions of 3 of the 100 patients in whom a diagnosis of benign hypertrophy was made preoperatively, carcinoma cells were confirmed pathologically at transurethral resection. Similar histologic pictures were presented on examination of sections of tissue, the degree of malignancy being graded 2 (Broders' method). In these 3 cases, the symptoms, which were similar and referable to the urinary tract, included frequency, nocturia, urgency, smallness of the stream, difficulty in starting the stream, and some burning. The ages of these 3 patients were between 40 and 60 years.

In the fourth case in this series the prostate was found to be malignant (grade 1) on histologic examination. There were small glands that lacked papillary infolding, there was lack of stroma, and it was difficult to distinguish the cells from normal cells. However, the secretion from this patient was not considered diagnostic when it was compared with the secretion from benign prostates that showed, on section of tissue at surgical removal, hyperplasia of the epithelium and resultant filling of some of the acini.

The cases in this series in which secretions were not obtained or in which no proof of malignancy was obtained on examination of the prostatic tissue were all cases of advanced carcinoma of the prostate clinically. Many of the patients had metastases, and 5 of these from whom secretions were not obtained had undergone resection previously.

The patient whose prostatic secretions failed to reveal carcinoma was observed, on examination of prostatic tissue, to have carcinoma of the most highly differentiated grade (grade 1).

In the 1 case in which prostatic secretions were positive for carcinoma cells and the prostatic tissue did not show carcinoma, every piece of 19 gm of tissue removed at transurethral resection was sectioned and examined but carcinoma was not found.

In 2 of the cases in which both the secretion and tissue were positive for carcinoma, the lesions were well differentiated carcinomas showing gland formation but malignant changes in the cells (grade 2), and in the rest the lesions were poorly differentiated carcinomas (grades 3 and 4). In 4 cases there was some question preoperatively as to whether the patients had a malignant lesion.

**Bladder Neck Obstruction. A Review of 508 Cases Treated by Endoscopic Resection.** HENRY MOR-  
TENSEN *Med J Australia*, 1948, 2: 714

The author briefly reviews the development of the periurethral route in operations for bladder neck obstruction. The first definite description of such an approach was given in the sixteenth century by Ambroise Paré. In recent years, with the advent of the electric current and the galvanocautery, instruments were devised to remove tissue by coagulation

The varied instruments of this period are described and illustrated. The procedures were blind, and the scarring, sepsis, and hemorrhage doomed the method to failure. Then the development of the cutting current and foreoblique endoscopic vision ushered in an era of enthusiasm for periurethral prostatic resection. After an early optimistic period, a reaction set in and the complications such as perforation, stricture, hemorrhage, incontinence, and inadequate resection were stressed as limitations of the operation. The position today has righted itself and endoscopic resection has found its proper place.

Over a 5-year period 689 cases of bladder neck obstruction were observed by the author in his private practice. In 508, or 82 per cent, he performed endoscopic resection with the McCarthy electrode. He presents his experiences, in which the results were considered very good. The average age of the patients in this series was 67.5 years. The mortality rate was 3.1, a figure which would have been lower had the author not accepted comparatively poor risks for this procedure. Patients were up from the first to the fourth day and usually out of the hospital on the tenth day. Postoperative complications were relatively infrequent. Some early urinary sepsis and residual urine in the immediate postoperative period cleared with epithelization of the resected area and recovery of the bladder tone.

The author is particularly fortunate in that readmission for secondary hemorrhage occurred less than once a year. An inflatable bag with continuous 48-hour irrigation and no traction was used. Some degree of incontinence was present in 23 cases, but in only 2 of them was there any degree of permanence. This complication is now commonly thought to be due to inadequate resection which permits the prolapse of tissue through the external sphincter. Formation of stricture is obviated if there is difficulty in introducing a large sound. There were 10 stricture complications, in 1 case dilatations were necessary for 6 months. Persisting obstructive symptoms requiring further resection occurred in only 6 cases.

There is no indication as to how much tissue is removed, but one obtains the impression that resection down to the capsule is not done. A massive obstructing gland is considered a contraindication to endoscopic approach. Questionnaire follow-up on subjective relief elicited graded responses varying from excellent in 72 per cent of the patients to poor in 1 per cent.

ALLAN K. SWERSIE, M.D.

**Perineal Prostatectomy Today.** DANIEL R. HIGBEE  
*J Am M Ass*, 1949, 139: 141

The purpose that Dr. Higbee had in presenting this subject was twofold: first, to present additional evidence on perineal prostatectomy as to its relative safety and good end results; and, secondly, to endeavor to stimulate wider interest in the perineal surgical treatment of cancer of the prostate.

Perineal prostatectomy has not had the popularity of suprapubic and retropubic prostatectomy or transurethral resection. The author's reasons for this are (1) lack of familiarity with anatomy of the male perineum, (2) inadequate teaching or complete lack of it in many of the well organized medical centers, and (3) the lack of courage of the surgeon to follow through and master the approach in spite of having previously encountered a difficult case, or one of the more serious complications associated with this surgical procedure.

Perineal prostatectomy is the one operation by which almost any pathological change encountered in the gland can be adequately dealt with. The great advantage of this operation, according to Hugh Young, is that it is performed in complete visual control of the operator, hemorrhage that is encountered is stopped, the enucleation is complete, the verumontanum, ejaculatory ducts, the internal and external sphincters are protected, dependent drainage for urinary and inflammatory secretions is obtained, and the lowest mortality rate is secured.

The disadvantages of the operation are well known. The patient's position during operation is unpleasant and may be associated with respiratory or cardiac embarrassment.

The author's series of 350 consecutive cases consisted of 334 simple enucleations, 2 subtotal prostatectomies, and 14 radical perineal operations. The 14 radical operations were separately considered.

In the group of 336 perineal prostatectomies for benign hypertrophy of the prostate, the mortality was 18%. Complications developed in 39 patients, or 11 per cent of the cases.

Postoperative hemorrhage required that 13 patients be returned to the operating room for removal of clots on the day of operation, however, in 3 cases hemorrhage occurred on the sixth postoperative day.

Rectal injuries occurred in 11 cases and fistulas occurred in 4, or 12 per cent of the cases. In 7 of the 11 cases perineal operation was abandoned, suprapubic enucleation was substituted in 2, and transurethral resection was done in 5 cases.

Pulmonary complications were present in 13 cases. In 7 of these the diagnosis was embolic pneumonia, in 4 bronchopneumonia, in 1 lobar pneumonia, and in 1 diaphragmatic pleurisy.

Cardiac complications were minimal, with 2 deaths. Coronary symptoms developed in 3 patients, and in 1 patient an acute decompensation with pulmonary edema followed the operation.

The author concluded that cardiac patients withstood perineal surgery well, although there is probably less immediate risk if the patient is operated upon by transurethral prostatic resection.

A persistent perineal fistula developed in one case.

The fear of urinary incontinence is more widespread than is justified. The methods of avoiding this complication consist of (1) strict observance of the lines of cleavage, especially separating the apical attachment of the rectourethralis muscle, (2) avoid-

ance of unnecessary dissection and exposure, there by interrupting as few nerve fibers as possible, and (3) gentleness and care in retraction both laterally and anteriorly in the region of the perineal body and the external sphincter.

The author concluded that perineal prostatectomy can be carried out with a low mortality, little blood loss, few complications, and good end results at any age.

Total prostatectomy is not a particularly difficult procedure if one is frequently performing other perineal operations, and surgical removal of the prostate remains today the only means of producing a cure in prostatic carcinoma.

Of the 14 patients who were subjected to radical perineal prostatectomy, 2 did not have evidence of cancer on pathological examination. In the 12 patients with proved cancer of the prostate, 4 were castrated in conjunction with radical perineal prostatectomy. The author's statistical end results seemed to indicate the value of this operation for carcinoma of the prostate. Previous to this type of operation, his patients were prepared by catheter drainage, and 5 mgm of diethylstilbestrol were administered daily from 10 to 14 days prior to operation, thus the operability was considered to be facilitated by preliminary treatment with diethylstilbestrol.

The author concluded that radical perineal excision should be attempted in all cases of cancer confined to the prostate gland and in those borderline cases which respond to diethylstilbestrol therapy.

CONRAD A. KUEHN, M.D.

#### Retropubic Prostatectomy THOMAS D. MOORE, J. Urol., Balt., 1949, 61: 46

Forty-six retropubic prostatectomies are reported and reviewed. The author adopted this procedure because of its apparent advantages, namely, greater degree of comfort, less evidence of shock, omission of suprapubic vesical drainage, and a smoother and shorter convalescence. Compared to transurethral resection, large glands are removed retropubically in less time, the operation is concluded at one sitting, less bleeding occurs postoperatively, the period of convalescence is the same, the risk is no greater, there is less immediate postoperative discomfort, and the functional results are good. During the 7 months in which the 46 retropubic prostatectomies were performed, the author performed 2 primary suprapubic prostatectomies and 193 transurethral prostatic resections.

Examination of the patients consisted of a general physical survey, routine 2 glass urinalysis, test for residual urine, pneumocystogram with the patient in the semilateral position, estimation of nonprotein nitrogen, phenolsulfonphthalein test in the usual manner, and, when advisable, an intravenous urogram. The digital examination and the pneumocystogram afford a reliable method for determining prostatic size. Cystoscopy is not routinely employed. The judicious use of sulfonamides prophylactically is suggested. If residual urine is greater than 60 cc,

an indwelling Foley catheter, size No 16 F, is inserted. If the cardiovascular status permits, the patient enjoys a large fluid intake and a regular diet. At the optimum time, dependent upon the results of the examination, the operative procedure is scheduled. Vas ligation is performed at the time of prostatic surgery.

The special Millan instrument facilitates the procedure. A suprapubic transverse incision is made about 2 cm above the symphysis, incising the recti sheath. The muscles are separated. The Trendelenburg position is attained and the dissection is carried down to the anterior aspect of the prostate gland, which is cleaned by gauze dissection.

Electrocoagulation secures the adjacent vessels. The prostate is mobilized anteriorly and laterally with sponge sticks. The prostatic capsule is incised transversely with the needle electrode and cutting current. The capsule is separated laterally and anteriorly with curved forceps in the cleavage plane. The margins of the capsule are grasped with special T capsule forceps. With finger dissection, the enucleation is completed after the urethra has been cut near the apex. The vesical neck attachments are clamped, cut, and fulgurated. If the vesical neck requires resection, a V-shaped wedge is removed inferiorly. After finger inspection of the bladder, a No 24 F Foley catheter is passed into the urethra, at which time a strip of oxidized gauze and a suspension of colloidal sulfathiazole is placed around the bag of the catheter. The latter is inflated so that it remains in the prostatic fossa with the tip of the catheter jutting into the bladder. The prostatic capsule is closed with 2 layers of chromic catgut interlocking sutures. The wound is closed in the conventional manner.

A detailed comparison is made between the suprapubic, retropubic, and transurethral prostatectomy. A table of comparative postoperative data of 46 cases in each series revealed that the catheter was removed in an average of 12 days in the suprapubic group, and in half that time when either of the other 2 procedures were performed. The average postoperative hospitalization was 15 days in the suprapubic group, or 4 days more than the average of the other 2 groups. The early functional result was somewhat better with the suprapubic and retropubic group than with the transurethral group.

While osteitis pubis might be confused with obturator neuritis and chondritis, the distressing symptom of this complication occurred in 8 (17%) of the 46 retropubic prostatectomies. This complication did not occur in the suprapubic or transurethral group. There was 1 death in the suprapubic group, 2 in the transurethral group, and none in the retropubic group.

An evaluation is made of late functional results following retropubic prostatectomy. Preoperative and postoperative cystourethrograms illustrate the results.

The author suggests that once osteitis pubis is prevented, the retropubic prostatectomy will replace

much of the suprapubic prostatic surgery for hypertrophies of unusually large degree.

PETER L. SCARDINO, M.D.

# **Sixty-Five Prostatectomies According To Freyer's Method** (Sessantacinque prostatectomie secondo Freyer) MARIO FERNANDEZ *Urologia*, 1948, 15 407

Although the enthusiasm for electroresection of the prostatic gland is growing, the author still favors the suprapubic prostatectomy because its technique is easy, the functional results are better than those following the perineal resection, the operation offers the opportunity for the beneficial drainage, and the postoperative mortality is low.

Of 65 patients who underwent the suprapubic prostatectomy, 3 died, 1 from bronchopneumonia, 1 from septicemia, and 1 from a cardiorenal disease. Twelve patients were between 50 and 60 years of age, 36 were in the sixties, and 17 were in the eighth decade of life. The time interval between the two stages of the operation ranged from 15 to 70 days. The nitrogen contents of the blood, d'Ambard's coefficient, the blood pressure, and the general condition of the patient were the determining factors in the selection of the interval between the stages of the operation.

The author has abolished the use of sponges for hemostatic purposes except in cases of severe hemorrhage which peril the patient's life.

JOSEPH K. NARAT, M.D.

# **Varicocele, Technique of Operation of Eurico Branco Ribeiro** (Varicocele, técnica de la operación de Eurico Branco Ribeiro) JOSÉ YOEL *Dia mtd*, B Air, 1949, 21 156

For the past 2 years the author has obtained very satisfactory results from the operation of Branco Ribeiro for varicocele because with high orchidopexy and the consequent disappearance of venous stasis the true object of surgical treatment is completely attained. Orchidopexy is realized with ample exteriorization of the cord, which is freed from the vas deferens and describes a loop on the aponeurosis of the external oblique muscle, the latter being formed into a tunnel for the loop. This aponeurotic tunnel exerts a compression on the dilated veins which prevents stasis, in addition, it forms a kind of valvular system by intermittent compression and decompression resulting from efforts, orthostatic position, and ambulation. Isolation of the spermatic artery is unnecessary.

The operation is done preferably under local anesthesia. An incision is made as for inguinal hernia, it extends from the pubic spine to the inner side of the anterosuperior iliac spine. The cord is exteriorized down to the proximity of the testicle, the anterior aspect of the fibrosa and the cremaster is incised, and the vas deferens with its artery is isolated from the cord up to the external inguinal orifice. The fibrosa and cremaster are extirpated. The cord is applied to the aponeurosis of the external ob-

lique muscle in the form of a horseshoe with its opening facing downward and inward, and is fixed in place with six or eight No. 16 cotton sutures which pick up the aponeurosis on each side of the cord to form a tunnel for the latter. After verification of the height at which the testicle will be kept, the highest suture is inserted first. The sutures should not compress the cord as it should be able to slide freely inside of the tunnel. Orchidopexy is done after creation of the tunnel, but if desired the testicle may be fixed with a suture that catches the highest part of the vaginal tunic and the external pillar of the inguinal opening. The cellular tissue and Cooper's fascia are repaired with separate sutures of No. 40 cotton and the skin is closed.

After trying a number of procedures for the cure of varicocele, the author has limited himself to this method as it does not require dangerous ligations nor open the inguinal canal, but stops the reflux physiologically.

RICHARD KEMEL, M.D.

#### Epithelioma of the Scrotum ARCHIE L. DEAN, J. *Urol*, Balt., 1948, 60: 508

The author has recorded observations from the study of 27 patients with epithelioma of the scrotum. While the most common causative factor was prolonged exposure to petroleum and its products, other substances encountered in the various occupations, such as, tar, pitch, crude wool, and soot, demonstrated carcinogenic properties. Eight patients required scrotal cancers without exposure to industrial carcinogens.

In most cases a warty growth appeared on the most dependent portion of the scrotum after many years of exposure. In from 3 to 12 months it ulcerated and became painful.

The diagnosis may be suspected from a characteristic story, but it must be proved by microscopic examination. The great majority of the growths are squamous carcinomas of grade 2.

The only curative therapy for an epithelioma of the scrotum is wide surgical excision. Electrocoagulation and roentgen radiation have been found inadequate. When the scrotal tumor is removed a safety zone of normal tissue at least 1 cm. wide should surround the lesion on all sides. Sometimes the gubernaculum testis is infiltrated and one or both testes must be sacrificed.

Fungating primary tumors usually give rise to inguinal adenopathy but the enlarged groin nodes are not always cancerous. There is no evidence that removal of noncancerous regional nodes increases the chances of cure, and the operation is so often followed by considerable disability due to obstruction of the lymph channels that it should not be done unnecessarily. It seems characteristic of metastases from squamous cancers, whether of the scrotum, penis, or lip, that early spread involves single nodes and causes them to enlarge and harden considerably so that it is easy to make a diagnosis of the metastases relatively early. It appears, therefore, to recommend that the inguinal metastases should

be demonstrated by aspiration biopsy before groin dissections are performed.

In no case in the author's study, when dissection of the regional nodes was not performed until histologic proof of their cancerous involvement had been obtained, did metastases subsequently develop beyond the groins. As soon as metastases have been discovered, radical dissections should be performed.

That epithelioma of the scrotum is a serious disease is shown by the fact that of the 27 patients observed only 8 lived 5 or more years after treatment.

FREDERICK A. LLOYD, M.D.

#### The Treatment of Cancer of the Penis (Sul trattamento del cancro della verga) BRUNO BERTICIA *Radiol. med.*, Milano, 1948, 34: 540

Thirty cases of carcinoma of the penis observed at the Instituto del Radio of Bologna between 1930 and 1946 were reported by the author. Seven of the patients were treated by combined surgery and irradiation and 18 by irradiation alone. Five of the first group and 5 of the second group were living 5 years after treatment.

Since the percentage surviving in both groups 5 years after treatment coincided almost exactly with the percentage surviving 3 years after treatment, it was concluded that the 3 year interval may be accepted as a criterion of cure, and that carcinoma of the penis treated by surgery plus irradiation carries a grave but not a hopeless prognosis.

EDITH B. FARNSWORTH, M.D.

### MISCELLANEOUS

#### An Evaluation of Antiseptic Drugs and Antibiotics in the Treatment of Infections of the Urinary Tract. AUSTIN J. DODSON, *West Virginia M. J.* 1949, 45: 1

The author presents a brief review of the most important and interesting chemical and antibiotic preparations used to combat urinary tract infections.

Hexamethylenamine (methenamine, urotropin), although far less effective than the more recently developed urinary antiseptics, is still widely used. The bactericidal effect is dependent upon the elimination of formaldehyde in a strongly acid urine. A dose of 15 gr. three times a day was shown by Hinman to produce antiseptic bladder urine in 30 per cent of his cases. Twenty grains, four times a day, can usually be administered 4 or 5 days before there is evidence of irritation. Burning, with frequency of urination and the finding of red blood cells in the urine are indications for a rest period or a change to some other antiseptic.

Acridavine, screnium, pyridium, and hexylresorcinol have enjoyed brief popularity as urinary antiseptics. Hexylresorcinol and pyridium exert some analgesic effect upon the inflamed bladder mucosa; however, the bactericidal effect of the latter drug is not very impressive.

Mandelic acid is now universally recognized as a useful chemotherapeutic agent in the treatment of



urinary tract infections. Dodson continues to find mandelic acid useful in chronic infections of the urinary tract, and he uses it rather extensively, particularly in office practice. The drug is almost entirely free from toxic effects. Occasionally, after prolonged administration, a few hyaline casts and red cells may appear in the urine, but they promptly disappear when the drug is discontinued. Occasionally, the drug is nauseating and must be discontinued for that reason. It is not effective when renal function is poor or the urine cannot be kept acid in reaction.

No group of drugs has given greater promise as urinary antiseptics or has more nearly fulfilled that promise than the sulfonamides. Crystals of the drug precipitated in the renal tubules, and toxic manifestations are apt to occur when large doses of the drug are given and also when fluid intake is restricted. Therefore, high blood and urine concentration of the sulfonamides are not without danger. A free fluid intake and administration of alkalies are helpful in preventing renal complications. As these drugs are excreted principally through the kidney, it is necessary to have knowledge of the patient's renal function before their administration. Nausea, headaches, dizziness, and fever are the most frequent toxic manifestations. Skin rashes, episcleritis, and conjunctivitis occur more frequently with the use of sulfathiazole. Sulfadiazine and sulfacetamide are the most easily tolerated of the drugs.

While all sulfonamides are bactericidal to some extent for most bacteria, Alyea found that sulfathiazole was more bactericidal for staphylococci while sulfadiazine was of greatest use in the treatment of infection caused by pneumococci and Friedlander's bacilli.

Several investigators have found that sulfacetamide in the treatment of bacillary infections of the urinary tract deserves preference over the sulfonamides now in use. Lehr found that sulfacetamide compared favorably with other members of the group in bactericidal activity, that there was rapid renal elimination, therefore low tissue concentration in the presence of high urine levels, and the drug was highly soluble even in physiologic acid range of urine.

Sulfathalidine has been reported by Everett, Vosberg, and Davis to have produced excellent results in the treatment of *Escherichia coli* infections.

Sufficient time has not elapsed since the introduction of penicillin and streptomycin to adequately appraise their therapeutic usefulness in the treatment of infections of the urinary tract. Experience seems to indicate that both are more limited in their scope of usefulness than are the sulfonamides.

From the author's observation, neither penicillin nor streptomycin is to be advocated in the routine treatment of urinary tract infections. Infections with *Escherichia coli*, which represent approximately 60 per cent of those encountered in urinary tract infections, are cured as a rule with mandelic acid and sulfacetamide. Sulfadiazine and sulfathiazole are almost, if not quite, as effective against the gram positive cocci. These antibiotics have a definite ad-

vantage in acute infections, for these patients tolerate oral medication poorly. Fever and other toxic manifestations often subside rapidly following the administration of streptomycin or penicillin. These drugs (streptomycin and penicillin) are also useful as adjuncts to surgical treatment.

The treatment of infections of the urinary tract has been revolutionized by chemotherapy, for it is often possible to use specific drug therapy against specific organisms. The use of these preparations in complicated infections has been very helpful but cure is rarely obtained unless there is adequate renal function, free drainage, and absence of foreign bodies or devitalized tissue.

During the toxic period of acute infections alkalies may be counted upon to combat acidosis, lessen nausea and, at times, lessen bladder distress resulting from sensitiveness of the bladder mucosa to acid urine. A low urine acidity may have a deciding effect on the elimination of the infection for all organisms in the urinary tract except *Escherichia coli* and *Aerobacter aerogenes*. The acidity of the urine is a deciding factor in the bactericidal effect of mandelic acid and methenamine.

The most useful drugs for the acidification of urine are ammonium chloride, nitrohydrochloric acid and gluconic acid. Ammonium chloride should not be administered when the infection is caused by the urea splitting organisms. Patients with poor renal function should be closely observed when acidifying drugs are administered because of the danger of acidosis.

Laboratory facilities for the identification of bacteria and the determination of sensitivity to various germicides are not always available. It is possible, however, by careful observation, to judge fairly accurately the character of the predominating organism in most infections. It is well to remember that bacillary infections are more prevalent in the female than in the male, and that urine which is infected by the group of organisms found in the colon usually is acid, and that very cloudy urine which is persistently alkaline is apt to be infected with staphylococci or proteus bacilli. A stained smear of the centrifuged sediment is helpful in determining the type of infection that is present, and this can be an office procedure.

If the renal function is poor or the history and examination suggest the presence of calculi or obstructive disease, the value of chemotherapy alone may be disappointing. CONRAD A. KUEHN, M.D.

**Streptomycin in Urogenital Infections** JOHN K. LATTIMER, WILLIAM H. STEARNS, J. BURNS AMBERSON, JOSEPH SCHWARTZ, and Others. *J. Urol.*, Balt., 1948, 60: 974.

Twenty-five patients with urogenital infections were given daily intramuscular injections of 1.8 gm. of streptomycin (0.3 gm. every 4 hours) for a period of 120 days. Sixteen of these patients had been followed for a period of 1 year at the time of this report. Twenty-one of the 25 patients were found to have additional tuberculous lesions outside the genito-



# SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

## CONDITIONS OF THE BONES, JOINTS MUSCLES, TENDONS, ETC

**Osteoid Osteoma** BRADLEY L. COLEY and NORMAN  
IFENSON *Am J Surg*, 1949, 77 3

Brailsford, the distinguished British roentgenologist, regards osteoid osteoma as a low-grade cortical or subcortical bone infection, the authors, however, share Jaffe's opinion that the disease is a benign neoplastic lesion sui generis.

The lesion appears as a small, ovoid, radiolucent, sharply circumscribed tumor surrounded by bone sclerosis in a male child whose average age is 13 7 years. The site of predilection is predominantly in the lower extremities.

Differential diagnosis should include the following diseases: osteomyelitis of the chronic sclerosing type, Brodie's abscess, periostitis, osteogenic sarcoma, Ewing's sarcoma, and bone repair following a greenstick fracture. Great difficulty may be encountered in differentiating osteoma from Brodie's abscess, roentgenologically.

Studies of blood chemistry, serology, and bacteriology have yielded no significant abnormalities in osteoma.

The treatment is surgical removal en bloc of the entire nidus. X-ray irradiation has not been practiced by the authors in the 10 cases herein reported.

The article is accompanied by many excellent roentgenograms and one photomicrograph of the osteoid osteoma obtained from one of the cases.

SAMUEL L. GOVERNALE, M.D.

**Granuloma of the Bones** (Granulomes des os) L.  
TAVERNIER *Lyon chir*, 1949, 44 41

The author presents a few cases of eosinophile granuloma, a disease not well known in France. A 28 month old boy had a lesion in his femur. The roentgenogram did not resemble any that the author had seen before. Exploration revealed thickening of the periosteum and the lesion was filled with a soft red tissue which was easily curetted. The microscopic examination revealed a certain type of granulomatous tissue. Five months later the lesion was healed.

Another case was diagnosed as osteogenic sarcoma. This lesion responded very favorably to x-ray therapy and finally healed. The biopsy specimen of this lesion was diagnosed as a fibrous osteitis. The final study revealed an eosinophile granuloma with radiation changes.

The third case was that of a 9 year old boy who had a cystlike lesion in the intertrochanteric area. The biopsy material resembled lymphosarcoma. There were no Steinberg cells (Dorothy Reed cells). A pathological fracture occurred which did not heal. There was shortening of the extremity with loss of bone substance. Because of the complete lack of

callus, bone grafting of the fracture site was done. Healing occurred and left a shortening of 2 cm.

The author then discusses the differential diagnosis of this unusual condition and mentions granuloma mycosis, fetal splenohepatic disease, Letterer-Siwe disease, and Hand-Schuller-Christian disease. He opposes the idea that Hand-Schuller-Christian disease and eosinophile granuloma are the same disease because in the former the patient usually dies while in the latter the condition usually heals.

GEORGE I. REISS, M.D.

**Causation and Treatment of Painful Stiff Shoulder**  
Subdeltoid Bursitis, Periarthritis, Tendinitis,  
and Adhesive Capsulitis HENRY W. MYERDINE  
and JOHN C. IVINS *Arch Surg*, 1948, 56 693

The clinical observations in 150 consecutive cases of stiff painful shoulder, in which manipulation under anesthesia, surgical excision of calcified plaques or bursas, injection or needling was performed at the Mayo Clinic during the years 1942 through 1946, form the basis for this study. Detailed reports of 9 cases are included in this article to illustrate certain points of diagnosis and treatment. It should be pointed out that statistics vary according to the type of practice. The majority of patients with painful stiff shoulders seen by the general practitioner are acutely disabled from some undue strain or exposure, whereas the orthopedic surgeon in his consulting practice usually sees patients who have a chronic condition attended by more or less atrophy of disuse. The condition in the authors' cases was essentially of the latter type.

In this study, 52 of 150 patients (35 per cent) were male and 98 (65 per cent) were female. The duration of symptoms varied from 7 days to 12 years, 65 per cent of the patients had trouble for less than 1 year and 54 per cent had trouble for less than 6 months. There was a definite history of trauma in 36 of the cases (24 per cent), and in 6 cases (4 per cent) there was a history of antecedent systemic infection. In the remaining 108 cases (72 per cent), in which the onset apparently was gradual and the course was intermittent, the causative factor was not ascertained. In this series of cases the urinalysis gave negative results, the results of flocculation tests for syphilis were negative in all cases, the sedimentation rate was rarely elevated, and the concentration of hemoglobin and the leucocyte counts were within normal limits in all cases. Roentgenographic examination revealed calcification in 59 cases (39 per cent), osteoporosis in 34 cases (23 per cent), and nothing abnormal in 57 (38 per cent). Since the evidence of calcification depends on the degree of deposit, calcification doubtless was present in more cases than mentioned. Because a certain percentage of patients do not show evidence of calcification at the time of examination although it may have been

present at a previous time. We have seen patients in whom calcification appeared and disappeared with or without treatment. In other words, the calcification may disappear spontaneously.

Pain, stiffness, and local tenderness were the characteristic symptoms, and they often followed some heavy undue exertion, such as gardening, painting, and washing walls. The pain was usually intermittent, aggravated by movement, and often worse at night. It was occasionally so severe that opiates were required for relief. At times it was referred down the arm and into the hand, so that neuralgia was the principal presenting complaint. Commonly the pain extended upward into the side of the neck. The stiffness was principally a limitation of abduction and rotation, to a variable degree. The frozen shoulder was held in the sling position and permitted no motion except some apparent forward flexion and backward extension as a result of movement of the shoulder girdle. Nineteen per cent of the patients gave a history of bilateral involvement or the subsequent development of a similar condition of the second shoulder.

In all cases of painful stiff shoulder a detailed history of the illness should be obtained. The next essential procedure is a complete physical examination. A roentgenographic examination of the shoulder should always be made to rule out arthritis, fracture, or the presence of organic bone disease, such as infection or primary or metastatic tumor, and to give evidence of the degree of osteoporosis or tendinous calcification present. In many cases there is decided osteoporosis, especially of the greater tuberosity and the anatomic neck of the humerus.

Tuberculosis of the shoulder joint may be confused with a frozen shoulder in the early stage of the disease because both pain and stiffness are present, but as the tuberculosis progresses the destructive changes indicate its true nature. The persistent temperature, gradual onset, progressive severity of symptoms, atrophy, and frequent presence of a primary tuberculous focus should make the physician suspect tuberculous arthritis of the shoulder. It is difficult to produce ankylosis, and it seldom takes place in tuberculosis, surgical operation, with prolonged fixation, is necessary. In cases of frozen shoulder, stiffness may develop within a few days of the onset of pain, in spite of treatment for relief of pain, but true bony ankylosis is rare. Adhesions can be broken by manipulation and a satisfactory functional result obtained, but in tuberculosis, once the destructive changes have occurred, action of the joint is permanently lost. The roentgenographic examination is of value in the diagnosis. With the exception of bony atrophy and regions of calcification described in frozen shoulder, the joint appears to be normal. In tuberculosis of the joint, however, roentgenograms reveal atrophy and later destructive arthritis with areas of absorption in the head of the humerus. Aspiration or excision of tissue for microscopic study may be needed to clarify the diagnosis as a final measure in perplexing cases.

Tuberculous bursitis produces a bulging soft mass which may contain palpable rice bodies. Such bursas usually are anterior to the shoulder. Careful dissection and complete excision will cure many of these tuberculous lesions, and the results will be improved by the administration of streptomycin.

Acromioclavicular separation follows severe injury and may be differentiated from frozen shoulder by the looseness of the joint on palpation. In complete separation a diagnosis may be made by mere inspection and demonstration of false motion, the roentgenograms will reveal wide separation of the articular surfaces, and a definite sulcus or depression also can be seen. In the acute stage of acromioclavicular arthritis local tenderness and swelling are present, in the chronic stage destructive or hypertrophic changes usually are revealed in the roentgenograms.

In cases of fractures of the glenoid cavity there is a history of trauma, and the roentgenograms should reveal an area of separation.

Fractures of the greater tuberosity of the humerus, with or without dislocation, may be recognized on palpation and by roentgenographic study.

Ruptured supraspinatus tendons do not cause fixed or frozen shoulders, nor is the pain on movement as severe as in the presence of frozen shoulder. The patients have ability to move the shoulder, but abduction causes pain and the patient may not be able to bring the arm up beyond a right angle.

Infection of the shoulder joint or osteomyelitis involving it should offer little difficulty in diagnosis, since it is accompanied with temperature locally and generally, an increased leucocyte count, and is roentgenographically visible.

Tumors do not cause symptoms of pain and stiffness unless they are of great size, and then clinical and roentgenographic evidence will reveal changes in the bone.

The patient with the acute stage of the disease or with intense pain, local tenderness, slight fever, and who keeps his arm at the side for protection may be treated for a few days at home by rest in bed, local application of heat, increased intake of fluid, and maintenance of elimination and traction, together with the administration of adequate anodynes. Abduction should be encouraged, and conventional diathermy and roentgen therapy may be used, after which patients who have painful stiff shoulders often are relieved of their symptoms. When the patient is seen with the disease in the subacute recurring stage, after much of the pain has subsided, and residual soreness and stiffness aggravated by movement persist, further examination should then be made to exclude calcification, traumatic lesion, or tumor. Conventional diathermy, radiant heat, stretching, and active and assistive exercises should be carried out routinely. If there is difficulty in obtaining abduction, traction may be employed or manipulation followed by abduction treatment in a splint or cast. In cases in which definite swelling of the bursa occurs as a result of

is probably due to a common etiological factor, possibly avascular necrosis. Coxa vara associated with multiple congenital deformities is not the same lesion as that with which the article is concerned. Subtrochanteric osteotomy at about 6 to 8 years of age with wide abduction of the distal part of the limb is the treatment of choice.

**Tuberculosis of the Greater Trochanter and Trochanteric Bursae** ALBERT AHLBERG *Acta chirurgica*, 1948, 97 201

During the period from 1928 to the middle of 1947, 127 patients (83 men and 44 women) with tuberculous bursitis or osteitis in the trochanteric region were treated by the author. These constituted 13 per cent of the cases of bone and joint tuberculosis treated during the corresponding period. Of these, 14 patients had had a tuberculous infection in another part of the body before the process in the trochanter developed, 44 had other tuberculous foci concurrently with the trochanteric process, and 20 patients developed tuberculosis in some other part at a later date, in 14 of the last-mentioned cases (11.02 per cent) the later process consisted in involvement of the hip joint of the same side. In 87 cases extirpation of the bursa and excision of the diseased bone in the trochanter was carried out. Sixty-one men and 35 women were discharged as cured after their first period in the hospital. Seventeen men and 5 women had small sinuses in the process of healing. Ten men and 3 women had small sinuses in the process of healing. Ten men and 3 women who had only trochanteritis with running sinuses died, 1 of the men dying of amyloidosis.

A follow-up examination of the patients who had been discharged more than a year previously revealed that 71 patients were cured and 6 had small sinuses almost completely healed. Eight men and 3 women who had been discharged less than a year previously were cured, and 2 other men had small sinuses. Two female patients who were cured and 4 men and 2 women with small sinuses were still in the hospital.

The x-ray films show, in addition to decalcification, either a subcortical focus or caries with small defects in the cortical outline. Sequestrumlike calcareous shadows in the soft tissue are often seen outside of the greater trochanter. According to Stracker, the tendons have loosened from their insertion on the greater trochanter because of the tuberculous process in the bone, with the result that a small necrotic bone fragment together with a small piece of the necrosed tendon works loose.

Most of the patients with bursitis or trochanteritis were extremely troublesome to treat. In instances in which there were other tuberculous foci in the pelvis or the lower part of the spine, and an abscess had penetrated downward causing secondary infection of the trochanteric bursa, particular difficulty in treatment was encountered.

Whenever there is an affection in the region of the greater trochanter, tuberculosis should be imme-

diately suspected and examinations at once undertaken so that a radical operation may be carried out without delay if this condition is found. The course of the disease would then probably be shortened, since the process would not have time to spread to such an extent as to cause difficulties in treatment.

C. FRED GOERINGER, M.D.

**Ischaemic Necrosis of Anterior Tibial Muscles** J. ROWLAND HUGHES *J. Bone Surg.*, 1948, 30-B 581

Ischemic necrosis of the lower limb muscles is well recognized as a complication of injury and recorded cases show that, as in the upper extremity, isolated muscles or muscle groups may be affected. Traumatic ischemic necrosis of the anterior tibial group of muscles may thus occur, but it is less widely appreciated that such necrosis may also arise when there has been no injury at all.

The author reports 3 cases of ischemic necrosis of the anterior tibial muscles which were not due to injury. In 2 of these, ischemia was the result of strenuous or unaccustomed exercise in young males, in the third case it was an incident in a systemic disturbance. In all 3 cases the condition probably was the result of spasm of a large segment of the anterior tibial artery.

During the first few hours the clinical features resemble those of tenosynovitis of the tibialis anterior, and after 12 to 24 hours, those of cellulitis of the leg. Later there is "drop foot" due to muscle weakness, contracture limiting plantar-flexion movement, and woody hardness of the muscles in the middle third.

The morbid histology is similar to that of Volkmann's ischemic contracture.

The possible explanations—primary arterial disease, arterial occlusion by pressure of the interosseous membrane, occlusion by tension with the fascial space, intraluminal occlusion by embolism or thrombosis, and fatigue arterial spasm—are discussed. It is concluded that the most likely cause of the necrosis is spasm of the anterior tibial artery due to muscle fatigue, aggravated by increased tension within the anterior fascial compartment due to reaction after strenuous exercise.

The object of treatment should be to relieve arterial spasm before necrosis supervenes. Early injection of eupaverine might be helpful. Assuming that the patient is seen within the first 12 hours, exploration appears to be warranted.

The operative approach should be between the muscles rather than through them. Care must be taken to avoid damage to intramuscular branches. The fascia cruris should not be repaired. If there is arterial spasm the appropriate treatment should be employed, but arteriotomy should be limited to resection of a very small segment, the part of the anterior tibial muscle which will be deprived permanently of its blood supply is directly proportionate to the length of arterial segment excised. The danger of exploring muscles after necrosis has supervened cannot be over-emphasized.

Whatever treatment may be undertaken during the first 24 hours, the limb should be supported with the ankle in the midposition and free from constriction. This position should be maintained until the acute inflammatory reaction has subsided and until there is no longer any tendency to further contracture. Subsequently a toe-elevating spring should be worn for the first few months of weight-bearing. Surviving muscle fibers should be redeveloped by graduated exercise.

Although not previously recognized, evidence is shown that regeneration of necrotic muscle is possible in the human being.

RUDOLPH S. REICH, M.D.

**Rupture of the Achilles Tendon** (*Ruptura del tendón de aquiles*) ENRIQUE MALLO *Sem. méd.*, B. Air., 1948, 55 Supp. 2863

Rupture of the Achilles tendon may be complete or incomplete, transverse or oblique. The tendon may be pulled away from the calcaneus or part of the bone fractured and attached to the disrupted tendon. The treatment depends upon the conditions presented. Immobilization without surgery is not satisfactory in most instances. Prolonged immobilization after surgery is equally as bad.

The author believes that after from 10 to 14 days, active motion should be permitted, particularly in the patients in whom his operative procedure has been done. This consists in sectioning of the long plantar muscle and reflection of an outer leaf of the Achilles tendon. The muscle is attached diagonally across the Achilles tendon and anchored to its lateral border, after which the dissected leaves are replaced to enclose the plantar muscle.

The results have been most gratifying from the viewpoints of early ambulation, utility, and strength of the tendon.

STEPHEN A. ZIEMAN, M.D.

## SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC

**Arthrodesis of the Wrist Joint by the Technique of Smith Petersen** (*Artrodesis de la muñeca según la técnica de Smith Petersen*) OSCAR R. MARÓTTOLI *Rev. ortop. traumat.*, B. Air., 1948, 18, 20

The technique of Smith Petersen was used in 2 cases of spastic pronation and flexion paralysis of the arm. One case was that of a 16 year old girl with a birth injury to the plexus at the shoulder. The deformity was that of flexion contracture of the hand resulting from paralysis of the extensor muscles. The second case was that of a 15 year old boy with infantile spastic paralysis of the hand in flexion. In this case the pronator syndrome could not be modified by any form of training.

In the young girl an excellent functional and esthetic result was evident a year after operation. The prehensile movements of the fingers showed a fine degree of extension and flexion, and pronation and supination of the hand were complete. In the boy, 6 months after the operation, the hand could be

closed to a fist with excellent force and the hand could be supinated to 90 degrees. In this case it was impossible to predict what other procedures would be necessary to obtain satisfactory results because this type is a complex paralytic residua.

The technique of the operation consists in a bayonet incision beginning about 6 cm. above the ulnar styloid and extending on the lateral border of the ulnar shaft to and across the wrist and then parallel to the metacarpal bone for about 3 cm. An osteotomy of the ulna is then done at a point 3 or 4 cm. above the ulnar styloid and the distal portion of this bone is excised to leave the lateral surface of the radius exposed. The articular cartilaginous surfaces of the radius and the first row of carpal bones is then removed. Toward the dorsal surfaces of these bones two holes are bored to receive the bone implant cut from the excised portion of the ulna. The remaining chips and spicules of the ulnar implant are then inserted into the remaining radiocarpal space and the tissues are closed in layers.

With completion of the operation the hand is put up in plaster in a position of moderate extension at the wrist and in exaggerated supination. After 3 months in the cast, it is removed and re-education is initiated.

JOHN W. BRENNAN, M.D.

**Approach to and Exposure of the Hip Joint for Mold Arthroplasty** M. N. SMITH PETERSEN *J. Bone Surg.*, 1949, 31-A, 40

A joint has two surfaces which must be so shaped as to permit function without interference or impingement through the greatest possible arc. Consequently, in the case of the hip joint, it is necessary to expose the acetabulum and its adjacent structures, as well as the femoral head and neck. In the past the various approaches to the hip joint have failed to expose the acetabulum properly, and the surgeon's efforts have been directed mainly at partial reconstruction of the femoral head. Reconstruction of the acetabulum demands intrapelvic exposure of this side of the joint. The approach to such an exposure necessitates extensive dissection. Since this can be carried out along structural planes, it is not destructive.

The exposure described is an extension of the hip joint approach previously described by the author. The refinement is essentially exposure of both the medial and lateral sides of the anterior third of the ilium and the anterior acetabulum, plus osteotomy of the anterior inferior iliac spine and the anterior acetabular wall. Utilization of this approach facilitates dislocation of the hip as well as reconstruction of the acetabulum.

The purpose of the operation is to create a joint with approximately normal mechanics. This supplies the clue to fitting of the mold. Normally, joint surfaces glide over one another with a minimum amount of friction; consequently, the mold must be loosely fitted so as to allow the greatest possible range of motion between it and the adjacent, reshaped surfaces of the femoral head and acetabulum.



Fig 1 (Nicola) Shoulder reduced by traction and adduction with fist high in the axilla

The author recommends testing the range of motion before wound closure which enables him to determine the optimum postoperative position and the proper exercises to be used later. His experiences lead him to conclude that diathermy cauterization of the edges of the new acetabulum diminishes the tendency of bone proliferation and spurring. Closure of the wound is made along fascial planes with normal tendinous relationships. Nine excellent drawings elucidate the technical details.

KENATH H. SPONSEL, M.D.

### FRACTURES AND DISLOCATIONS

**Acute Anterior Dislocation of the Shoulder** TOUFICK NICOLA *J Bone Surg*, 1949, 31-A 153

The author has, in the past 6 years, operated upon 22 acute dislocations of the shoulder and found that the location and extent of the injury vary with the mechanism producing it. The observations include 5 cases previously reported, making a total of 27 cases. In most of the cases studied, the capsule and labrum had been torn from their attachment to the periosteum of the scapular neck. When hyperabduction produces the injury, the capsule and more or less of the subscapularis are torn from the humerus. Two such cases were reduced only after the torn flap had been lifted from the glenoid cavity where it had been sucked.

Downward traction and adduction with the fist high in the patient's axilla is the most satisfactory and least traumatic means of reducing the dislocation as observed in this series of cases. Five of these patients suffered redislocation probably from too

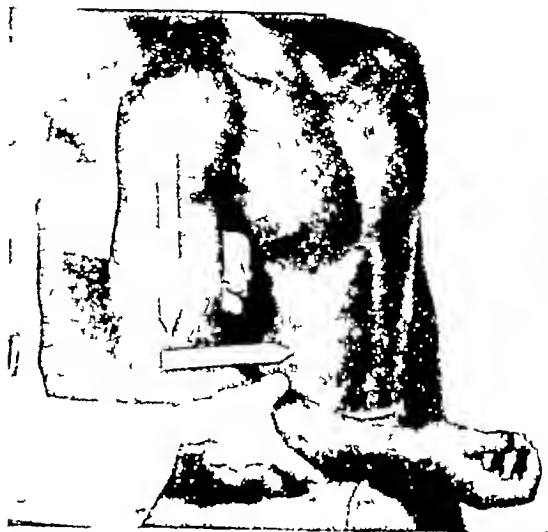


Fig 2 (Nicola) Apparatus which prevents redislocation by restricting abduction and external rotation

early vigorous use of the shoulder before capsule reattachment was secure. Tunneling the long head of the biceps and the coracohumeral ligament through the humerus gave permanent relief.

Restraint of external rotation and abduction for 8 weeks gives optimum results. The apparatus shown by the author accomplished this well.

FRANCES E. BRENNER, M.D.

**The Treatment of Recent Dislocations and Fracture Dislocations of the Shoulder** HENRY MILCH *J Bone Surg*, 1949, 31-A 173

In the light of present knowledge, the treatment of acute dislocation of the shoulder by the Kocher manipulation, as described in 1870, proves not only unphysiological but risks fracture of the shaft. When the humerus hangs alongside of the trunk, the muscles about the shoulder girdle pull in various directions with the principal resultant in a medial direction. If the tensile strength of the bone is less than the combined medial muscle pull, Kocher's maneuver results in an oblique fracture between the tuberosities.

When the arm is fully abducted to the overhead position, all the shoulder girdle muscles run in the line of the humeral shaft. Muscle antagonism is then overcome by the same line of pull needed to reduce the dislocation.

The technique of reduction based on this position is simple. With the patient supine, the dislocated humeral head is firmly fixed by the surgeon's hand and the arm is gently brought to the overhead position when the head can be gently pushed over the glenoid rim. This can be accomplished so gently that anesthesia is rarely needed, and injury to the vessels or nerves has not been encountered in 10 years' use of this measure.

Prereduction check for nerve involvement is as essential as roentgenograms to rule out fracture of the glenoid or the greater tuberosity. In the presence of fracture, this same maneuver safely effects reduction and alignment of the fracture. It was described by Sir Robert Jones for this purpose.

In simple dislocations, a "check rein" to prevent abduction and external rotation is the optimum dressing. When fracture is present, motion must be restricted by a hanging plaster, Velpeau bandage, abduction splint, or traction until consolidation occurs.

FRANCES E. BRENNER, M.D.

#### Open Reduction and Internal Fixation of Fractures of the Long Bones

HARRISON L. McLAUGHLIN, SAWNIE R. GASTON, CHARLES S. NEER, and FRED ERICK S. CRAIG. *J. Bone Surg.*, 1949, 31-A: 94.

This article deals with 200 consecutive shaft fractures of the tibia and femur treated by open reduction and internal fixation. Sixty-five patients were operated upon in spite of the fact that the same result might have been anticipated from the use of other methods of treatment; 57 were operated upon because no other type of treatment was suitable; 78 patients presented compound fractures.

The percentage of patients immobilized after operation, the percentage of physiological function maintained, and the percentage of cases in each category in which there was protected early weight bearing are given in table form in the original article. The table covers 179 consecutive shaft fractures. Immobilization was not used after operation when it was not indicated. There were 7 cases of nonunion in the tibia, and 1 case of loss of fixation in the femur. Among 179 shaft fractures there were 15 extremities which were short, the greatest amount being 3 cm., and there were 5 cases of visible angulation. Among the 179 shaft fractures there were 12 cases of fractures of the tibia in which there was limitation of the adjacent joint, and there were 17 cases of fracture of the femur in which there was limitation of the adjacent joint. Among the 179 shaft fractures, 131 cases were asymptomatic.

Among 121 cases of fractures of the tibia, the average time of economic recovery with full normal activity was 5.7 months. In 58 cases of fracture of the femur, the average time of economic recovery was 6.5 months. It was thought that the good results depended more upon the way the materials for internal fixation were used than upon their composition.

RICHARD J. BENNETT, JR., M.D.

#### The Treatment of Complicated Inflammatory Processes of the Elbow Articulation (Zur Behandlung schwieriger Ellbogengelenkentzündungen)

HEINRICH WESTHUES. *Chirurg*, 1948, 19: 545.

Metal plates and a so-called wire extensor allow the application of tension to wire within and outside of a cast for inflammatory processes of the elbow, and also the immobilization of the wire without the use of metal extension arches. This method is useful particularly when the time element is of importance and

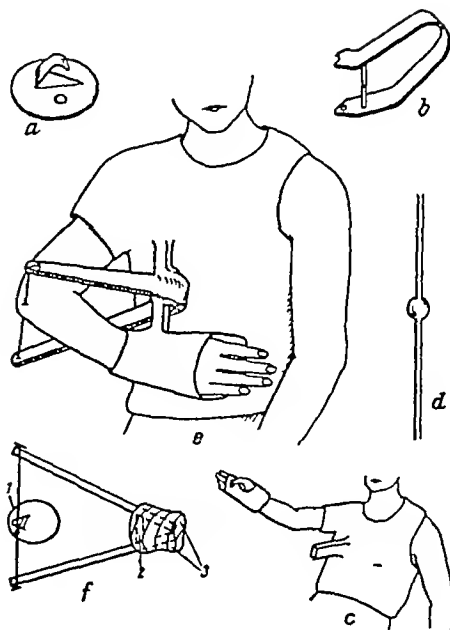


Fig. 1 (Westhues) a, Metal plate, b, wire extensor, c, the main part of the cast with the arm support, d, beaded wire, e, complete dressing, f, transverse section through the supporting apparatus, f', section through the arm, f'', section through the support, f''', cast.

the working conditions are primitive, for instance, in advanced positions on the battlefield.

Both shoulders should be included in the body cast, into which a wooden plank, 2 cm. thick, 5 cm. wide, and from 20 to 25 cm. long, is incorporated. After the application of the body cast, plaster of paris is applied to the forearm and the hand. On the dorsal side this cast reaches the proximal phalanges of the fingers, but on the volar side it extends to the middle phalanges to prevent premature movements of the fingers and also flexion contractures. A stab wound is made and a beaded wire is carried through the olecranon so that the bead is in contact with the bone. The cast surrounding the hand is attached with plaster of paris to the support protruding from the body cast. Two wooden planks, 1.5 cm. thick, 35 cm. long, and 4 cm. wide on one end and 2 cm. wide on the perforated end, are applied so that the narrow ends are slipped over the ends of the wire, while the wide extremities are attached to the support with plaster of paris.

After the cast is hardened, tension is applied to the extension wire by means of the wire extensor. The two metal plates immobilize the wire.

The apparatus provides immobilization of the injured elbow without interfering with the accessibility of the articulation. The arm needs no support and therefore one person is able to change the dressing. Further operations can be performed if necessary, without removal of the apparatus.

The apparatus is recommended by the author for grave injuries of the elbow accompanied by severe trauma of the soft tissues, because the frequently resulting phlegmon is easily accessible. However, the apparatus should not be used if the bones in the region of the articulation are completely destroyed.

JOSEPH K. NARAT, M.D.

**The Treatment of Fractures of the Metacarpals**  
(Tratamiento de las fracturas de los metacarpiños)  
SILVANO MONDOLFO and VICENTE A. MOLINA *Rev orlop traumat*, B. Air, 1948, 18: 32

The material on which this report is based consists of 157 cases of simple, or closed, fractures and 20 cases of open, or complicated, fractures.

Of the simple fractures, 32 involved the second metacarpal, 21 the third, 21 the fourth, and 64 the fifth. In 19 instances the breaks were multiple. There were 31 fractures of the base of the metacarpal, 69 of the shaft, and 51 of the distal end (head, or subcapital fractures of Roemer).

In 140 of the closed fractures the displacement was slight, and these were treated by manual reduction and immobilization in plaster. In the base involvements, the cast included the first phalanx of the corresponding finger. Results are evaluated on the basis of 98 of these patients who could be followed up and in whom the late results could be observed. In these 98 cases there were 50 optimal, 27 good, 12 mediocre, and 9 poor anatomical results, and 61 optimal, 31 good, 3 mediocre, and 3 poor functional results. Thus, the functional results were better, on the whole, than was promised by the anatomical conditions after healing. In the basal and diaphyseal involvements the functional and anatomical results accorded rather well, however, in fractures of the head of the metacarpal the functional results were so much better than the anatomical results that there was a sharp contrast to those in the other two fracture locations. The better functional results in fractures of the head are tentatively explained on the basis of the more rapid consolidation of the subcapital fractures, the basal lesions required, on the average, 37 days for consolidation, those of the shaft 31 days, and those of the head 26 days.

In the more marked types of displacement which consisted, as a rule, in angulation toward the palm, and which were more frequent in the oblique type of fractures of the shaft, other types of treatment were at times attempted. In 11 instances traction was tried by means of a thread passed through the pulp of the fingers, this form of traction was painful, at times produced trophic disturbances of the finger pulp tissues, and was not very effective. Skeletal traction by Kirschner wire through the basal phalangeal bone tended to correct the over-riding of the fragments but failed to correct the lateral displacements. The results with regard to the residual stiff finger were unsatisfactory, despite the fact that the wire used was only one-third of a millimeter in diameter. Four cases were treated surgically. One patient with a subcapital fracture of the fifth meta-

carpus was osteotomized with immobilization in a plaster cast, the result was poor. A second patient with fracture of the second and fourth metacarpals who was treated by excision of the proximal fragment had a poor result. A third patient with subcapital fractures of the second, third, and fourth metacarpals who was treated by the osteosynthesis of Lambotte had a poor result. The fourth patient with comminuted fracture of the head of the second metacarpal was treated by resection of the head of the bone and had a poor functional result. In these more severe displacements of the closed fracture of the metacarpals the best treatment would seem to be the best possible correction by the method of Jahss (traction and manipulation by grasping the basal phalanx), with a modeled cast fitting closely to the dorsal surface of the fractured bone.

In the various types of open fracture, results from the functional standpoint were, on the whole, not good. In 1 of the 20 cases of open fracture an amputation of the finger was performed. In 4 cases infectious complications developed, requiring in 2 instances the amputation of the hand, and in 1 case the amputation of the finger. In the fourth case osteomyelitis developed and the condition healed with a pseudarthrosis. Finally, in 1 patient gangrene of 3 fingers developed which required their amputation. Of the remaining 14 patients with open fracture, 9 were treated by manual reduction with plaster immobilization, 3 by open reduction and plaster, and 2 by skeletal traction. Neither the anatomical nor functional results were satisfactory following any of these methods of treatment. The results in the healing of the soft tissues in these open fractures have improved with the advent of the newer drugs for combating infection, without, however, bringing any apparent improvement in the functional results.

The authors agree with Waugh and Ferrassano, that fracture of the metacarpal bones is a serious lesion and one requiring more attention than has previously been allotted to it.

JOHN W. BRENNAN, M.D.

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A study of the anatomy and fracture sites in the majority of pregnant patients suggests that the shearing stress occurs along the line between the origin of the external oblique muscle (from the lower four ribs) and the costal slips of the latissimus dorsi. This, however, ignores the long back muscles, the sacrospinalis. In the pregnancy stance the head and shoulders are thrown back, compensatory to this is a lordosis involving increased postural tone, and perhaps hypertrophy of the iliocostalis and longissimus portions of the sacrospinalis. Inco-ordination or action of more than normal violence might occur in this muscle in such circumstances. Thus forcible expiration, as in coughing with depression of the lower ribs by the iliocostalis, could provide con-



ditions for a shearing stress sufficient to fracture a rib. Another possible mechanism is that the uterine mass is driven backward and upward against the inner surface of the lower chest in coughing by contraction of the anterior abdominal muscles. If bone fragility can be excluded the remarkable incidence of fracture of the lower ribs, consistently on the left side in late pregnancy, could be due to a mechanical cause peculiar to the abdominal mass or compensatory lordosis.

Another possible etiological factor is the likelihood of fracture when the serratus is taut at the time of coughing, as it may be when the arm is raised or when the patient is resting on one elbow.

The treatment advocated is adequate strapping of the chest, which gives these patients considerable relief.

There are relatively few cases of this condition reported in the literature. From a study of these cases and the 4 patients in their own series the authors noted the following common findings: (1) cough fractures occur late in pregnancy, (2) they tend to be on the left side, (3) the lower ribs are chiefly involved, and (4) multiple fractures are the exception.

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Experience gained from the treatment of 46 patients with suppurative processes in the hip joint following injuries by firearms led the authors to the following conclusions:

There are three methods of treatment of such conditions: (1) partial resection of the femoral head, (2) total resection of the head which may be supplemented by resection of the neck or a portion of the shaft of the femur, and (3) exarticulation.

The first method furnished in 23 cases an excellent exposure of the articulation and ideal drainage at the deepest point. An oblique incision is made through the gluteus maximus muscle and the upper margin of the quadratus femoris. The leg is kept in a position of internal rotation and flexion. A part of the femoral head is resected from its lower, posterior portion. The adjoining rim of the acetabulum may also be removed. As the body cast interferes with early

detection of a phlegmon, the leg is placed, after the operation, on a metal splint in a position of abduction and external rotation, and slight extension is applied to it. After the fever subsides, usually after 4 or 5 weeks, a body cast is applied for approximately 5 months. Occasionally a wire extension may be employed. Of the 23 patients treated by this method 4 succumbed to septicemia.

The most popular method, namely, total resection of the femoral head, was employed in 14 patients. The author uses it only when the head or the neck is completely destroyed. He employs the same approach as that used for a partial resection because it creates better conditions for drainage than the anterior route. The latter is recommended only when the port of entry lies anteriorly. It should be supplemented by a posterior incision to allow the introduction of a drain through the entire thickness of the hip. The leg is placed in a metal splint and extension is applied. After from 4 to 6 weeks, when the fever subsides, the free femoral end is placed in the acetabulum and a fenestrated body cast is applied for approximately 7 months. Of the 14 patients operated upon in this manner, 5 died from septicemia.

In 9 cases an exarticulation could not be avoided. Four patients died. JOSEPH K. NARAT, M.D.

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The authors differentiate between true dislocations and subluxations.

Dislocations are characterized by the interposition of soft parts between the femoral head and the acetabulum. Closed reduction, as a rule, is almost impossible and necessitates an operation in most instances.

Subluxations are characterized by the absence of interposing soft tissue. The femoral head is usually larger which makes it impossible for it to articulate properly with the acetabulum. In these cases closed reduction is possible and the results, as a rule, are excellent. Open reduction is very satisfactory in young infants, and the only complication of any consequence is epiphysitis of the femoral head which results in change of the shape of the femoral head. This complication was found in 24 per cent of the cases.

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#### Roentgenographic Changes in Nailed Slipped Capital Femoral Epiphysis ARMIN KLEIN, ROBERT J. JOPLIN, JOHN A. REIDY, and JOSEPH HANELIN *J. Bone Surg.*, 1949, 31-A: 1

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The apparatus is recommended by the author for grave injuries of the elbow accompanied by severe trauma of the soft tissues, because the frequently resulting phlegmon is easily accessible. However, the apparatus should not be used if the bones in the region of the articulation are completely destroyed.

JOSEPH K. NARAT, M D

**The Treatment of Fractures of the Metacarpals**  
(Tratamiento de las fracturas de los metacarpiños)  
SILVANO MONDOLFO and VICENTE A MOLINA *Rev  
ortop traumat*, B Air, 1948, 18 32

The material on which this report is based consists of 157 cases of simple, or closed, fractures and 20 cases of open, or complicated, fractures.

Of the simple fractures, 32 involved the second metacarpal, 21 the third, 21 the fourth, and 64 the fifth. In 19 instances the breaks were multiple. There were 31 fractures of the base of the metacarpal, 69 of the shaft, and 51 of the distal end (head, or subcapital fractures of Roemer).

In 140 of the closed fractures the displacement was slight, and these were treated by manual reduction and immobilization in plaster. In the base involvements, the cast included the first phalanx of the corresponding finger. Results are evaluated on the basis of 98 of these patients who could be followed up and in whom the late results could be observed. In these 98 cases there were 50 optimal, 27 good, 12 mediocre, and 9 poor anatomical results, and 61 optimal, 31 good, 3 mediocre, and 3 poor functional results. Thus, the functional results were better, on the whole, than was promised by the anatomical conditions after healing. In the basal and diaphyseal involvements the functional and anatomical results accorded rather well, however, in fractures of the head of the metacarpal the functional results were so much better than the anatomical results that there was a sharp contrast to those in the other two fracture locations. The better functional results in fractures of the head are tentatively explained on the basis of the more rapid consolidation of the subcapital fractures, the basal lesions required, on the average, 37 days for consolidation, those of the shaft 31 days, and those of the head 26 days.

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than 1 cm. After an average follow-up period of 32 months, the average index of motion was 90 per cent of normal, and the average percentage of normal hip function was 96.

Early mobilization and active weight bearing on crutches within 2 or 3 weeks after operation promote preservation of the physiological function of the hip. In this series of cases, in which nailing was done *in situ*, traumatic arthritis or aseptic necrosis of the femoral head has not occurred.

Sixteen patients were reported with marked slipping (more than 1 cm). They were treated by arthrotomy, osteotomy through the epiphyseal plate, replacement of the head to its anatomical position in relation to the neck, and lateral nailing for fixation. After an average follow-up period of 33 months, the average index of motion was 85 per cent of normal, the average percentage of normal hip function, 92.

To obtain early motion, active weight bearing on crutches is permitted within 2 or 3 weeks after operation. Two additional basic requirements are necessary to obtain the results shown: (1) sufficient exposure should be obtained to permit replacement of the head, and (2) the hip joint should be entered through an incision across the capsule over the anterior portion of the epiphyseal plate. This spares the ligamentum teres and the posterior, superior, and inferior portions of the visceral capsule. The osteotomy is performed through the epiphyseal plate, which is avascular, no part of the neck being sacrificed. These details minimize the possibility of damage to the circulation of the head. Thus, the head is replaced to its normal position, its margins draped anteriorly and laterally beyond the neck, with a minimal amount of damage to the epiphyseal circulation. Two incidents of traumatic arthritis were encountered in the follow-up. Faulty performance of the operations was contributory.

The authors have noted roentgenographic evidence of fusion of the epiphysis within 4 to 8 months after nailing in the open reduction cases and within 6 to 18 months in the cases nailed *in situ*. In the latter group, the nailed epiphysis fused 8 to 21 months sooner than the epiphysis on the uninvolved side. With open reduction, the nailed epiphysis fused 5 to 35 months before the epiphysis on the uninvolved side. The nail should extend well into the head. In 4 cases nailed *in situ*, growth continued beyond the end of the nail. In 2 cases with slipping of more than 1 cm, nailing *in situ* was performed. By the authors' present criteria, these cases would have open reduction to correct the deformity.

Excellent roentgenographic reproductions are included to illustrate the results. These include the prevention of further slipping, acceleration of fusion of the epiphysis, and preservation of a relatively normal anatomy of the hip. Treatment of the slipping while it is minimal permits a simpler operative procedure with an excellent prognosis. It obviates further slipping, eliminates more extensive surgery, and leads to more normal hips.

KENETH H. SPONSEL, M.D.

#### Treatment of the Necrotic Head of the Femur in Adults DALLAS B. PHEMISTER, *J. Bone Surg.*, 1949, 31-A, 55

Cases in which there was necrosis of the head of the femur are presented in detail. One case was associated with an ununited fracture of the neck. The second case was associated with an ununited fracture at the junction of the head and neck. The patients were treated by drilling two holes across the neck and upper portion of the head of the femur. A rectangular tibial bone graft was inserted into each hole. These fractures united promptly and the upper portion of the head was rapidly invaded and replaced by new bone. There was little roentgenographic evidence of degenerative arthritis 7½ years after operation. A similar result is anticipated in the second case in which a period of 12½ months has elapsed since operation.

In a third case of ununited fracture and death of the head of 2 years' duration, one graft was inserted across the fracture line deep into the head, while the upper graft was inserted only to the margin of the upper portion of the head. Beginning 16 months after operation, the upper portion of the head, which had not been drilled and supported by a graft, underwent collapse and absorption with a poor result.

It is believed that the method here suggested holds promise in cases similar to those presented.

RICHARD J. BENNETT, JR., M.D.

#### Intracapsular Fractures of the Femur Treated with a Combined Smith-Petersen Nail and Fibular Graft JAMES PATRICK, *J. Bone Surg.*, 1949, 31-A, 67

The technique of fixation in intracapsular fractures in conjunction with the use of fibular grafts and the Smith-Petersen nail is explained in detail.

It is believed that the addition of a fibular graft lengthens the operation time only a few minutes. Sixty-three cases are presented in table form showing the important items of treatment. In 87 per cent of the cases bony union occurred, and in 9 per cent of these there was also aseptic necrosis. The real end result can be judged only after a follow-up study of many years. The number of cases in this series and the length of time involved is too limited. It is suggested that nonweight-bearing does not prevent necrosis. It is also suggested that weight bearing should be avoided for the first 3 months.

The results presented in this article seem to justify the combined use of the Smith-Petersen nail and fibular grafts.

RICHARD J. BENNETT, JR., M.D.

#### Follow-Up Results of Fractures of the Femoral Shaft in Children—Early and Late Infancy (Résultats éloignés des fractures de la diaphyse fémorale chez l'enfant) N. OECONOMOS, *Rev. orthop.*, Par., 1948, 34, 375

This report is based on 118 patients from the age of 1 to 6 years seen at the St. Louis and Bretonneau Hospital between the years 1939 and 1946. In no case was open reduction necessary. In 70 cases trac-

tion was employed. In 12 cases traction was used for from 30 to 40 hours. In 11 cases reduction was done on the fracture table, in 7 cases traction was applied for from 8 to 10 hours, followed by immobilization in a cast.

Although reduction was not satisfactory in many cases there was no functional impairment. Eventually every deformity disappeared. Shortening was also overcome by compensatory growth. Occasionally the affected limb would grow longer than the unaffected leg. It was therefore to the advantage of the patient to shorten the extremity at the time of reduction to allow for future increased growth which was observed in the majority of cases.

GEORGE I. REISS, M.D.

**Arthrodesis of the Ankle Joint** W. E. GALLIE, J.  
*Bone Surg.*, 1948, 30-B 619

Previously, ankle arthrodesis had required wide incision into the joint and the removal of cartilage from the tibia, fibula, and astragalus. This resulted in a poor fit and difficulty in holding the desired position while the cast was being applied. It also gave a thick, ugly appearance which is objectionable. The author's operation overcomes these objections. His technique is as follows: two short, vertical incisions, one in front of each malleolus, are made. The ankle joint is opened and the articular surfaces are exposed. A wide, thin osteotome is then applied to the lower end of the tibia and astragalus by which to cut a deep mortice about  $1\frac{1}{2}$  inches long and  $\frac{1}{4}$  of an inch wide, the upper half of which involves the lower end of the tibia and the lower half, the articular surfaces of the astragalus and the malleoli. These mortices should be cleanly cut with exactly parallel walls at least 1 inch deep. A bone fragment 3 inches by 1 inch is then cut from the tibia and divided into two parts, each of which is hammered firmly into a mortice. This results in a firm "ankylosis" from the time of surgery. The operation is not complicated and can be accomplished in less than 30 minutes.

The present study is based on 25 operations. All patients obtained painless, bony fusion. Postoperative care consists in leaving the original postoperative cast on for 3 months, following which a walking cast is worn for another month. Patients return to work in from 6 to 7 months.

Modifications of the technique may be required if there is varus or valgus deformity to be overcome. Occasionally osteotomy of the fibula, or removal of a portion of the edge of a tilted astragalus is necessary. In all cases, however, the author relies on the grafts alone for the fusion.

Roentgenograms of gross sections demonstrate the bony fusion obtained. NEWTON C. MEAD, M.D.

## ORTHOPEDICS IN GENERAL

**A Discussion of Tendon Repair** H. MINOR NICHOLS  
*Ann Surg.*, 1949, 129 223

The author in clear-cut fashion discusses the reasons for common failures experienced in the suture

and repair of flexor tendons according to various levels of involvement.

The poorest results in repair are experienced at the level of the heads of the metacarpal bones and at the bases of the fingers.

In the palm the juncture may be protected from adhesions by using the lumbrical muscles.

At the distal phalanges only slight motion is required so the conditions are more favorable.

Various methods have been employed by modern surgeons. Bunnell recommends slitting the tendon sheath. Koch, Mason, and Allen excise a window in the sheath. Many surgeons who have given up primary repair, advise secondary surgery of the tendons.

Cutler's method of advancing the proximal stump and suturing it as closely as possible to the insertion of the distal stump has been used successfully by the author in 15 cases. Favorable clinical experience is supported by animal experimentation. His work has been rewarded with excellent results and his conclusions appear entirely logical and correct.

1. Gelatin sponge may be placed around a sutured tendon without danger and apparently allows earlier free tendon motion.

2. When used about a tendon juncture the sponge causes excessive fibrosis and prolonged fixation of the tendon.

3. Tendon grafts are apparently autolyzed when surrounded by gelatin sponge.

KENNETH E. SIEMAN, M.D.

**Quantitative Parathyroidectomy in Orthopedic**  
(Parathyroidectomie quantitative et chirurgie orthopédique) M. SALMON *Rev. orthop.*, Par., 1948, 34 303

Orthopedic surgeons very often observe ankylosis of a joint in which arthroplasty was performed. This complication may be prevented by quantitative parathyroidectomy.

The difficulty of this procedure is based on the fact that (1) the actual amount of parathyroid parenchyma is unknown, and (2) this parenchyma cannot be differentiated from the embryonic islands.

The author presents 2 cases, one in which 80 mgm of parathyroid parenchyma were removed, and one in which 73 mgm were excised. In both cases arthroplasty of the hips was performed and no ankylosis was seen 18 months postoperatively.

The author does not reach any definite conclusion, but is desirous of stimulating further investigation along these lines.

GEORGE I. REISS, M.D.

**Congenital Elephantiasis** A. W. FARMER, J. BOYD  
*Surg.*, 1948, 30-B 606

Congenital anomalous bands of the extremities are variable in position, depth, and in the completeness of their encirclement. They represent one of a group of abnormalities which are often present in the same individual. Cases associated with gross lymphedema are rare. The treatment of the condition is presented in this article.

A male child, 4 months of age, was admitted to the hospital with multiple congenital anomalies of the hands and feet. There was no history of deformity in the child's ancestors. The left foot presented a tight constricting band which wholly encompassed the limb above the malleoli. Below this encirclement was a tremendous enlargement. The skin was shiny and tight, and it had a transparent, waxy appearance. The tissues were firm. There was no pitting on pressure. After digital compression there was immediate return to the original shape. Radiographs showed very great soft tissue thickening, but there was no abnormality of the bones.

The condition was treated by three operative procedures carried out at intervals of approximately 2 weeks. The first 2 operations were similar in nature: first, the anterior half, and then the posterior half, of the constricting band was excised. In each case a strip of tissue, one quarter of an inch wide and half the circumference of the limb, was excised in the line of the band. Transposition of flaps was accomplished by means of a "Z" plastic maneuver from the normal area above, into the abnormal area below, and vice versa. This was performed on so large a scale as to remove the indentation from the whole circumference of the limb. At a third stage operation, skin and subcutaneous tissues were removed from the dorsum of the foot down to the deep fascia. Part of the skin was converted into a free full-thickness graft by ex-

cision of all subcutaneous fibrous tissue. It was then replaced and a pressure dressing was applied. In one area there was some loss of skin which was replaced later by a split-skin graft.

At the original operation, when the incision was first made, clear fluid flowed from the wound as blood might flow from a large vein. Four test tubes were filled with this liquid which, on analysis, showed a serum protein content of 2.2 gm per cent. Laboratory reports showed that only albumin was present. The fluid did not clot even after several hours. Microscopic examination showed no more than a few lymphocytes.

Histological examination of removed tissue showed a great increase in thickness of the epidermis of the skin from the dorsum of the foot. In a section of the deeper tissues, large lymph channels could be seen clearly.

Before operation it was almost impossible to recognize the shape of the toes. Within a few days of the first operation there was remarkable shrinking of tissues. By the time the patient was discharged from the hospital, after the third operative procedure, the foot was almost normal in appearance. Re-examination several months later showed that the cosmetic appearance was still satisfactory and function was excellent. There had been no recurrence of swelling or enlargement of the limb.

RUDOLPH S. REICH, M.D.

# SURGERY OF THE BLOOD AND LYMPH SYSTEMS

## BLOOD VESSELS

**Arteriography in Pathologic Stumps The Role of Arterial Circulation in the Genesis of Trophic Disturbances** (De l'artériographie dans les moignons pathologiques Du rôle de la circulation artérielle dans la genèse des troubles trophiques) RENÉ LERICHE *Presse méd*, 1949, No 2 23

Arteriography plays an important role for the differentiation of the causes of trophic disturbances in stumps. Poor circulation may be caused either by obliteration or by spasm of the main artery. On the other hand, a too abundant vascularization and circulation may also cause trophic and vasomotor disturbances, and pain.

Lumbar gangliectomy may give relief in many cases  
WERNER M. SOLMITZ, M.D.

**An Experimental Study on the Use of Dicumarol in Arterial Suture** (Sull'uso del dicumarolo nella sutura delle arterie Ricerche sperimentali) FILIPPO BELLANTI *Rass internaz clin ter*, 1948, 28 553

The right femoral arteries of 14 dogs were exposed for a distance of 3 cm. under local anesthesia, and an incision 1 cm. in length was made into the lumen of each, proximal and distal loops of silk being used for temporary hemostasis. The arteries were then repaired with continuous 0000 chromic catgut on an atraumatic needle, the edges of the vessel wall being everted, which decreased the size of the lumen by one-third. Six of the dogs received dicumarol for 4 days prior to operation and during the postoperative period. The drug was given in amounts sufficient to maintain a prothrombin time double that of their previous normal figure. Eight dogs were used as controls and were not given dicumarol. Twenty days after operation the dogs were sacrificed by exsanguination under ether anesthesia and the sutured arteries were examined macroscopically as well as by serial microscopic sections.

It was found that each of the untreated dogs developed a thrombus which obliterated the lumen at the site of the suture line, whereas the lumen was patent in every one of the treated dogs and in only 1 dog were there a few small thrombi.

The author concluded that, in dogs, dicumarol demonstrated its value in maintaining the patency of sutured arteries.  
N. CHRISTIAN MEYER, M.D.

**Multiple Arterial Emboli 3 Successful Embolectomies in a Case of Bacterial Endocarditis** H. WILLIAM SCOTT, JR., and J. MAXWELL WILLIAMS, JR. *Arch Surg*, 1949, 58 28

The optimal treatment of peripheral arterial emboli involving the lower extremities is prompt embolectomy, with local anesthesia, supplemented by lumbar sympathetic block and the use of papaverine and anticoagulants.

The case reported illustrates the value of prompt recognition of the situation in repeated episodes of peripheral embolism, and the desirability of close co-operation between medical and surgical services in utilizing this plan of treatment. Arterial embolism is a true surgical emergency, and a markedly diminished cardiac reserve should not be a deterrent to arterial embolectomy, with local or regional anesthesia.

Lumbar sympathetic block was not performed before the second embolectomy because a spinal anesthetic, accomplishing the same purpose, was given almost immediately. It is of interest to note that during the second and third embolectomies no excessive bleeding was encountered, despite the fact that the patient was fully dicumarolized. All wounds healed by first intention without hematoma or ecchymosis.

Major embolic phenomena occurring during the course of bacterial endocarditis are usually visceral. Large peripheral emboli occluding the major vessels of the extremities apparently have been uncommon. Several observers have noted an increased incidence of embolism since the advent of intensive penicillin therapy of this disease. It is possible that cases of the type reported here will be encountered more frequently in the future.

BENJAMIN GOLDMAN, M.D.

**Phlebography and Surgery of True Varicose Veins of the Lower Limb** (Phlébographie et chirurgie des varices essentielles du membre inférieur) CL. OLIVIER *Presse méd*, 1949, No 2 36

Although injection of sclerosing substances is satisfactory in many cases, a certain percentage of recurrences is observed even in the hands of the most experienced therapists. Therefore, many surgeons, especially in the Anglo-Saxon countries, perform routine ligation of the saphenous vein after injection of morrhuates or similar substances. This method of treatment gives better results than injection alone, however, even with this method, a certain percentage of failures occur due to short circuits via communicating veins to the deep vessels. Furthermore, if injection treatment precedes the ligation, embolisms or phlebitis may occur in rare instances.

By phlebography, the short circuits can be ascertained and their location visualized. Therefore, phlebography should be done routinely in all cases before the type of treatment is decided upon.

The author recommends ligation not only of the trunk of the saphenous, but the perforant tributaries which communicate with the deep venous network, and which can be localized easily by phlebography. The ligation should precede the injection treatment in order to obviate accidents and to shorten the time of bed rest. This method has been used in 100 cases since 1943 without a single incidence of embolism or

phlebitis. In local anesthesia, the vein is exposed by vertical rather than by horizontal incision close to the femoral vein, and resected to a length of 4 cm. At the same time, all communicating tributaries, previously demonstrated by phlebography, are ligated. The patient is not confined to bed at all and leaves the hospital on the fourth day after surgery. One month later, the sclerosing injections are done. Usually, much fewer injections are necessary than in the preoperative injection method.

Finally, the author stresses the beneficial effect of this method of treatment on the healing of varicose ulcers.

WERNER M. SOLMITZ, M.D.

#### Treatment of Varicosities of the Lower Extremities (Tratamento actual das varizes dos membros inferiores) JOSÉ DE BORJA ARAÚJO *Gaz méd Portuguesa*, 1948, 1: 644

Four methods of treatment of varicosities of the lower extremities may be distinguished, as follows:

- 1 Prophylaxis, chiefly applicable to pregnant women who should be instructed to do bending and stretching exercises of the legs several times a day, and to assume a reclining position with the legs elevated in the middle of the day.

- 2 Conservative treatment consisting of the application of elastic bandages and elevation of the lower extremities, and employable when there are contraindications to an active therapy, e.g., senility, debilitating diseases, impairment of arterial circulation, pelvic tumors or other obstacles to the venous reflux, pregnancy, and phlebitis of the deep veins.

- 3 Employment of sclerosing substances alone or combined with operative procedures. The author reports recurrences in 60 per cent of cases in which injections alone had been given.

- 4 Operative methods, namely, single or multiple ligations, with or without concomitant injections of sclerosing solutions. The vena saphena magna is exposed at its junction with the femoral vein through a longitudinal incision, the vein and its tributaries are ligated, the lesser or external saphenous vein is exposed in the popliteal region. Five cubic centimeters of sodium morrhuate are injected into the distal portion of the transected vein.

In patients with bilateral varicosities, the author prefers to perform the operation in two stages, allowing a period of 7 days to elapse between them.

JOSEPH K. NARAT, M.D.

#### Further Consideration of the Surgical Management of Chronic Varicose Ulcers. N. OWENS and H. BETHEA *Plast Reconstr Surg*, 1948, 3: 633

The authors present a brief history of varicose ulcers and their treatment. Chronic varicose ulcers of the lower extremity are more commonly observed than any other type, they represent about 90 per cent of all chronic ulcers of the leg. Heredity is an important factor in about 65 per cent of all patients suffering from varicose veins or chronic ulcers. These ulcers frequently occupy the area above the medial malleolus and occur on the left leg more often than

on the right. The incidence of syphilis in chronic ulcers of the lower extremities is discussed. A small percentage of chronic ulcers of the lower extremity will be found to arise as the result of sickle cell anemia. Both of these conditions should be ruled out before a positive diagnosis of chronic varicose ulcer is considered established.

An extended discussion of the pathologic characteristics of these cases is presented. One of the factors in the development of a chronic leg ulcer is that of venous stasis. Associated with this is a progressive anoxemia and local acidosis which develops as the result of stagnation of the metabolic processes in the skin and subcutaneous tissue. Slight trauma to the tissue undergoing such alterations provides an entrance to bacteria that leads to early ulceration and may act as a focus for the development of a chronic leg ulcer. Because of the lowered resistance of local tissue, infection is difficult to combat. Progressive infection means further interference with lymph drainage, subsequent proliferation of scar, and increased diminution of local blood supply.

The author observes that probably no surgical condition has been subjected to a greater variety of treatments than chronic varicose ulcers of the lower extremity. During the initial, acute stage of the development of varicose ulcers, approximately 50 per cent of these ulcers could be cured by relatively simple methods. The administration of penicillin and the sulfonamides, in association with venoligation and injection, physiologic rest, elevation of the extremity for adequate drainage, and the application of moist, saline pressure dressings should insure a satisfactory cure in the vast majority of these early cases. A satisfactory cure will require that treatment be directed to chronic varicose ulcers complicated by varying amounts of infection, marked diminution in the vascular supply, sufficient disturbance in the local lymph drainage to produce chronic lymphedema, and a massive amount of scar. Obviously, that treatment must offer an adequate blood supply to the part and correct the disturbance in lymph drainage of the local area if the other pathologic states are to be improved. From a study of the regional anatomy, it appears that the correction of these defects will entail complete excision of all offending scar, together with complete excision of an equal area of deep fascia because the deep fascia completely invests the musculature of the lower leg, and separates the blood supply into the superficial and deep circulation.

In all of the cases reported in the present article, half-thickness grafts were applied immediately following the excision of scar and deep fascia. All grafts have remained entirely stable and there has been no disability due to adherence of the grafts to the muscles, tendons, or bones. There have been no breakdowns in the grafts that have not been associated directly with trauma and which have not healed spontaneously. The postoperative care of these patients is a very important factor in the success of the procedure. After the application of the graft,



single layer of surgical rayon is applied over the graft, followed by the application of the usual type of pressure dressing held fixed by a No 8 Ace bandage. The foot is splinted to produce complete immobilization. The patient is kept in bed for 4 or 5 days and the dressing is then changed with reapplication of the splint. When the graft has become firmly attached and circulation is insured, the patient is supervised in a series of vascular exercises. These exercises are described in detail. Eight cases are presented in detail together with photographs illustrating the procedures for each of the ulcers.

HERBERT F. THURSTON, M.D.

**The Question of Gangrene Following Popliteal Injury** (Ueber die Frage der Gangraen nach Popliteaverletzung) BÉLA GOMBKÖTÖ *Helvet chir acta*, 1948, 15 454

The author presents his views concerning the high percentage of cases of gangrene of the lower extremity following injury to the popliteal artery. He considers the older points of view concerning well developed collaterals, good heart function, and complete adaptability of the circulatory system, as well as the opposing points of view that the number and caliber of collateral vessels at the knee are or are not adequate. He believes that the results of animal experiments throw little light on the subject, and that the occurrence of the condition may be explained by phylogenetic circumstances.

The collateral circulations at the shoulder and hip are not analogous to that at the knee, since at the knee there are hardly any arteries which contribute to the collateral network that originate higher up and are not involved in the injury. The connections of the branches proceeding from the popliteal artery itself upwards are maintained by the popliteal artery alone. In the case of early ligature of the popliteal artery, collateral circulation does not develop because the capacity of the available collaterals is poor, due to fall in blood pressure, pressure of the hematoma, and also because of the fact that the major part of the collateral circulation has been damaged along with the popliteal artery and is dependent on the popliteal artery. The results of ligature of the cubital artery at the elbow and the popliteal artery at the knee are different because the circulation at the corresponding regions is dissimilar. The collaterals at the elbow originate higher and terminate lower into the chief branches than those at the

knee. At the knee the popliteal artery and the collateral branches are confined to a smaller space than are the vessels at the elbow.

JOHN L. LINDQUIST, M.D.

## LYMPH GLANDS AND LYMPATHIC VESSELS

**Notes on the Anatomy and Physiology of the Thoracic Duct and on the Treatment of Injuries to It** LARS HOLMBERG *Acta chir scand*, 1948, 97 215

Four cases of injury to the thoracic duct are reported. Excision of the left cervical metastatic nodes, scalenotomy plus division of the cervical sympathetic trunk, a Peet sympathectomy, and a possible traumatic rupture accounted for the injuries. In 2 of the cases reoperation with ligature of the duct in one and tamponade in the other was required. In the third case the injury was discovered at operation and the ends of the duct were sutured. The injury healed spontaneously in the fourth case.

A summary of the literature with regard to the anatomy and physiology of the thoracic duct and the treatment of its injuries is presented. The consequence of either an internal or external thoracic duct fistula is usually a rapid loss of protein, fluid, salts, and fat. Inanition quickly supervenes if the patient is left without effective treatment. Blood and plasma transfusions, a rich diet, and protein substitutes are recommended. Fat should be reduced to a minimum in the diet and it is suggested that the administration of atropin may lessen the flow of chyle. The chief finding of internal affections of the thoracic duct is said to be chylothorax, for which thoracenteses may be employed.

Ligature is recommended for the injury in the cervical portion of the duct with tamponade reserved for those cases in which it fails. An expectant attitude is warranted in those injuries which involve the intrathoracic portion, for the operative correction of the defect is considerably more difficult. Should the defect fail to heal spontaneously, ligature of both the central and peripheral ends must be made. External drainage of these injuries may be resorted to only as a palliative procedure to prevent the formation of chylothorax and its complications. As a result of modern fluid therapy and the progress of cervical and thoracic surgery the prognosis may now be judged to be relatively good.

ALLAN D. CALLOW, M.D.



# SURGICAL TECHNIQUE

## OPERATIVE SURGERY AND TECHNIQUE, POSTOPERATIVE TREATMENT

**The Use as Controls of Various Hematologic Values and in Particular the Plasma Protein Level after Surgical Intervention** (Sull'utilità del controllo di alcuni valori ematologici ed in particolare del tasso delle proteine plasmatiche dopo interventi chirurgici) CORRADO CONFALONIERI *Ann ostet gin*, 1948, 70 601

The author reviews the literature on the value of protein therapy in surgery. He then reports on studies made on 20 patients. Plasma protein, hematocrit, hemoglobin, and red cell determinations were made preoperatively, immediately following surgery, and during convalescence. All the data are given for each case.

Hypoproteinemia was found in 16.6 per cent of the cases. It was noted that fever was more common with hypoproteinemia, but it was also noted that this was true in the patients subjected to major surgery. Edema was not encountered, and it was believed that this was accounted for because no values below 4.5 per cent (the absolute limit of edema of Efskind) were found. One wound with infection and another with poor healing were both associated with low protein values.

The author believes that one cannot estimate blood loss or protein values without laboratory studies. He uses the Phillips copper sulfate gravimetric method for determining the plasma protein values because he believes that it is more practical than the more precise methods. The use of amino acids is recommended when the plasma protein values are low and their administration should be controlled by plasma protein determinations.

LUCIAN J. FRONZUTI, M.D.

## ANTISEPTIC SURGERY, TREATMENT OF WOUNDS AND INFECTIONS

**The Nature of the Shift of Plasma Protein to the Extravascular Space Following Thermal Trauma** OLIVER COPE, JOHN B. GRAHAM, FRANCIS D. MOORE, and MARGARET R. BALL. *Ann Surg*, 1948, 128 1041

Discussion of the circulatory disorder of the burned patient and of the need for fluid is inadequate if it does not include a consideration of the abnormal distribution of the plasma proteins which occurs within the body as a direct result of the injury. Colloid osmotic pressure is exerted by the plasma proteins in differential concentrations on either side of the semipermeable capillary membrane which portions water between the plasma and the interstitial space. The sudden increase in permeability of the capillary wall caused by the burn destroys the osmotic pressure of the plasma in the area of injury and permits the collection of edema in the wound.

Two current misconceptions regarding the distribution of plasma proteins are (1) that the proteins of plasma circulate only within the blood stream, and (2) that the remaining circulating plasma has a lowered protein concentration.

The disordered distribution of protein as a result of a burn has been approached experimentally by collecting lymph flowing from the burned foot of the dog. There is an increased flow of lymph following the burn and a significant one in lymph protein. This indicates the permeability of the damaged capillary membrane to protein. The degree of capillary damage depends to an extent upon the intensity of the burn. However, no matter how severe the burn, the protein concentration of the lymph is never as high as that of the plasma. There is only a portion of the plasma protein that passes with the water into the lymphatics. The unaccounted for fraction is not lodged in the wound, as indicated by the observation that fluids removed by needle from the wound have protein concentrations slightly lower than that of the lymph. There is only one place for the unaccounted for protein fraction to be and that is still in the blood stream.

This assumption was proved by the findings of an increased protein concentration in the plasma of dogs after burning. The dilution of protein succeeding the initially increased concentration indicates withdrawal of fluid from the unburned tissues into the blood stream.

It was proved experimentally that the initially more concentrated plasma does not take back water from the wound. The lymphatic trunks of the hind feet, the neck, and the thoracic duct of the dog were cannulated and a control flow of lymph was observed. The feet were then burned and when the typical curve of increasing lymph flow from the feet and rising serum protein concentration and hematocrit were established the animal was given hypertonic albumin intravenously. The hematocrit fell promptly, and this represented an increase of plasma volume due to absorption of fluid from the tissues. This fluid came virtually entirely from the unburned tissues and not from the burn wounds as indicated by cessation of the flow of lymph from the cervical trunk and a drop in the thoracic duct pressure while the increased flow from the burned feet continued. The cessation of flow of lymph from the cervical region persisted and indicated severe dehydration of this unburned region of the body. This suggests that the mechanism for the reabsorption of water locally is also damaged by a burn, the only mechanism for return of fluid from the wound remaining intact being the lymphatic system.

The osmotic influence of the increased concentration of protein found in the circulating plasma, immediately after injury, upon the water concentration of the unburned tissues depends in part upon the

**albumin-globulin ratio** The lower the ratio the less dehydrating it should be This was proved experimentally by using radioactive diazo dyes and by chemical analysis of the proteins in both the plasma and lymph of dogs As a result of the burn the capillary wall becomes wholly permeable to albumin but not to the globulins This fall of the albumin-globulin ratio encountered immediately after injury should offset or reduce the rise in osmotic tension indicated by the increase in concentration of the total proteins

Tests for abnormal proteins were made but none was found

Clinical observations on burned patients were made, comparing the protein content of the initial blebs at varying time intervals with that of the blood plasma This data on the human patients gave comparable results with the same implications as those on the dog HARVEY S ALLEN, M D

#### **Antibiotic Therapy for Cutaneous Anthrax Report of 5 Cases** W A REILLY and C R BEESON *Arch Int M*, 1948, 82 529

The purpose of this article is to outline the favorable results of treating cutaneous anthrax with penicillin and sulfadiazine and with streptomycin

It is claimed that the incidence of anthrax is rising in the United States

For many years there has been a greater incidence of human anthrax in the United States in certain areas, i e, the Atlantic seaboard, in which infected hides from foreign countries (Arabia and Egypt) were processed

The patients in cases 1, 2, 3, and 4 were given 300,000 units of penicillin and sulfadiazine daily for 5 days Improvement started within 24 hours and continued thereafter

The improvement in all 4 was quick in onset and progressively more notable daily Some evidence of the "tissue damaging factor" of the *Bacillus anthracis* was detected, but it was only slight This damage, probably due to the toxin, continues to operate for a short time after the organisms have been killed by the penicillin

In case 5 the dosage of streptomycin was in keeping with the normal amount recommended for its proper usage The patient's toxicity and the malignant appearance of the lesions were decreased to a great extent within the first 24 hours, the fever disappeared after 36 hours, and axillary lymphadenopathy was barely palpable (the areas being no longer tender) by the sixth day of treatment with streptomycin The renal lesion slowly improved and was not aggravated It is possible that the dosage of the drug and the duration of its administration could have been decreased

A choice between penicillin and streptomycin for therapy in human beings would at present probably favor penicillin for it has more effectively suppressed the cultural growth of anthrax, it is more widely distributed, and it costs less since only from 100,000 to 200,000 units daily for from 5 to 7 days are required

A sensitivity test with the two antibiotics is very desirable when there is doubt, as, for instance, when a patient has cutaneous anthrax and septicemia

GEORGE W RICHARDSON, M D

#### **The Use of Penicillin in Open Injuries of the Hand and Fingers** (*L'emploi de la pénicilline dans les traumatismes ouverts de la main et des doigts*) M BELENGER *Acta chir belg*, 1948, No 8 490

The author believes that, in the era of antibiotic therapy, the indications for mutilating operations of the hand and fingers should be completely revised

Up to recent times, the fear of infections caused most surgeons to recommend finger amputations or other mutilating interventions in the majority of open injuries with fracture The author suggests a much more conservative proceeding Only total interruption of the circulation or complete crushing of all the soft tissues warrants ablation Under penicillin therapy, from 30,000 to 100,000 units every 3 hours for 2 to 3 days, not one infection occurred in a series of 148 complicated fractures although in part of the cases the phalangeal articulations were open and exposed Suture of the opened joints and severed tendons, and skin grafts when necessary gave excellent functional results which would not have been possible before the penicillin era

Healing of the injuries was considerably accelerated under this therapy The author shows in an interesting table that the average time until return to work was reduced by more than one-third as compared with patients treated without antibiotics

WERNER M SOLMITZ, M D

### **ANESTHESIA**

#### **Anesthesia for Neurosurgery** LOUIS L TEPLINSKY, ZIGMORE HARRIS, W H CASSELS, and OSCAR SUGAR *Anesthesiology*, 1949, 10 82

The anesthesia problems involved in neurosurgery are analyzed and a number of requirements are outlined The characteristics of the common anesthetic agents as they pertain to these requirements are discussed

The authors state that ideally, we should find a solution common to all these problems, but practically, this has never been achieved We are forced to compromise and to accept the solution which most nearly meets all the requirements A method of anesthesia in which nitrous oxide is supplemented with dilute pentothal solution by drip, and intubation is facilitated by topical anesthesia has proved satisfactory in a series of 203 cases

MARY FRANCES POE, M D

#### **Anesthetic Management for Surgery Within the Thorax A Report of 309 Cases** KATHERINE FISHER, LAWRENCE D LEE, DIRK E STEGEMAN, and ROBERT B YOUNG *Anesthesiology*, 1948, 9 623

The authors present the methods used by one group of anesthesiologists in dealing with the special

problems encountered in the management of anesthesia for major intrathoracic surgery. The operative and postoperative courses have been studied, and a comparison made as to the efficacy of the various agents and the condition of the patient.

The goal of the anesthetist in intrathoracic surgery is to produce satisfactory anesthesia with adequate oxygen for all tissue requirements and to prevent the secretions of the diseased lung from entering the healthy one. The method that has seemed to prove most satisfactory in this series is endotracheal anesthesia with the patient in deep Trendelenburg position. The anesthetic combinations which seem to depress the patient the least with a minimum of untoward effects are pentothal with topical anesthesia, or pentothal and curare for intubation, followed by ether, or ether and curare for maintenance. Certain undesirable results have been observed with cyclopropane.

Strict attention to detail and co-operation between the anesthetist and surgeon have been factors in lowering the mortality and the morbidity.

MARY FRANCES POF, M D

**Myanesin As a Muscle Relaxant** HAROLD R. GRIF-FITH, C. R. STEPHEN, WILLIAM G. CULLEN, and WESLEY BOURNE *Anesthesiology*, 1940, 10, 61

The muscle relaxing properties of myanesin, one of the substituted ethers of glycerol, have been reviewed from clinical and laboratory experience, and compared with curare. The present study was motivated by the report of Mallinson who concluded, from clinical experience in 112 patients, that myanesin appeared to have well marked advantages over curare, such as a wider margin of safety, abdominal relaxation in the conscious patient without distressing intercostal paralysis, and with full abdominal muscle relaxation.

In this series myanesin was administered to 120 anesthetized patients, 75 conscious patients, and to 25 cats and rabbits. The results were compared with more than 2,000 personally observed administrations of curare in anesthesia, either as intocostin or one of the preparations of d-tubocurarine chloride. Myanesin was used in the same kind of cases and under the same conditions as curare was used. Cyclopropane was the most commonly used anesthetic agent. It was found that myanesin was effective as a muscle relaxant provided enough of it was used, but its relaxing effect was less predictable in any case. The average dose was 8.7 c.c. With myanesin, the duration of relaxation was no longer than that obtained with curare, and respiratory depression was observed as occasionally as with curare. The relaxing effect of 10 c.c. of myanesin appeared to be approximately equal to that of 3 c.c. (60 units) of intocostin.

Observations of the conscious patient given 20 mgm. of myanesin per kilogram of body weight at the rate of 1 to 2 c.c. per minute demonstrated that there were no measurable effects on nerve and muscle action potentials upon transmission at the neuro-

muscular junction, on induction along the sciatic nerve, or on synaptic transmission of impulses through the spinal cord. This led to the opinion that the site of action of the drug was central rather than peripheral. None of the conscious patients showed any loss in voluntary muscle power as measured by the dynamometer.

The disadvantages to the use of myanesin are (1) occasional local irritation set up in the vein at or above the site of injection, and (2) the occurrence of hemoglobinuria associated with albuminuria. These complicating factors are sufficiently serious to indicate that myanesin in its present form is not a satisfactory substitute for curare in clinical anesthesia. Through its central action the drug may have some useful place in the treatment of certain neurologic diseases, and its further study in this field should be encouraged.

MARY KARR, M D

**Intravenous Demerol-Scopolamine Amnesia During Labor** JOHN M. BROWN, FERRY P. VOLPITTO, and RICHARD TORPIN *Anesthesiology*, 1940, 10, 15

A method is described in which demerol hydrochloride and scopolamine hydrochloride was utilized during parturition.

The first administration of the drug is at the onset of true labor, that is, when labor pains are of 40 seconds duration, and when they occur at regular intervals of 5 minutes or less. At this point a solution containing 10 mgm. of demerol and 1/1000 grain of scopolamine per cubic centimeter is injected intravenously at the rate of 1 c.c. per minute until the patient begins to talk incoherently, shows signs of falling asleep between pains, and exhibits only a slight amount of restlessness with each pain. Usually this initial dose is from 8 to 10 c.c. of the solution in those patients who had received no previous drugs. The second intravenous injection (an average of 3 to 5 c.c. of the solution) is required in from 2 to 3 hours after the first. This is usually sufficient for multiparas, however, primiparas require a third administration in from 3 to 5 hours after the second. The criteria for a repeat dosage are undue excitement with each pain, restlessness, alertness and coherence, and the lapse of time from the last injection of the drug.

All episiotomies are performed under local anesthesia and repaired under cyclopropane anesthesia. This technique was employed in 250 obstetrical patients over a period of 1 year, and 100 unselected case histories were studied in detail, with information on method of delivery, progress of labor, infant mortality and morbidity, state of the newborn, amnesia during labor, and analgesia during labor.

The primary effect of the combination of agents used was the production of adequate amnesia in a high percentage of the patients studied (excellent in 53.3 per cent and good in 32.6 per cent). Demerol, as employed in these cases, produces a sufficient degree of analgesia to reduce the restlessness of the mother during labor, but not a sufficient amount of analgesia to reduce pain entirely.

The incidence of apnea neonatorum was low, this condition occurred in only 10 patients, 6 of whom required resuscitation. The previous or simultaneous administration of barbiturates or morphine with demerol resulted in a greater incidence of apnea in the newborn.

The administration of these drugs is justified because of the amnesic action of scopolamine and the analgesic action of demerol. The intravenous route of administration of these drugs produced side effects of a minor nature. No spasmolytic effect of demerol was observed upon the uterus. The potentiation of barbiturate medullary depression by demerol was noted.

MARY KARP, M D

**A Study of Pentothal Sodium Anesthesia and a Critical Investigation of the Use of Succinate as an Antidote** JOHN H TUCCI, MARY A B BRAZIER, HENRY H W MILES, and JACOB E FINESINGER. *Anesthesiology*, 1949, 10 25

Some of the biochemical aspects of the oxidative theory of anesthesia are presented and discussed. On the basis of succinate oxidation being unaffected by barbiturate anesthesia, the authors postulate that disodium succinate might be expected to act as an antidote to sodium pentothal anesthesia.

Electroencephalogram records were used as the objective record in the cases studied. Both healthy males and psychiatric patients were studied; the psychiatric diagnoses were all in the psychoneurotic classifications. Pentothal sodium anesthesia was induced and a classification of the stages and planes of anesthesia was made on the basis of clinical observation correlated with electroencephalographic records.

Disodium succinate was administered intravenously before, during, and at the completion of anesthesia, and controls were run with other sodium salts instead of succinate. The electroencephalographic effects of the succinate administration were variable, as were the clinical findings. Some patients awakened more rapidly following the succinate, but others were essentially unchanged.

The authors conclude that a definitive decision as to the value of succinate would be unjustifiable at this time.

Several variables, such as tolerance to pentothal sodium, are suggested as reasons for the need of caution in assessing the antidotal effects of disodium succinate.

R GIBSON PARRISH, M D

**Tachycardia in Children During Anesthesia** KATHERINE JACKSON. *Anesthesiology*, 1948, 9 573

The present study was undertaken to determine the effect of four factors upon the average maintenance pulse rate during anesthesia, namely: preanesthetic apprehension, premedication with nembutal, the agent used, and the technique of administration. In 108 children, the pulse rate was recorded at frequent intervals during the period of anesthesia. Averages of these individual readings were used to compute a general average maintenance pulse rate

for the entire group. Repeated pulse readings, on the wards, of the same group of children provided a control.

The average maintenance pulse rate was 10 to 14 per cent higher in the apprehensive group than in the group that showed no fear. Nembutal premedication seemed to have a physiologic sedative effect independent of its psychic sedation since in the non-apprehensive children, those who had been given nembutal had 10 per cent lower pulse rates than those who had not had nembutal. The lowering of the pulse rate was particularly noticeable in the younger children.

For the purpose of maintaining a more physiologic pulse rate, cyclopropane seemed to be a better anesthetic agent than ether. The technique of administration has little effect on the average pulse rate in children during anesthesia. When ether must be administered, the quiet child is much more likely to have a reasonably physiologic pulse rate than is the apprehensive child.

MARY FRANCES POE, M D

## SURGICAL INSTRUMENTS AND APPARATUS

**Blood Determination and Estimation of Blood Loss During Surgical Operations** NORRIS E LENAHEAN, THEODORE A SPITZ, and DEFOREST W METCALF. *Arch Surg*, 1948, 57 435

The gravimetric method was used to estimate the blood loss from a variety of surgical procedures. During the course of an operation the curve of the blood loss and the curve of blood gained by transfusion could serve as a guide to the volume of necessary replacement.

In the present article the blood loss incurred in 270 surgical operations was reported. The average

TABLE I — DATA ON BLOOD LOSS

Operations	Number of cases	Blood loss cc.		
		Minimum	Maximum	Average
Hernia	20	25	75	40
Appendectomy	20	25	50	35
Hemorrhoidectomy	20	25	150	55
Salpingectomy	25	80	225	150
Hysterectomy	25	155	375	300
Thyroidectomy	10	75	200	125
Biliary	10	75	525	300
Gastric resections	12	320	780	503
Intestinal resections	10	510	1 425	760
Abdominal perineal resections	10	415	2,420	1 080
Vagotomy	10	165	600	423
Suprapubic prostatectomy	10	265	1 235	551
Transurethral resections	15	172	855	563
Nephrectomy	10	285	845	478

loss of blood in 12 gastric resections was 503 ml. It was emphasized that in the latter operation there was a tendency to overinfuse the patient with blood unless the actual loss was measured.

BENJAMIN G. P. SHAFIROFF, M.D.

**Concept and New Techniques of the Dermoepidermal Graft** (Conception et technique nouvelles de la greffe dermo-épidermique) F. LAGROT and R. FAVRE. *Rev. chir., Par.*, 1948, 67: 332.

The authors present their concept and technique of skin grafting after 3 years of extensive experience with skin lesions requiring cutaneous grafts. They emphasize the importance of early grafting before extensive cicatrization has occurred. Third degree burns were grafted by the eighth day, after careful preparation with chemotherapy, débridement, and local application of a solution of salt, glycerin, and acetic acid which aided in the separation of the eschar. Traumatic avulsions were immediately débrided and grafted with excellent results. The authors also grafted cutaneous ulcerations including extensive cutaneous anthrax, and many postoperative wounds doomed, by their extent, to heal by second intention.

Their grafts were of the split-thickness variety, usually obtained from the anteromedial aspect of the thigh by means of an adjustable razor plane. The superficial surface of the graft was spread out on vaseline gauze or tullegras, and cut to the desired size. Excessive skin was refrigerated in glass tubes and remained viable for 20 days.

The authors illustrate their technique of grafting a large cutaneous anthrax. Complete excision of the ulcerated area is carried out. Hemostasis is accomplished by electrocoagulation and adrenalin compresses. Several uncut wire sutures are placed around the periphery of the lesion. The graft is treated with a "glue" of plasma and prothrombin, and is placed in position. The peripherally placed wire sutures are then tied over several layers of gauze, thus holding and compressing the graft in place.

Following operation, the grafted areas are immobilized as completely as possible for a period of 7 to 10 days. Extremities are elevated and enclosed in plaster with windows cut over the grafted areas. Ice bags are applied to these areas for 8 days after the operation, in order to prevent necrosis of the graft. Chemotherapy is administered during the entire preoperative and postoperative period. The first dressings are done on the seventh to tenth days and the preserved "refrigerated" grafts are applied to any denuded zones.

The authors used homografts in several cases without success. They noted that grafting with the same foreign skin two different times resulted in more rapid destruction of the graft the second time. This phenomenon, they believed, was of an anaphylactic type, and they suggest the possibility of desensitizing the recipient with a skin extract of the donor prior to grafting.

According to the authors' statistics, they obtained 92 per cent successful "takes" in 100 cases by their method of skin grafting. JOHN H. FLANN, M.D.

# PHYSICOCHEMICAL METHODS IN SURGERY

## ROENTGENOLOGY

**New Applications of the Principles of Kymography**  
(Nouvelles applications des principes de la chymographie) LOPO DE CARVALHO *Bruxelles méd*, 1948, 28 2709

The author describes a method by which the circulation time is accurately measured by the injection of thorotrast into the vein of the arm. For this purpose he and his coworkers revived the old kymograph with a transverse split. A film moving downward at known speed gives the kymograms of the superior vena cava, aorta, main branches of the pulmonary artery, and pulmonary veins. The kymograms appear on the film at different times depending upon the lung circulation time. They are measured by the known speed of the film. On varying the position of the split, the time of the right and left heart circulation and that of the pulmonary tree can be measured. This method can be applied to other organs, the brain, and the limbs.

In the second part of the article the author describes a procedure for determining the mobility of the wall of a cavity in the lung. For this purpose he devised a kymograph with two crossed splits moving clockwise and describing a 90 degree angle. The center of the cavity must coincide with the point at which the two splits cross. Some practical examples of the usefulness of this apparatus are given.

MARC K. P. STU, M.D.

**Visualization of the Cavum Tympani and the Auditory Canal with Opaque Medium Experiments on Dogs** (Visualizzazione con mezzi di contrasto opachi del cavo del timpano e della tuba auditiva. Prime esperienze sui cani) MARIO FACCINI *Radiol med*, Milano, 1948, 34 842

An opaque medium, namely, ioduron (30 per cent iodized oil), was injected by the author into the pharyngeal orifice of the eustachian tube in dogs. The reaction of the mucosa of the cavum tympani and the rate of elimination of the opaque medium were studied.

The author suggests the employment of this method in man, especially in skull fractures involving the cavum tympani.

The histologic examination of the mucosa from 4 to 8 weeks after the injection failed to reveal any sign of sclerosis or inflammation.

JOSEPH K. NARAT, M.D.

**Peripheral Vascular Disease in the Lungs** ROBERT P. BARDEN and DAVID A. COOPER *Am J Roentg*, 1949, 61 17

Conditions producing changes in the peripheral vascular system may be demonstrable in chest roentgenograms. They are congestion following heart disease, intrinsic vascular obstruction, in-

trinsic disease of a blood vessel, obliteration of vessels by adjacent pulmonary disease (tuberculosis, carcinoma, abscess), and hypersensitivity states and toxins causing increased permeability (collagen diseases).

Illustrative cases are reported depicting the various vascular lesions of the lungs which may be of differential diagnostic value in problem cases.

MAURICE D. SACHS, M.D.

**Stratigraphy in 1947 and in 1930, from the Initiation to the Termination of Thoracoplasty** (La stratigrafia 1947 e la stratigrafia 1930 nell'indagine degli esiti di interventi di toracoplastica) ALESSANDRO PIAZZA *Radiol med*, Milano, 1948, 34 753

The value of combination of the customary roentgenographic technique with stratigraphy is illustrated by the author in 5 cases. The customary stratigraphic examination was done in 1930 in all 5 patients, and in 1947 transverse axial stratigraphy was also employed in 3 of the patients. Such combined examinations are of particularly great value in the determination of skeletal deformities and for study of the evolution of cavities after thoracoplastic operations.

The three-dimensional images are of especially great value for the study of secondary thoracopulmonary alterations, such as deviation of the spine or mediastinum, following surgical intervention.

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**The Roentgenologic Symptoms of Esophageal and Gastric Injuries Resulting from Caustic Poisons** (Roentgensymptome der Speiseröhren und Magenverletzungen durch ätzende Gifte) IVÁN RODE. *Acta radiol*, Stockh., 1948, 30 105

The material for this report consists of 111 cases of caustic poisonings. Of these, 79 were poisonings with lye, 29 with acids, and 3 with other caustic substances. Of the patients poisoned with lye, 78 were females and 1 was a male. The average age of the women was 22 years, the youngest being 14 and the oldest 59. The man's age was 25 years. The alkali used was always sodium hydroxide. All of the patients poisoned with acids were women. Of these, the average age was 24 years, the youngest being 17 and the oldest 47. The acid used in 24 instances was hydrochloric acid, in 2, sulphuric acid, in 2, oxalic acid, and in 1, formic acid. Because of the similarity of effect with acid poisonings there were also classed with this latter group a case of potassium permanganate poisoning, a case of zinc chloride poisoning, and a case of formalin poisoning.

In 18 of the patients poisoned with alkali and in 9 poisoned with acid no pathologic changes in the esophagus or stomach could be found. In the remainder, more or less outspoken alterations could be demonstrated, in the less severe cases only spasmodic

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In 18 of the patients poisoned with alkali and in 9 poisoned with acid no pathologic changes in the esophagus or stomach could be found. In the remainder, more or less outspoken alterations could be demonstrated, in the less severe cases only spasmodic



manifestations were seen, while in the severe cases more or less widespread cicatricial stenoses were found

The most widespread and severe lesions predominated among the alkali poisonings. This seems to be due to the greater viscosity of the lye preparations so that they tend to adhere all along the route, and to the wet, disintegrative type of necrosis (colliquation) produced, so that the necrotic surface itself tends to soak up the caustic liquid like blotting paper. The acids, on the contrary, produce a dry crustlike necrosis of the tissues (coagulation) which protects the deeper structures.

In this material it was found that only the alkalis presented esophageal lesions of lasting character. In fact, in 3 of the patients the lye seemed to have penetrated so deeply as to paralyze the nerve supply governing the muscular action of the esophagus. In these cases the patient could not even swallow liquids, yet the largest sound could be passed all the way to the stomach. Roentgenology disclosed a uniformly cylindrical esophagus without a trace of peristalsis. This condition the author designates "inactive esophagus," and he warns that these cases demand gastrostomy just as early and urgently as the cases of impermeable stricture. Another peculiarity of the alkalis was their ability to get through the pyloric sphincter and produce lesions of the duodenum. In 4 instances high grade stenosis of the duodenum could be demonstrated in the cases of alkali poisoning. This finding would seem to be of differential diagnostic value as between alkali and the acid poisonings.

The acids, on the other hand, tended to pass rapidly through the esophagus and along the lesser curvature of the stomach, to be eventually held up at the pylorus and produce the well-known isolated lesions of this region of the stomach. Another finding of possible differential-diagnostic interest in the acid poisonings was the peculiar honeycomb appearance of the antrum of the stomach, which tended to disappear as the superficial injuries to the gastric mucosal folds healed.

On the whole, however, there were no constant roentgenologic findings permitting a definitive distinction between the lesions caused by acids and those caused by alkalis. In fact, there was no definite differentiation between the lesions of caustic poisonings and other pathologic conditions of the stomach, such as cicatricial changes produced by peptic ulcer, and the cicatricial stenotic forms of fibrous carcinoma, lues, lymphogranulomatosis, actinomycosis, and even of certain types of gastric changes in lymphatic leucemia.

Therefore, the differential diagnosis of caustic poisoning will frequently depend ultimately upon the history, and such amnesic data must consequently be sought diligently in every case of cicatricial lesion of the gastrointestinal tract. It is surprising how often such data are forgotten or suppressed through a feeling of shame.

JOHN W. BRENNAN, M.D.

**Gastric Dyskinesia Roentgen Kymographic Semeiology** (Le discinesie gastriche Semeiotica roentgenchumografica) ANTONIO LURA. *Arch ital mal app diger*, 1949, 15 3

Contrary to gastrography, roentgenologic examination is not able to furnish manometric data concerning the endogastric pressure, but it allows a morphologic and functional study of the stomach. Of both methods, one is not a substitute for, but a supplement to, the other. Only a combination of roentgenologic and clinical findings is able to give the true picture of the condition.

While roentgen cinematography never gained popularity, roentgen kymography has proved its value in the study of gastric function under normal and pathologic conditions. Two groups of movements of the stomach may be distinguished:

1. Passive (1) pulsations transmitted to the stomach by the heart and large blood vessels, and (2) respiratory movements.

Active (1) peristaltic movements accompanied by either a single, rapid oscillation of the tonus, or its multiple variations, and (2) oscillations of the tonus without peristaltic movements.

Kymographic studies offer the opportunity of exact physicomathematical investigation of the peristalsis. The shape of the curves, their length, amplitude, frequency, and velocity of propagation can be studied.

Individual variations of the gastric motility, which depend upon constitutional factors, should not be mistaken for pathologic dystonia.

A circumscribed hypertonus and hyperperistalsis confined to the antrum may be observed in patients with chronic appendicitis. This is an example of the value of kymographic studies. A relative immobility of the gastric pylcae is observed in individuals suffering from hypertrophic gastritis. Absence of peristalsis at the site of an ulcer, local spasm, and the presence of a niche are characteristic for this condition. Kymography is particularly valuable for the detection of scirrhus carcinoma because it visualizes the alterations of the gastric motility much better than the customary roentgenograms.

JOSEPH K. NARAT, M.D.

**An Analysis of X-Ray Findings in 405 Cases of Benign Gastric and Pyloric Ulcer** WALTER A. RUSSELL, SYDNEY WEINTRAUB, and HAROLD L. TEMPLE. *Radiology*, 1948, 51 790

The authors state that the primary purpose of their study was (a) to determine the most frequent sites of benign gastric ulcers, and (b) to discover the reasons for the differences in location as reported by the radiologist, the surgeon, and the pathologist. The material consists of 429 gastric and pyloric ulcers in 405 patients.

The confusion that exists in the anatomical terminology of the component parts of the stomach is pointed out and suggestions for standardization are made. A diagram is included. The term "antrum" is applied by the authors to that portion of the stom-

ach between the incisura angularis and the pylorus, the distal 2.5 cm of this area being called the prepyloric area. The word "pylorus" is applied only to the aperture between the stomach and duodenum. Use of the terms "parapyloric" and "juxtapyloric" ulcer is deplored.

The contradictory reports on the incidence of pyloric ulcers could be avoided by accepting the following criteria: "(a) lengthening of the pyloric sphincter (wide interval), (h) distortion of the pyloric sphincter (crooked stem), (c) a niche, usually small, located within the elongated canal."

Most of the discrepancies between surgical and radiological localization of the ulcer occurred in the region of the pylorus. The authors believe that relaxation due to anesthesia, the variation in the course of the pyloric vein, and distortion by adhesions place the surgeon at a disadvantage as compared to the radiologist since, during his examination, there is a distinct dividing line between the stomach and duodenum. The results of surgical and radiologic localization are compared in 198 cases in which operation was performed a few days following roentgen examination. There was agreement in 135 cases and disagreement in 22 cases, in 9 of which the roentgen localization was verified by the pathologist, whereas the surgical localization was verified in only 1 case. In 30 cases the ulcers were not localized by surgery.

Of the 429 ulcers, 64.8 per cent occurred on the lesser curvature of the body, including the region of the incisura angularis, 8.2 per cent were prepyloric, 18.9 per cent occurred at the pylorus, 7.5 per cent were in that portion of the antrum proximal to the prepyloric area. Two ulcers were in the fundus.

The size of the ulcer was determined in 310 cases, 88.7 per cent of these ulcers were found to measure less than 2.5 cm, and 11.3 per cent (35) were 2.5 cm or larger. Of these 35, 26 were proved benign and 5 others were followed up medically for 5 years or longer.

A comparison of medical and surgical treatment showed that good results were obtained in 92.1 per cent of patients who were treated by gastric resection as compared with 40.8 per cent of patients who were treated medically.

PAUL R. NOBLE, M.D.

#### X-Ray Observations Before and After Vagotomy

WARREN W. FUREY, *Radiology*, 1948, 51: 806

The current literature with regard to vagotomy is discussed. The controversial reports of the efficacy of this operation in the treatment of peptic ulcer are mentioned, and a summary is given of the results of vagotomy in 40 cases.

Patients were observed for a period of 5 years, with follow-up examinations at from 6 to 18 months postoperatively. The transabdominal approach was used in 30 cases and the transthoracic route in 10 cases. The average duration of symptoms was 10 years.

Ten patients registered "minor" complaints postoperatively, in 3 patients the operation was considered a failure because of recurrence of symptoms.

The striking discrepancy between roentgen findings and symptoms postoperatively is pointed out. Persistent deformity of the duodenum or ulcer niche, absence of peristalsis, and marked retention were repeatedly observed postoperatively in patients who had no symptoms. Because of these complications, the authors believe that more time is necessary for a complete evaluation of the method.

Twelve cases are reported.

PAUL R. NOBLE, M.D.

#### The Diagnosis of Internal Genital Tuberculosis in the Male by Roentgenograms

(Die Diagnose der inneren männlichen Genitaltuberkulose im Roentgenbild) WERNER STAEHLER, *Helvet. chir. acta*, 1948, 15: 476

On the basis of his experience with more than 300 vesiculographies and urethroographies for various diseases of the genital system, the author believes that the extent of dissemination of tuberculosis in the inner genitalia in the male can be determined with a certain degree of accuracy by means of roentgenograms. The technique of vesiculography is described and the x-ray findings are illustrated.

It is possible to demonstrate early changes in the seminal vesicles, vas deferens, and ampulla, and also in the prostate gland by this means. However, small foci in the prostate may not be revealed. It is possible to determine whether the tuberculous process is unilateral or bilateral, and to carry out operative measures to meet the individual problem. The author found that internal dissemination is frequently unilateral and can be checked by operative intervention.

JOHN L. LINDQUIST, M.D.

#### The Evaluation of the Lesser Circulation as Portrayed by the Roentgenogram

WALTER WASSON, *Am. J. Roentg.*, 1949, 61: 30

Until recently, investigations of the lesser circulation have been carried out by physiologists and through animal experimentation. A thorough knowledge of chest anatomy, physiology, variations, and diseases is essential for a final evaluation of the lesser circulation.

Chest films should be taken in deep inspiration. A chest film, in expiration, will serve to demonstrate emphysema. All film exposures should be taken no slower than one-twentieth of a second, or the heart and vessel motion will cause a blurring of the image. Multiple views frequently are necessary in order to show the many anatomical structures.

Right ventricular enlargement is a late manifestation of increased tension within the lesser circulation. The ratio of thickness of the right to left ventricular wall may be used to calculate lesser circulation pressure, provided the greater circulation pressure is known.

Pulmonary arteries under pressure become dilated and pulsate—"hilar dance." Lymph stasis or edema displaces air from air sacs and is characteristic of increased lesser circulation pressure, capillary permeability, or lymph stasis.

Most lesions of the lesser circulation are secondary to other chest diseases. There are four main classes of disease of the lesser circulation (1) heart disease, (2) vascular sclerosis, arteriovenous fistula, emboli, tumors, and allergic response, (3) pulmonary fibrosis, tuberculosis, cor pulmonale, or any pulmonary disease which may secondarily interfere with lesser circulation, and (4) deformity of the thoracic cage, obesity, postoperative or posttraumatic chest changes

MAURICE D SACHS, M D

**Studies on the Harmful Effects of Thorotrast on the Tissues** (Untersuchungen ueber die gewebeschaedigende Wirkung des Thorotrast) WERNER WACHSMUTH. *Chirurg*, 1948, 19 390

A 28 year old medical student was injured in the left temporal region by a shell splinter. A brain abscess developed with cerebral prolapse and osteomyelitis of the temporal bone. A well known neurologic surgeon injected thorotrast percutaneously into the carotid artery, evidently there was some paravascular spilling, for there subsequently developed at the spot a small apple-sized, dense, nonsensitive tumor. The arterial pulsations on that side could not be felt and the patient complained of dizziness, visual disturbances, fainting sensations, tinnitus, and sweating attacks.

Operation disclosed a much more extensive process than was at first presumed. The dense connective tissue masses enveloped the common carotid artery from the region of the clavicle to the point of arterial bifurcation in the neck. The cicatricial masses were removed and the artery began to pulsate again, however, it seemed peculiarly inelastic and thickened. Nineteen days after the operation profuse bleeding developed from the artery and the clavicle had to be cut in order to find a place, low down, where the ligature would not cut through the arterial wall.

It was on the thorotrast-infiltrated tissues removed at these operations that the physicist Kulenkampff made his measurements of the gamma radiations of the thorium in the thorium dioxide contained in this preparation. Although the best apparatus was not available for this type of work, nevertheless, by comparing the results of the measurements of the infiltrated tissue in an ionization chamber, and making allowance for every known source of error, he was able to show that the thorium in these tissues was giving off ten times the irradiation permitted as the minimum for safety.

The roentgenologic examination showed the extensive infiltration of the thorotrast not only locally in the cicatricial tissues but also in the lymph glands, within the walls of the carotid artery and, eventually, in the spleen. From these observations the author concludes that thorotrast as a means of demonstrating the blood vessels is contraindicated, unless the patient has no more than a few years to live anyhow, and that percutaneous injection of the material, when a certain amount of pervascular spilling cannot be avoided, is absolutely contraindicated in any case.

JOHN W BRENNAN, M D

**Concerning Thorotrast Injuries and the Sarcoma Peril of Thorotrast** (Ueber Thorotrastschaeden und Thorotrastsarkomgefahr) K H BAUER. *Chirurg*, 1948, 19 387

The first article in condemnation of thorotrast used as a contrast material appeared in 1943 (*Chirurg*, 1943, 15 204). Recently, Kuhlendahl, in this same journal (*Chirurg*, 1948, No 9) has defended its further use but "under strictest indications," because of its allegedly great scientific usefulness in the past and the absence of positively proved injury to the human being. Stimulated by this article, the author feels impelled to publish what further proofs he now has in support of his previous contentions.

In the first place the author does not think that the scientific usefulness of thorotrast in the past has been so great. It has been proved that, experimentally at least, every length of wave from the ultraviolet on down to the gamma waves has a carcinogenic action, and that thorotrast itself increases the list of approximately 300 cancerogenic novae. Experience in general, including the author's own, teaches that in 90 per cent of the instances in which the preparation is used, such employment is unnecessary and that in the remaining 10 per cent it can be replaced by something else. Finally, it is insisted that thorotrast is harmful even to the human being and such harm grows progressively with the passage of time.

That this contrast medium is harmful to man has been shown by the figures from the author's own service at Heidelberg, where in the past 5 years 35 cases of thorotrast injury of the severest type have been demonstrated. Now the demonstration of the actual production of a sarcoma of the liver has been made by MacMahon, Murphy, and Boates (*Am J Path*, 1947, 23 585). Karcher had already shown the carcinogenic action of this chemical in mice, rats, guinea pigs, and rabbits, the latent period ranging from 9 to 39 months, in the human being the comparable period would be from 12 to 18 years. It is just 12 years since the medium was used in the American case, just cited. Therefore, the cumulative effects of the preparations used during all the years since 1933, when they began to gain wide recognition, may now be expected to appear. This prospect creates a problem for the future, and it is peculiarly a German problem since in other countries, notably the United States in 1932, thorotrast was openly condemned. This problem is designated the iatrogenic thorotrast problem.

As regards the question as to what is to be done about this condition of affairs, the work of the physicist Kulenkampff is cited. He proves that the irradiation effect of thorotrast amounts to about 6 roentgens daily, which is about ten times the minimal safe dosage for the contiguous tissues. From this it develops that any further irradiation (as recommended by some authors for the combating of thorotrast injury) would only add to the burden of such tissues. Jacob and Wachsmann (*Klin Wschr*, 1948, 26 20) have shown that under the usual conditions

in which thorotrast has been used, the further irradiation of its deposits would increase the effects to as much as 50,000 roentgens, and such a procedure would not be therapy but syncarcinogenesis.

It is therefore contended that not only should thorotrast disappear from use as a contrast medium but discussions concerning its merits and demerits should cease. "What will the world think of German medicine when it sees in the medical periodicals that this preparation is still being used for 'neurographies,' 'spermatographies,' 'mammographies,' 'pulmo-radiographies,' and all the other kinds of 'graphies'?" To say that one has not seen any complications from roentgenography with thorotrast and that others have not observed any serious complications is begging the question. The drug is at first well tolerated, herein lies its curse. It is the late injuries that one must consider the thorotrast granuloma, the injury to the liver, spleen, lymph glands, vascular system (perivascular granulomas), and the blood-forming organs, and, finally, the danger of sarcoma.

Certainly, thorotrast should not be used as a contrast medium without the express consent of the patient.

JOHN W. BRENNAN, M.D.

**Should We Continue to Use Thorotrast for Angiographic Purposes** (Darf das Thorotrast zur Angiographie heute noch angewandt werden)? HANS KUHLEDAHL *Chirurg*, 1948, 19: 396

Since the work of Ruland (*Chirurg*, 1947, 17:18-540) the question is no longer whether it is wise to use thorotrast for angiography of the cerebral vessels, but whether it is ethical for the physician to use the preparation at any time. Neurologic surgery, for which this contrast medium was used most extensively, can hardly be thought of as existing in its present form without the aid of this most valuable adjunct. It is true that thorotrast is not the ideal medium, and with the advent of a better one it will without question be discarded. This better medium can be confidently expected to appear in the not too distant future. Vasoselectan is now in the experimental stage. Perabrodil is not a solution of the problem.

Ruland's work has not succeeded in proving a sarcomatous change in the tissue of his experimental animals, and his conclusions as to such a possibility are therefore hypothetical in character. It should be emphasized ever anew that the value of thorotrast in the fields of research and practice has, up to the present, been of enormous consequence, and such value has not as yet been challenged by any incontrovertible proof that its skilful and intelligent use (in the percutaneous injection method, and, for instance, in hepatography) has been harmful to the human subject.

The argument concerning the long latent period before the irradiations effect their harmfulness does not apply, at least not in the matter of arteriography in the diagnosis of brain tumors. Is not the lack of diagnostic certainty in such conditions as cerebral aneurysm or expanding growths within the skull

even more harmful, even more an immediate threat to life than the hypothetical injuries of thorotrast? Merely to cite one instance when preliminary arteriography leads to correctly timed interruption of the vascular supply of a bloody meningioma and thus lowers the operative mortality essentially, the use of thorotrast surely is justified.

It is true that the alarming reports from the studies of Ruland demand that only an absolutely certain intravascular application of the medium is permissible, that the huge quantities used in hepatographies and lenographies be proscribed, that the preparation not be used in tests of the efficacy of the circulation such as those carried out on the peripheral vessels of the extremities, that any injected quantity be limited to not more than 14 to 20 c.c., and that thorotrast not be used (as far as possible) in young adults and children. However, in patients with a life expectancy which does not exceed the hypothetical latent period the advantages of thorotrast should not be underestimated.

JOHN W. BRENNAN, M.D.

**The Role of Irradiation in the Management of Carcinoma of the Breast** EUGENE P. PENDERGRASS and DAVID KIRSH *Radiology*, 1948, 51: 767

By the inclusion of 406 cases of carcinoma of the breast which were seen during the period from 1932 to 1939, the authors have brought up to date a survey of the cases seen in the Radiologic Clinic of the University of Pennsylvania since 1902. Previous communications included 387 cases seen from 1902 to 1931.

The material is classified according to Steintal's plan, which was used previously, although the authors express preference for Portman's classification as well as his "criteria of curability."

A definition of terms is included. The criteria for operability and inoperability set forth by Haagensen and Stout are recommended. "Prophylactic irradiation" is a term reserved for radiation over areas of lymphatic drainage in which there is no evidence of metastasis.

The technique of irradiation for six periods of time is given in detail.

Of the 406 patients whose cases are reported, 350 were treated surgically, 188 received postoperative roentgen irradiation to the operative site and lymph node areas, while 162 received no irradiation except when metastatic or recurrent disease developed. Irradiation alone was used in 56 cases because (1) the lesion was inoperable, (2) there was some medical contraindication, or (3) surgery was refused.

Ten tables listing the 5 year survivals according to successive periods, Steintal's classification, age group, type of treatment, and effect of metastases, are included. These were subjected to statistical analysis, and the authors concluded that the reported increase of 26 per cent in the 5 year survival rate from 1902 to 1931, to 42 per cent from 1932 to 1939 is statistically significant. They attribute this to improved treatment, both surgical and radiological.

They believe that lesions are seen earlier and that better selection of cases suitable for operative care is being exercised

A comparison of the survival time of patients who received only surgical treatment with that of patients who received postoperative irradiation showed no significant difference regardless of whether the contralateral side was irradiated as well as the side operated upon. This is also true of cases compared as to histological evidence of axillary metastases. Irradiation further fails to influence the development of metastases or recurrence.

Pleural effusion developed in 26 patients, 14 of whom had received previous irradiation. Sixteen (4%) patients had herpes zoster. Nontoxic goiter was observed in 9 patients and toxic goiter in 12, 13 of the 21 survived more than 5 years. A second primary cancer occurred in 20 (4%) of these patients. The lesions were distributed over ten locations, and in only one case did the lesion appear in the opposite breast 11 years after the previous mastectomy.

The authors used x-ray castration in 38 patients after the appearance of metastatic disease. They believe that this method of castration should be used only at that time.

Lymphedema of the arm developed in 59 (34%) of the patients, 34 of whom had received irradiation.

The authors state that at the present time irradiation in the management of carcinoma has been relegated to a palliative role. Suggestions pertaining to the treatment of bone pain, dyspnea, cough, and pleural effusion due to metastasis, are presented.

In summary, the authors state that no significant improvement was observed in the 5 year survival rate which could be attributed to postoperative irradiation, and that there appears to be a relatively high incidence of herpes zoster which probably is due to metastatic involvement of the spinal ganglion.

PAUL R. NOBLE M D

#### Intravaginal Roentgen Therapy in Cancer of the Cervix Uteri GRAY H. TWOMBLY and J. ALLEN CHAMBERLIN *Radiology*, 1949, 52 14

The authors present the results of treatment of cancer of the cervix in 104 of 113 patients treated at the Memorial Hospital, New York. In these patients intravaginal x-ray radiation was substituted for intravaginal radium application in a "bomb" placed against the cervix.

During 1943 and 1944, four treatments of 500 roentgens each, total 2,000 roentgens, were given directly to the cervix, usually through a cone 4 cm. in diameter. The fornices were treated with a small cone 3 or 3.5 cm. in diameter, which gave 750 roentgens at each treatment for four treatments, or a total of 3,000 roentgens to each area. The tube was directed outward at an angle of 30 degrees. Effort was made to avoid overlapping. The factors used were 120 kv., 3 mm. of aluminum filter, and 25 cm. target-skin distance. The intravaginal treatments were given simultaneously with divided dose external roentgen therapy and were followed by the

intracervical application of radium for 3,000 hours.

The use of intravaginal cones for roentgen therapy in cancer of the cervix has three obvious advantages. It gives a more uniform distribution of radiation, does radium and gives it directly to the lesion without passing it first through normal tissue which lessens the quality and diminishes the quantity. It irradiates quite effectively the parametria and the pelvic lymph nodes, and it can be done in such a fashion that the irritation and permanent changes which are usually produced in the bladder and rectum by large quantities of external roentgen therapy are avoided to a great extent.

The 3 year or longer survival was obtained in 10 patients, or 36.5 per cent, these patients were entirely free of cancer. This 3 year salvage is as good or better than previous 3 year figures obtained with other forms of therapy in this clinic.

The authors' experience has shown that the quantity of irradiation in intravaginal cone therapy can be increased considerably over the amounts previously given, when the external therapy and radium are kept constant. At present, patients are receiving 750 roentgens to each of three vaginal cones, the factors being 250 kv., 55 cm. target-skin distance and 2 mm. of copper, half value layer.

FRANK L. HUSSEY, M D

#### Review of 10 Years Experience with Transvaginal Roentgen Therapy RALPH M. CAULK. *Radiology*, 1949, 52 26

The author analyzes the results of treatment of 100 unselected patients at Warwick Clinic (Washington, D. C.) with carcinoma of the cervix in whom the treatment was an absolute 5 to 10 year survival of 35 per cent. Of this series of patients, 79 per cent received transvaginal roentgen therapy either alone or supplemented by radium, external roentgen therapy, or both. Two pieces of x-ray apparatus were employed for the transvaginal therapy. One machine operated at 140 kv. (peak), with 8 ma., 3 mm. of aluminum filter (added), half value layer, 3.85 mm. of aluminum. The anode-cervix distance varied from 24 to 28 cm. The other machine operated at 220 kv. (peak), with 5 ma., 0.5 mm. of copper filter (added) half value layer equivalent to 1.0 mm. of copper. The anode-cervix distance varied from 37 to 41 cm. The anode-cervix distance and the size of the irradiated field varied with the length and diameter of the speculum and the diameter of the master cone aperture.

With the patient in the lithotomy position the cervix was exposed to the x-rays by use of a Ferguson speculum. No effort was made to direct the beam to either of the fornices or the parametria. The introitus was adequately protected. A daily dose of 800 roentgens were given. The total dose varied from 5,000 to 8,000 roentgens. In the early cases which were considered suitable for transvaginal therapy only, many received small doses of external radiation (from 50 to 100 roentgens). This has since been abandoned. The



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PAUL R. NOBLE, M.D.

#### Intravaginal Roentgen Therapy in Cancer of the Cervix Uteri. GRAY H. TWOMBLY and J. ALLEN CHAMBERLIN. *Radiology*, 1940, 52, 14.

The authors present the results of treatment of cancer of the cervix in 104 of 113 patients treated at the Memorial Hospital, New York. In these patients intravaginal x-ray radiation was substituted for intravaginal radium application in a "bomb" placed against the cervix.

During 1943 and 1944, four treatments of 500 roentgens each, total 2,000 roentgens, were given directly to the cervix, usually through a cone 4 cm in diameter. The fornices were treated with a small cone 3 or 3.5 cm in diameter, which gave 750 roentgens at each treatment for four treatments, or a total of 3,000 roentgens to each area. The tube was directed outward at an angle of 30 degrees. Effort was made to avoid overlapping. The factors used were 120 kv, 3 mm of aluminum filter, and 25 cm target skin distance. The intravaginal treatments were given simultaneously with divided dose external roentgen therapy and were followed by the

intracervical application of radium for 300 hours.

The use of intravaginal cones for roentgen therapy in cancer of the cervix has three characteristics: it gives a more uniform distribution of radiation; it gives radium and gives it directly to the lesion, without passing it first through normal tissue; it intensifies the quality and diminishes the quantity of radiation. It irradiates quite effectively the parametral and the pelvic lymph nodes, and it can be used in such a fashion that the irritation and hemorrhages which are usually produced in the vagina and rectum by large quantities of external roentgen therapy are avoided to a great extent.

The 3 year or longer survival was obtained in 10 patients, or 36.5 per cent; these patients were entirely free of cancer. This 3 year salvage rate is as good or better than previous 3 year figures for all other forms of therapy in this clinic.

The authors' experience has shown that the intensity of irradiation in intravaginal cone therapy can be increased considerably over the amount previously given, when the external therapy and radium dose is kept constant. At present, patients are receiving 750 roentgens to each of three vaginal cones, the factors being 250 kv, 55 cm target-skin distance, and 2 mm of copper, half value layer.

FRANK L. HESSER, M.D.

#### Review of 10 Years Experience with T. Roentgen Therapy. RALPH M. CAULK. *Radiology*, 1949, 52, 26.

The author analyzes the results of treatment of 100 unselected patients at Warwick Clinic (Washington, D.C.) with carcinoma of the cervix in whom L.D.C. was an absolute 5 to 10 year survival of 35 per cent. Of this series of patients, 79 per cent received intravaginal roentgen therapy either alone or supplemented by radium, external roentgen therapy, or both. Two pieces of x-ray apparatus were employed for the transvaginal therapy. One machine operated at 140 kv (peak), with 8 ma, 3 mm of aluminum filter (added), half value layer, 3.85 mm of aluminum. The anode-cervix distance varied from 24 to 28 cm. The other machine operated at 220 kv (peak), 10 ma, 0.5 mm of copper filter (added) half value layer equivalent to 1.0 mm of copper. The anode-cervix distance varied from 37 to 41 cm. The anode-cervix distance and the size of the irradiated field varied with the length and diameter of the speculum and the diameter of the master cone aperture.

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presented are based on transvaginal roentgen delivered at 200 kv p  
indications consisted of bowel reactions, of the cervix, vulvar and vaginal ne- h, and vaginal atresia. The author con- transvaginal roentgen therapy is an ideal r local cervical radium application in all h it can be practically applied

FRANK L. HUSSEY, M D

## RADIUM

and Late Results of Intracavitary Rad-  
therapy for Malignant Lesions of the Cer-  
RERRY H. BOWING *Radiology*, 1949, 52 1

or presents data prepared by the Division  
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of the lesion was recorded in 2,146 cases  
stage I (lesions confined to cervix), 13  
stage II (moderate local invasion), 143  
stage III (extensive local invasion), 661  
stage IV (massive local invasion), 184 per  
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main, the initial radium therapy employed  
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can tube containing 50 mgm of radium sul-  
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given by a course of roentgen therapy from a  
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days for the average lesion of stage III.  
Survival rates, according to the stage of  
the lesion, were as follows: 58.8 per cent  
for lesions of stage I, 65.3 per cent for lesions  
of stage II, 33.7 per cent for lesions of stage III,  
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for lesions (previous treatment elsewhere),  
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The treatment of choice in the management of the  
stage III, stage IV, selected stage I, and most stage  
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## MISCELLANEOUS

Carcinoma of the Cervical Stump WILLIAM E.  
COSTLOW *Radiology*, 1949, 52 41

The author reviews 165 cases of carcinoma of the  
cervical stump seen at the Los Angeles Tumor In-  
stitute, Los Angeles, California, between 1922 and  
1947. During this period 1,906 cases of carcinoma of  
the cervix were seen. The incidence of carcinoma of  
the stump is thus 8 per cent of the total of 2,071  
cases. In 63 of the 165 cases, cancer occurred in the  
first 2 years after supravaginal hysterectomy and  
probably should not be classified as true carcinoma  
of the cervical stump. In the remaining 102 cases  
the condition was probably true carcinoma of the  
stump, an incidence of 4.9 per cent of the total num-  
ber of cervical cancers for the 25 year period.

Radium and x-rays were used in combination  
in the treatment of practically all patients. The  
total dosage of radium varied from 4,000 to 5,000  
mgm hours. The roentgen therapy was usually  
begun immediately following the radium cycle. From  
1922 to 1934, from 180 to 200 kv were used. Since  
then from 450 to 500 kv have been employed. The  
amount of therapy has varied from a tissue dose of  
from 3,000 to 5,000 roentgens to the midpelvis.

A 5 year survival of 32.5 per cent was obtained as  
shown by the records of 114 of the 168 cases. Of the  
patients, 18 per cent were alive with disease after  
5 years, and 30.5 per cent were alive without evidence  
of disease. The necessity of thorough examination  
of the cervix and uterine canal before supravaginal  
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FRANK L. HUSSEY,



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PAUL R. NOBLE, M.D.

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The use of intravaginal cones for roentgen therapy in cancer of the cervix has three obvious advantages: it gives a more uniform distribution of radiation than does radium and gives it directly to the lesion without passing it first through normal tissue which softens the quality and diminishes the quantity; it irradiates quite effectively the parametrial tissues and the pelvic lymph nodes, and it can be directed in such a fashion that the irritation and permanent changes which are usually produced in the bladder and rectum by large quantities of external roentgen therapy are avoided to a great extent.

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The authors' experience has shown that the quantity of irradiation in intravaginal cone therapy can be increased considerably over the amounts herein given, when the external therapy and radium dosage is kept constant. At present, patients are receiving 6 times 750 roentgens to each of three vaginal fields, the factors being 250 kv, 55 cm target-skin distance, and 2 mm of copper, half value layer.

FRANK L. HUSSEY, M.D.

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# PHYSICOCHEMICAL METHODS IN SURGERY

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The complications consisted of bowel reactions, local necrosis of the cervix, vulvar and vaginal necrosis, or both, and vaginal atresia. The author considers that transvaginal roentgen therapy is an ideal substitute for local cervical radium application in all cases in which it can be practicably applied.

FRANK L. HUSSEY, M D

## RADIUM

**Immediate and Late Results of Intracavitary Radium Therapy for Malignant Lesions of the Cervix**  
vix HARRY H. BOWING *Radiology*, 1949, 52: 1

The author presents data prepared by the Division of Biometry and Medical Statistics of the Mayo Clinic, concerning patients with malignant disease of the uterine cervix treated at the Clinic by irradiation during the period from 1915 through 1944.

During the period of inquiry, 3,798 patients received various types of radium treatment. Of these, 2,246 (59.1 per cent) received initial radium therapy and supplemental roentgen therapy, and they are the patients chiefly considered in this discussion.

The stage of the lesion was recorded in 2,146 cases as follows: stage I (lesions confined to cervix), 13 per cent; stage II (moderate local invasion), 14.3 per cent; stage III (extensive local invasion), 66.1 per cent; stage IV (massive local invasion), 18.4 per cent of the classified group.

In the main, the initial radium therapy employed may be defined as an intensive broken-dose procedure, designed for cure or palliation, applied in a rather brief period. To give the radium, the American type of tube containing 50 mgm of radium sulfate (element) was employed, and treatment was supplemented by a course of roentgen therapy from a 200-kv installation. The total treatment time is about 21 days for the average lesion of stage III.

Five-year survival rates, according to the stage of lesion, for 1,631 traced cases were as follows: 58.8 per cent for lesions of stage I, 65.3 per cent for lesions of stage II, 33.7 per cent for lesions of stage III, 16.5 per cent for lesions of stage IV, 25.1 per cent for modified lesions (previous treatment elsewhere), and 42.2 per cent for a small group in whom the

stage of the lesion was not recorded. The 5 year survival rate for all patients traced was 32.8 per cent.

For various reasons, about 2 per cent of the patients referred to the Section on Radium Therapy were not treated. The hospital mortality was in the range of 1 per cent.

The treatment of choice in the management of the stage III, stage IV, selected stage I, and most stage II malignant lesions of the uterine cervix is well planned radium and roentgen therapy.

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FRANK L. HUSSEY, M D



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For various reasons, about 2 per cent of the patients referred to the Section on Radium Therapy were not treated. The hospital mortality was in the range of 1 per cent.

The treatment of choice in the management of the stage III, stage IV, selected stage I, and most stage II malignant lesions of the uterine cervix is well planned radium and roentgen therapy.

## MISCELLANEOUS

**Carcinoma of the Cervical Stump** WILLIAM E. COSTOLOW *Radiology*, 1949, 52: 41

The author reviews 165 cases of carcinoma of the cervical stump seen at the Los Angeles Tumor Institute, Los Angeles, California, between 1922 and 1947. During this period 1,906 cases of carcinoma of the cervix were seen. The incidence of carcinoma of the stump is thus 8 per cent of the total of 2,071 cases. In 63 of the 165 cases, cancer occurred in the first 2 years after supravaginal hysterectomy and probably should not be classified as true carcinoma of the cervical stump. In the remaining 102 cases the condition was probably true carcinoma of the stump, an incidence of 4.9 per cent of the total number of cervical cancers for the 25 year period.

Radium and x-rays were used in combination in the treatment of practically all patients. The total dosage of radium varied from 4,000 to 5,000 mgm hours. The roentgen therapy was usually begun immediately following the radium cycle. From 1922 to 1934, from 180 to 200 kv were used. Since then from 450 to 500 kv have been employed. The amount of therapy has varied from a tissue dose of from 3,000 to 5,000 roentgens to the midpelvis.

A 5 year survival of 32.5 per cent was obtained as shown by the records of 114 of the 168 cases. Of the patients, 18 per cent were alive with disease after 5 years, and 30.5 per cent were alive without evidence of disease. The necessity of thorough examination of the cervix and uterine canal before supravaginal hysterectomy is indicated. Adequate radiation treatment is essential, but care must be taken to avoid rectovaginal and vesicovaginal fistulas.

FRANK L. HUSSEY, M D

## MISCELLANEOUS

### CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

#### Bacteriological Analysis of Plaster Bandages L GREENBERG *Canad M Ass J*, 1949, 60 4

A fatal case of tetanus resulting from contamination of the wound by a plaster cast led to an investigation of plaster of paris bandages taken from all parts of Canada

In all, 194 bandages of this type were taken from 75 hospitals and 43 commercial distributors. These bandages represented products of 14 commercial manufacturers and 14 hospitals which made their own bandages. Aerobic and anaerobic culture were made of all specimens, and each anaerobic culture was tested for virulence by inoculation into a guinea pig.

Of the 163 specimens from commercial manufacturers, 111 (68%) were found to harbor anaerobes. Of the 31 specimens prepared by hospitals, 23 (74%) harbored anaerobes. Only one bandage was found to be sterile. There were spore-bearing aerobic bacilli in 177 (91%) of the bandages, many having two or more species. In 108 bandages (56%) *Clostridium welchii* was found, in 18 (9%) *Clostridium sporogenes*, and in 67 (34%) anaerobes of different species.

Further analysis of 7 samples of plaster of paris alone showed these specimens to be heavily contaminated with anaerobes and indicated that this material might be the principal source of contamination of the finished bandage.

BENJAMIN F LOUNSBURY, M D

#### Sterilization of Plaster Bandages M O KLOTZ *Canad M Ass J*, 1949, 60 6

The author of this brief article has summarized his hospital's experience with the sterilization of plaster bandages. Autoclaving of the bandages was found to be impractical because of difficulty in maintaining moisture-free conditions. Because autoclaved plaster was found to have very poor setting and holding qualities, that method of sterilization was abandoned.

By trial and error an effective dry heat sterilization was devised, utilizing the upper shelves of a gas oven at a temperature of 190 degrees C for an hour and a half. The plaster bandages were left in the original containers, unopened. Temperatures of 200 degrees C tended to char the bandage. Thus far, the lower temperature has produced effective sterilization, but the surgeons complain that the plaster sets and dries more slowly than unsterilized plaster. The variability in the quality of the plaster has resulted in some wastage, but all of these disadvantages are much more than offset by the prophylactic value of having surgically sterile plaster over open wounds.

BENJAMIN F LOUNSBURY, M D

#### Dextran as a Plasma Substitute GUNNAR THORSÉN *Lancet*, Lond, 1949, 1 132

Results with the colloid, dextran, which has been used in Sweden since 1943, are reported. The preparation in present use, "Dextran Ph," is a proprietary preparation. It is a 6 per cent solution of the polydispersoid glucose, polymer dextran, in which most of the molecules have been hydrolytically given a molecular weight conforming to that of albumin, with 0.9 per cent of sodium chloride added to it.

Dextran has been given to 5,000 patients and in a few cases up to 4 liters have been given in a single infusion. Total elimination from the body and nontoxicity are reported. Dextran has been found very useful as a substitute for blood and plasma in cases in which an increase in the blood volume or in the colloid osmotic pressure is desired.

WALTER H NADLER, M D

#### Dextran as a Plasma Substitute J P BULL, C RICKETTS, J R SQUIRE, W d'A MAXCOCK, and Others *Lancet*, Lond, 1949, 1 134

It was found possible to prepare dextran with a range of molecular size similar to that of the plasma proteins. The solution was well tolerated as an infusion by man and was not pyrogenic, toxic, or antigenic. After infusion into animals and man such dextran was only slowly removed from the plasma in about a week. British dextran was efficacious as a plasma substitute in cases of burns, and produced a sustained increase in the venous return in patients with surgical shock or hemorrhage. There is still doubt about the ultimate fate of dextran in the body and, therefore, it cannot yet be recommended unreservedly for widespread use. However, in the investigation reported it has not been shown to produce any harmful effect on the tissues, and further investigation is recommended.

WALTER H NADLER, M D

#### The Collateral Circulation J R IFEMONTH J *internal chir*, Brux, 1948, 8 1008

The author emphasizes the importance of maintaining and encouraging the collateral circulation as a part of the treatment of obstructive lesions of the large arteries. The surgeon must be ready from the very beginning to encourage the collateral blood supply and in certain cases to augment it, since his period of usefulness is strictly limited to the critical survival period for each individual tissue after its blood supply ceases to be adequate, a period which varies from a minute or 2 for cerebral tissue to about 24 hours for skin. The possibility of adequate collateral flow depends on the maintenance of adequate blood pressure and on the number and caliber of available collateral vessels. Collaterals function at their best only when they return blood to the main vessels distal to the point of interruption, and the

outlook for nutrition is poor when they merely provide alternative pathways

Pathologic conditions which affect the collateral circulation include arterial spasm. In this connection, Learmonth refers to the observations of MacWilliam on the behavior of living arteries and of segments and strips of excised arteries, and adds his own experiences which show that spasm may occur (1) in an artery of which the extrinsic nerves have been interrupted by spinal anesthesia, (2) in the arteries of a limb in which the peripheral nerves have been interrupted, and therefore the extrinsic nerves of the arterial tree, (3) on arterial puncture through an adventitial coat anesthetized by novocain, at the site of puncture (he has seen spasm extend distally from this point but never proximally), (4) after injury to or exercise of the lower extremity, and (5) in the absence of any local injury. The suggestion is made that the phenomenon of spasm resembles the behavior of the smooth adductor muscle of mollusks, from which it is deduced that the mere relief of vasoconstrictor tone cannot be expected to relax spasm, but that efferent dilator impulses are necessary in addition.

The second factor which interferes with the collateral circulation is consecutive thrombosis, and Learmonth emphasizes that when the possibility of thrombosis is present the immediate treatment of the condition should include the administration of adequate doses of anticoagulant drugs. A further factor influencing the collateral circulation is the previous lodgment of an embolus in diseases such as auricular fibrillation in which multiple emboli are known to occur.

In treatment, nonoperative measures for securing vasodilatation are to be preferred, with sympathectomy as a later possibility to provide against later nutritional disturbances. The measures include rapid restoration of the blood volume, maintenance of adequate blood pressure, avoidance of pain, and the provision of rest and sleep. Ischemic tissues should not be heated but should be maintained at a temperature between 15 and 26°C.

RICHARD KEMEL, M D

**The Effect of Injury on Wound Healing** PH SANDBLOM *Ann Surg*, 1949, 129 305

Using the tensile strength of wounds to evaluate the healing process (as described by Chlumsky), the author attempts to demonstrate a healing-promoting effect caused by a primary wound. His work shows the definite effect of a primary wound on the tensile strength of a subsequently inflicted symmetrical incision—the secondary wound. The healing-promoting effect is apparent within 12 hours after the primary wound is inflicted, reaches a relative plateau between 5 and 25 days, and disappears between 35 and 45 days.

The author believes that both a stronger coagulum and increased fibroplasia are concerned in the greater tensile strength of the secondary wounds as compared to that of the primary. His work also suggests

that the degree of the healing-promoting effect is related directly to the extent of the primary injury.

JOHN H KAY, M D

**Restoration of Grasping Function Following the Loss of All Five Digits** BRADFORD CANNON, WALTER C GRAHAM, and JAMES BARRETT BROWN *Surgery*, 1949, 25 420

A method of restoring grasping function without disturbing normal sensation is described. Closure of the unhealed or scarred stump is accomplished with a direct flap, if possible, or with a free skin graft. Elongation of the thumb is accomplished by transplanting the distal portion of the second metacarpal to the end of the first metacarpal. The remainder of the second metacarpal is removed except for the base.

The last stage consists of the formation of a cleft between the first and third metacarpals, which is done after there is good bony union.

The procedure results in good motion and considerable strength, but depends on the capability of movement of the first metacarpal multangular articulation.

JOHN H KAY, M D

**Tropical Phagedenic Ulcer The Problem of Phagedenism** (A propos de l'ulcère phagédénique tropical Le problème du phagédénisme) M H COSTANTINI *Afrique fr chir*, 1948, No 9-10, 195

The author describes a severe epidemic of tropical ulcer which occurred in Algiers in 1943. Detailed clinical notes made by him and his collaborators were lost so that he was able to present only a general description and discussion in this article.

Tropical ulcer is endemic only in very humid tropical climes of equatorial Africa (Madagascar) and Asia and is not usually seen in Algiers. Most of the afflicted in this tremendous epidemic of 10,000 cases were stevedores and workers at the airport. During the last war, Algiers was the site of very intensive traffic. Goods from the French equatorial colonies were unloaded here in great amount. This fact was probably responsible for the outbreak.

Although it has been known for a long time that a combination of fusiform bacilli in symbiosis with a special kind of Spirochaeta is present in the ulcers, a great many problems have not yet been solved. The ulcer always originates from an insignificant wound or scratch, in most cases on the feet or legs, sometimes on the hands and forearms. It has never been observed on the trunk. It grows with tremendous rapidity and destroys, often within a few days, the subcutaneous tissue, fasciae, and muscles. It often exposes the periosteum and the bone and causes necrosis of the bone. Its borders are undermined and its surface is covered with a thin putrid exudate of a cadaveric odor. Bacteriologic examination of the exudate reveals enormous masses of staphylococci and streptococci in addition to the spirochetes and fusiform bacilli. In spite of this severe infection and the large extent of the ulcer, the general condition is good, the regional lymph nodes

are not affected, and no complications such as gas gangrene, diffuse phlegmon, or septicemia have ever been observed. It is remarkable that these enormous open wounds never bleed. Even in the excision of excessive granulations at the border of the ulcer with the electrocautery, no bleeding takes place.

The patients complain of severe lancinating pains which interfere with their sleep. These pains are the first sign of the affection and often start before the ulcer has developed. They have all the characteristics of sympathetic pains and cease temporarily after lumbar or perifemoral infiltration.

Biopsies taken by the author from the borders of the ulcer revealed that all the arterioles and venules were obliterated. The lumina were closed by thrombi, and the vessels were enclosed by a perivascular inflammatory sheath. Also, the lymph vessels were obliterated. The author assumes that the complete obliteration of all the small blood and lymph vessels accounts for the clinical symptoms: the rapid growth of the ulcer, the relatively good general condition, the absence of lymphadenitis, and secondary infection.

The problem of etiology has not yet been solved satisfactorily. Attempts at producing the ulcer experimentally by inoculation with the spirilla and fusiform bacilli have failed. The author supposes that these organisms can develop only in a wound which is primarily infected by staphylococci or streptococci.

No specific treatment has been found as yet. The topical application of sulfonamides is ineffective. Penicillin was not available to the author in 1943 but more recent publications reported failure with the use of penicillin. Other antibiotics have not been tried.

The routine treatment consists in dressing with Dakin's solution or 1 per cent formalin, the local application of neoarsphenamin powder, electrocauterization of the borders of the ulcer, and repeated radical curettage of the surface. After the infection has subsided, skin grafts are sometimes necessary. However, in most of the cases it is remarkable how fast epithelization and scarring proceed after the infection has cleared up.

WERNER M. SOLMITZ, M.D.

## EXPERIMENTAL SURGERY

**Comparison of the Efficacy of Therapeutic Agents in the Treatment of Experimentally Induced Diffuse Peritonitis of Intestinal Origin.** SANFORD ROTHENBERG, HENRY SILVANI, SPENCER CHESTER, HELEN WARMER, and H. J. MCCORKLE. *Ann Surg*, 1948, 128: 1148.

Fulminating diffuse peritonitis was produced in 93 dogs by dividing the vascular supply to the appendix, ligating the base, and crushing the appendix. The omentum and spleen were removed. Twenty untreated control animals died with acute diffuse peritonitis from bacterial infection with intestinal organisms. The average survival period was 39 hours.

Sulfonamide therapy with (1) intravenous sodium sulfadiazine, (2) intraperitoneal sulfasuxidine, (3) combined intraperitoneal sulfanilamide and intravenous sodium sulfadiazine apparently had no beneficial effect. All died with peritonitis similar to that observed in the control animals. However, the survival period in the sulfanilamide-sulfadiazine group was prolonged to 80 hours.

Streptomycin therapy given intramuscularly or intraperitoneally apparently prolonged the survival period of dogs with experimental appendiceal peritonitis to averages of 75 to 92 hours in 14 out of 15 dogs. One animal survived. However, doses of streptomycin that effectively controlled the organisms in the peritoneal cavity caused death from the toxic effect of streptomycin (apparently on the medullary respiratory center).

Commercially available penicillin given intramuscularly at four-hour intervals daily in doses of 100,000 units, 200,000 units, 500,000 units, and 500,000 units, combined with streptomycin, 24 gm, was definitely beneficial in the treatment of experimental appendiceal peritonitis. All animals receiving 500,000 units of penicillin daily survived.

Penicillin containing 15 to 25 per cent penicillin-x in doses of 100,000 units daily, intramuscularly or intraperitoneally, was effective in the treatment of experimental appendiceal peritonitis. Nine of 10 animals treated intramuscularly, and 2 of 5 animals treated intraperitoneally with penicillin-x recovered.

JOHN L. LINDQUIST, M.D.

# SURGERY

## GYNECOLOGY AND OBSTETRICS

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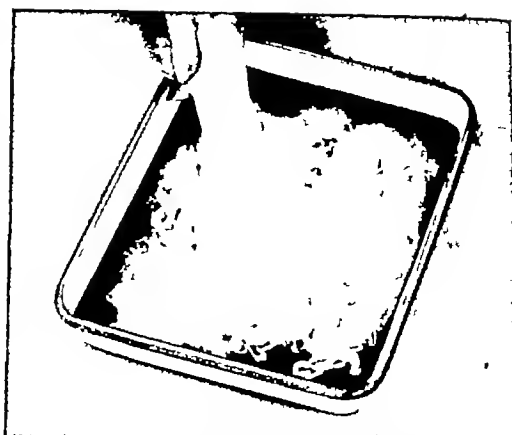
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#### **SURFACE-CHROMICIZING\***

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*\*To illustrate this comparison, small laboratory trays are used. In commercial production, surface-chromicizing is done under tension. Bath processes are performed in large vats.*

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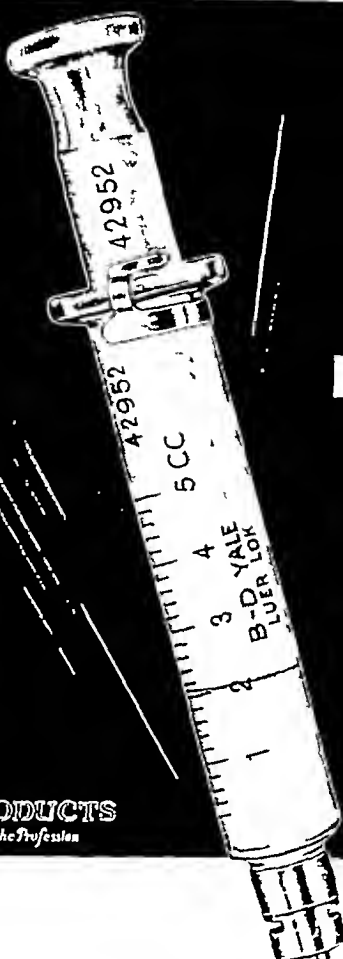
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# SURGERY

## GYNECOLOGY AND OBSTETRICS

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### UNILATERAL PREFRONTAL LOBOTOMY FOR THE RELIEF OF INTRACTABLE PAIN AND TERMINA- TION OF NARCOTIC ADDICTION

JOHN E. SCARFF, M.D., F.A.C.S., New York, New York

IN 1943, Freeman and Watts observed that patients on whom they had performed bilateral prefrontal lobotomy for the relief of psychotic behavior appeared not to suffer somatic pain to the degree normally expected. Subsequently they electively performed bilateral lobotomy in a group of patients without psychotic disturbances, with relief of somatic pain (1, 9, 10).

Bilateral prefrontal lobotomy, however, because of undesirable effects on intellect and personality, could not be generally applied to the relief of pain due to less lethal though incapacitating disorders.

Since the pain-relieving mechanism of prefrontal lobotomy was not understood, it occurred to me that a unilateral procedure might be as effective as the bilateral one. It was my expectation that a unilateral procedure would not affect intellect and personality adversely, since removal of an entire frontal lobe, when necessary for the removal of a tumor, had been found to have only negligible effect (2, 4, 5). In January of 1948, I performed my first unilateral prefrontal lobotomy. In March, I reported in the *Journal of Neurosurgery* (5) 3 cases in which the unilateral procedure had

been performed, with relief of ipsilateral pain in one case, contralateral pain in the second, and bilateral pain in the third. It was observed even then that abrupt termination of the narcotics on which these patients had become dependent prior to operation was followed postoperatively by none of the customary withdrawal symptoms or signs.

In June of 1948, I reported at the annual meeting of the American Neurological Association a series of 10 cases in which unilateral prefrontal lobotomy had been performed for relief of intractable pain (7).

In the recently published *Proceedings of the Association for Research in Nervous and Mental Diseases*, Koskoff, Dennis, Lazovik, and Wheeler in a paper on the psychological effects of prefrontal lobotomy for the relief of pain, report among other cases 2 in which unilateral lobotomy had been performed in August, 1947, with success. They suggested that unilateral lobotomy be tried before the bilateral operation in patients suffering from neoplastic malignancies (3).

My present paper reports 33 cases of unilateral prefrontal lobotomy performed by me for the relief of pain. These are consecutive cases without omission, beginning in January, 1948, and ending in mid-November. The follow-up periods range from 1 month to 10 months.

From the Department of Neurological Surgery, College of Physicians and Surgeons, Columbia University, and the Service of Neurological Surgery, Neurological Institute of New York, Columbia Presbyterian Medical Center, and the Veterans Administration Hospital, the Bronx, New York.

results in relief of pain were good in 66 per cent, fair in 18 per cent, and poor in 15 per cent.

Establishment of rigid criteria for these series presents a problem for the conscious investigator. When is a result "good," when is it "fair," and when is it "poor"? In the very beginning I set up standards as follows: "Good" meant the patient never voluntarily complained and required no narcotics after the operation; "Fair" meant that the patient continued to complain of some pain after operation but required far less medication to be comfortable; "Poor" meant that he had the same degree of pain and required the same amount of narcotic after operation as before. Twenty-two of the 33 patients have met the criteria set for a good result. Their preoperative pain arose from a variety of pathological processes widely distributed throughout the body, including carcinoma of the breast, carcinoma of the jaw, trigeminal neuralgia, atypical facial pain, aneurysm of the thoracic aorta, carcinoma of the pancreas, carcinoma of the bladder, metastatic carcinoma of the long bones, metastases to spine and pelvis, neuritis of the cauda equina, and advanced arthritis (Table I). The results in these 22 cases were 66 per cent of the series have been completely satisfactory. These patients include those with the longest follow-up periods, the average being  $2\frac{1}{2}$  months. One case has followed 5 months, 1 for 8 months, and 1 for 10 months.

Two patients or 15 per cent of the series, obtained completely poor results (Table III). The pathological processes and their sites are just listed in this group as in the group with good results. They include sarcoma of the skull, or sulcus tumor of the lung, metastatic carcinoma of the spine, idiopathic hemicephalalgia, and palindromic rheumatism.

The most conspicuous failure occurred with a sarcoma of the skull, or Schminke's tumor. It wonders whether the unique anatomical features present in this case and not encountered in any of the others, notably stripping of the dura, were responsible for this failure. Not only was the unilateral lobotomy unsuccessful in this patient but a

subsequent lobotomy on the second side failed equally to give relief.

A second type of failure is illustrated by the case of a young man suffering intense pain in the left side of the head associated with a rapidly developing third nerve palsy on that side. In addition, he also complained of a somewhat lesser pain in the distribution of the left cervical plexus. Unilateral lobotomy on this man stopped the intracranial pain but had no effect on the cervical pain. The latter was subsequently entirely relieved by laminectomy and posterior rhizotomy. The reason why the lobotomy relieved the severe intracranial pain but failed to relieve the lesser cervical pain remains unexplained. This is the only case in which a patient with more than one pain was not relieved of all pains equally.

In both of the cases cited, nonrelief of pain was immediate after operation. In the other 3 patients of the "poor" group, immediate relief was later followed by return of pain.

Mrs. A. was a woman suffering intense pain from metastases to the cervical spine from a mammary carcinoma, who was completely relieved by a unilateral prefrontal lobotomy. Bedridden by pain before operation, after operation she left her bed, attended church, and enjoyed a quiet round of activities. Six weeks later fresh metastases to the pleura initiated violent paroxysms of coughing, which induced collapse of the cervical spine. With these new developments, pain again appeared in its original distribution, although much less severe than before the unilateral lobotomy.

Another of the patients with result classified as poor had return of pain after a period of complete relief. This paralleled an increasing compression of spinal roots by a superior sulcus tumor of the lung. These 2 cases bring up one of the major questions regarding the efficacy of unilateral lobotomy: Is the late return of pain due to a gradual "fatigue" of the effectiveness of the lobotomy? Or is the return due to progress of the disease with an increase of pain beyond the point where the barrier imposed by the operation is effective? It is my own feeling that one should regard unilateral lobotomy as introducing a *quantitative* rather than an absolute barrier to the experience of pain, and that if pain increases suf-

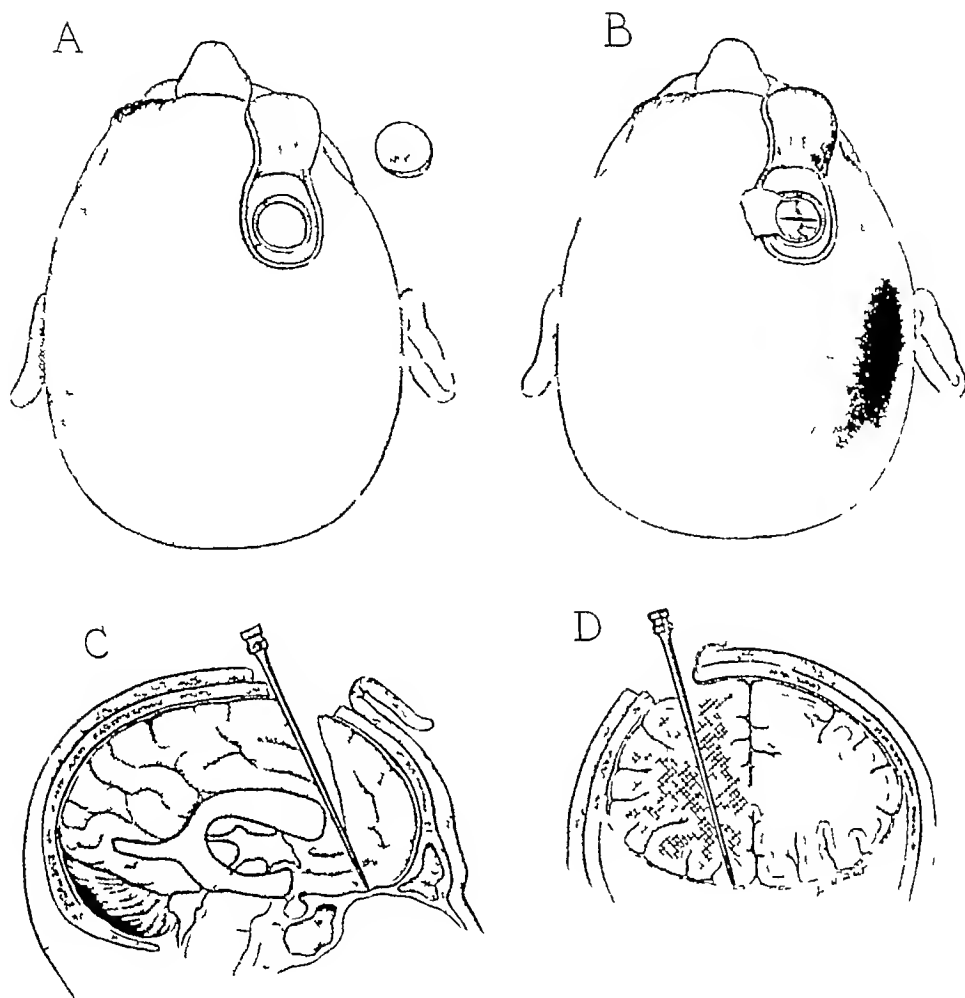


Fig 1 Author's technique for performing unilateral prefrontal lobotomy under direct vision A, Relationship of incision and trephine opening to coronal suture B Cortical incision corresponds approximately to coronal suture C, The anterior tip of the lateral ventricle is located with a ventricular needle, and the plane of section established immediately anterior to it D, In the plane of section, the white matter is divided in radial fashion until grey matter is everywhere encountered

ficiently, it may penetrate this barrier to some degree

In 6 patients, I have classified the results as fair (Table II) Although the empirical criteria of partial relief of pain and reduction in medication seem reasonable, it is often difficult to determine whether individual cases meet these standards Here are 2 examples

General B was a staff officer of the Greek Army A year ago, he was struck by a military vehicle

and suffered avulsion of the left brachial plexus He arrived in this country 4 months later, complaining bitterly of pain in his denervated extremity, and almost a complete invalid from his reaction to the pain He was observed for several weeks in the hospital before lobotomy was performed During that time, he could be interested in no subject other than his pain He lay in bed moaning and groaning, and all efforts to divert his thoughts from himself were futile Yet the very morning after unilateral lobotomy, this patient demanded that the daily papers be translated for him A few days later, he initiated plans for



TABLE I—PAIN—GOOD RESULTS

	Patient	Pathology	Side of pain	Pain relieved on			Dominant or nondominant	Follow-up months
				Ipsilateral	Contralateral	Bilateral		
1	Aaronson	Metastasizing carcinoma skull and pelvis	Bilateral			Bil	N Dom	2
2	Abosch	Carcinoma of tongue	Right	Ips			N Dom	1½
3	Rivera	Carcinoma of tongue	Left	Ips			Dom	1
4	H D	Carcinoma of jaw	Left	Ips			Dom	1½ D
5	W B	Carcinoma of jaw	Right		Cont		Dom	3½ D
6	Bishop	Trigeminal neuralgia	Left	Ips			Dom	3 D
7	Jewett	Atypical facial pain	Right	Ips			N Dom	10
8	Calarino	Atypical facial pain	Left	Ips			Dom	8
9	Larson	Thoracic aneurysm	Left	Ips			Dom	3
10	Redfield	Carcinoma of pancreas	Left	Ips			Dom	3
11	Johns	Carcinoma of pancreas	Right	Ips			N Dom	9 days D
12	Helne	Carcinoma of uterus	Right		Cont		Dom	1
13	Grass	Carcinoma of uterus	Left	Ips			Dom	1½
14	Fajardo	Carcinoma of bladder	Left	Ips			Dom	1
15	Miner	Metastasizing carcinoma humerus	Right	Ips			N Dom	4 D
16	Wilds	Metastases to spine (cervical thoracic, lumbar) and femur	Bilateral			Bil	N Dom	5 D
17	Devine	Metastasizing carcinoma C 7 T 1	Right	Ips			N Dom	2
18	Bozzo	Metastasizing carcinoma T-9	Bilateral			Bil	Dom	1½ D
19	Stiner	Metastases both ilia ischia femora	Bilateral			Bil	Dom	1 D
20	S Rosalie	Arthritis spine	Bilateral			Bil	Dom	1
21	Greenberg	Arthritis cervical	Right	Ips			N Dom	1½
22	Irwin	Neuritis cauda equina	Bilateral			Bil	N Dom	1

flying his children out of Greece and saw that the plans were effectively carried out. He began a vigorous correspondence with his fellow officers in Greece regarding the war. He left the hospital to make patriotic speeches. He visited relatives in the middle west. Finally he secured passage on a plane and returned to Greece, where he resumed his former position in the War Ministry. His wife wrote in November as follows: "The General is much better, very calm, reads hours at a time without complaining of his ailment." A few days later, the General himself wrote "It is impossible for me to bear up. My misfortune is great. I doubt whether anyone else has suffered and is suffering as much as I without any improvement."

How shall we classify this patient? By his own protestations, he is a complete failure. By the account of his wife, and in the light of his activities, he has been vastly improved by his operation. He was classified as fair.

Mr A is a 56 year old employee of the city of New York and works as a legal clerk in the tax division of the department of finance. He has a superior sulcus tumor of the left lung, at present so extensive that it presents as a huge mass in the supraclavicular triangle. He has complete paralysis of all the muscles of the left hand, which is now blue and swollen, and a partial paralysis of many other muscles of the upper extremity. Before lobotomy, this man was a bed patient at the Presbyterian Hospital for 3 weeks because of pain. Since operation, he has returned to his job, working a full 8 hour day, and functioning as efficiently as before operation. Yet this man, with a smiling face tells me that his pain is worse than it was before the operation.

How is he to be classified? An independent study of him recently made by Dr. James Cattell of the Psychiatric Institute states "The pain has been definitely diminished by the operation in view of his present performance."

TABLE II—PAIN—FAIR RESULTS

	Patient	Pathology	Side of pain	Pain relieved on			Dominant or oodominant	Follow up months
				Ipsilateral	Contralateral	Bilateral		
1	Bakopoulos	Phantom limb syndrome	Left	Ips			Dom	7
2	Alleo	Superior sulcus tumor	Left	Ips			Dom	2
3	Kiog	Carcinoma jaw with fractured mandible	Left	Ips			Dom	3
4	Blumberg	Compression fracture T 12 Parkinsonism	Right		Cont		Dom	3
5	Remling	Carcinoma of pancreas	Bilateral			Bil	Dom	3
6	Turner	Neuritis lumbosacral	Bilateral			Bil	Dom	1

TABLE III—PAIN—POOR RESULTS

	Patient	Pathology	Side of pain	Pain relieved on			Dominant or oodominant	Follow up months
				Ipsilateral	Contralateral	Bilateral		
1	Pensata	Schmincke tumor base of skull	Left		Cont		N Dom	7
2	Credico	Hemicephalgia idiopathic	Left	Ips			Dom	5
3	Hellweg	Carcinoma lung cerebral metastases	Right	Ips			N Dom	1½ D
4	Auchincloss	Carcinoma, breast metastases to spine lungs	Right	Ips			N Dom	4 D
5	Young	Palindromic rheumatism	Bilateral			Bil	Dom	3

and his emotional state as objectively viewed " I have therefore classified him as fair

As will be seen from these cases, there is difficulty in evaluating the results in patients who, after operation, still complain of pain but act as if they did not have it

Effort has been made to determine factors responsible for good or bad results. In my earlier series of 10 cases reported in June, it was pointed out that failures to relieve pain had occurred only in those cases in which the lobotomy had been performed on the side of the brain contralateral to the somatic pain, and on the nondominant hemisphere. Although it was recognized that the series was too short to justify any firm conclusions, it was thought that these observations might subsequently lead to significant deductions. As the series has increased, however, these earlier observations have not been confirmed. At present there is no evidence establishing the superiority of the ipsilateral lobotomy, or of lobotomy on the dominant hemisphere.

A standard technique has been employed in all 33 procedures. The lobotomy has been

performed under direct vision, in a plane passing just anterior to the tip of the lateral ventricle, and carried laterally, medially, and ventrally until grey matter is everywhere encountered (6) (Fig 1). If pain is to be relieved by unilateral lobotomy, the lobotomy must be thorough, and this can be accomplished only under direct vision. If performed in this manner, the operation produces amazingly little shock. Many of the patients have been out of bed on the day following operation, and almost all of them by the end of the third postoperative day. Unilateral lobotomy can be safely applied to persons who could not tolerate more difficult technical procedures such as high cervical cordotomy, medullary tractotomy, section of multiple cranial nerves, or mesencephalic tractotomy.

#### EFFECT ON INTELLECT AND PERSONALITY

If unilateral prefrontal lobotomy is to prove a better procedure for the relief of intractable pain than the bilateral operation, it must not only relieve pain, but it must do this without the undesirable effects on intellect and per-

sonality which often accompany the bilateral operation. Postoperative evaluation of the patients in this series has established the fact that unilateral lobotomy characteristically produces no significant alteration in intellect or personality.

Of the 33 patients operated upon, 15 received standard psychometric evaluations both before and after operation. In addition, 9 other patients unable to be tested before operation because of pain received postoperative evaluations. Nine patients were not tested. Only 1 of the 24 receiving postoperative testing had a score as low as "borderline", unfortunately, this patient was one of those whose preoperative suffering was so great that preoperative tests could not be given. On the other hand, 5 patients scored "superior" after operation, and 2 scored "very superior".

Chief interest, of course, lies in the patients who had standard psychometric testing both before and after operation. Of these 15, 11 had no significant differences between their preoperative and postoperative scores. Four showed falls in score, ranging from 13 to 23 points. In each of these, however, there were factors other than the operation which might well have contributed to the lowered score. One of the patients was in the terminal stage of carcinomatosis by the time postoperative testing was done. Another had advancing cerebral metastases, and the 2 remaining had showed strong psychotic tendencies prior to operation.

Of the 15 patients having both preoperative and postoperative psychometrics, there were 6 who had tests done shortly after operation, and then had repeat testing several weeks later. It is of prime significance that every 1 of these 6 patients' second postoperative test showed a substantial gain in score over his first postoperative test. The gains ranged from 10 to 23 points. One of these repeat-test patients was Case 31, a young woman who dropped from a preoperative score of 122 to 107 immediately after operation. However, when tested a second time, 3 weeks after the first postoperative test, her score was 126. This score represents not only a recovery of the lost 15 points, but a gain of 4 points over her preoperative psychometric level. These observations

mean that the patient's intellectual condition after operation is not a static one but a progressively improving one.

An effort was made to determine in what principal categories of intellectual activity significant changes took place following operation. The categories of greatest interest, because of their general acceptance as indices of adult intelligence, are retention of old learning, capacity for new learning, arithmetical reasoning, and social adjustment. On analysis of the 15 patients with preoperative and postoperative testing, we find no characteristic constancy in the categories affected, or in the direction in which they were affected. The retention of old learning was unchanged in any patient. In rate of new learning, there was marked increase in 2 of the patients, moderate increase in 2 others, slight increase in 1, no change in 2, slight decrease in 1, and moderate decrease in 2. Wherever changes were recorded in ability for mathematical reasoning, there was improvement. Only 1 of the 15 patients showed any decrease in social adjustment as evidenced by the Rorschach test. The only conclusion which can logically be drawn from this analysis is that there is no characteristic improvement or impairment in any field of intellectual activity following unilateral prefrontal lobotomy.

Quite apart from these formal scorings, but of no little importance in evaluating the results of this operation, are the opinions of the patient's personality expressed by his friends and relatives after operation. In not a single instance has the comment been made that the patient's personality has suffered. Indeed, in several instances, the family and friends have expressed pleasure over the striking improvement in the patient's general social outlook after operation.

The inevitable conclusion is that the only postoperative change in personality is the change which anyone would experience from being relieved of intolerable pain.

#### TERMINATION OF DRUG ADDICTION

The effect of unilateral prefrontal lobotomy on the termination of drug addiction was entirely unforeseen. It certainly was not a primary objective of the operation, indeed it was

my expectation that patients who no longer needed narcotics to relieve pain after operation would still need them to forestall withdrawal symptoms. However, experience with 15 patients of this series who were addicted to the use of drugs in varying degrees because of pain has shown that unilateral lobotomy permits withdrawal of narcotics without withdrawal symptoms.

The first patient heavily addicted to narcotics operated upon was Mrs R. When admitted to the Neurological Institute in August, 1948, Mrs R. already had extensive carcinomatosis involving liver, bile ducts, and pancreas. For many months prior to operation, she had been receiving  $3\frac{3}{8}$  grains of morphine, plus  $\frac{1}{4}$  grain of dilaudid, every 3 hours. Within 48 hours after unilateral lobotomy, her entire narcotic intake had been reduced to  $\frac{1}{2}$  grain of morphine, every 3 hours. This was accompanied by none of the symptoms and signs usually associated with abrupt reduction of the drug. A note written on the third postoperative day by Dr Rollo Masselink, attending neurologist, reads as follows: "The patient was lying quietly in bed in no apparent distress. There was no evidence of increased perspiration or increased pulse rate, no agitation. When asked if she needed sedative, she replied, 'No, I have a little pain, but it doesn't bother me any'." A letter from her family physician, Dr Robert S. Achlerlev, written 2 months after her operation, reads as follows: "The patient has no pain. She now receives  $\frac{1}{8}$  grain of morphine every 3 or 4 hours, and sometimes only bellergal or sterile hypos. I allow her the comfort of such small doses in view of the advance of the carcinoma." This means that the patient's narcotic intake of 25 grains of morphine, plus an equivalent amount of dilaudid, per day has been reduced to  $\frac{3}{4}$  grain of morphine per day, with the dilaudid entirely stopped.

Another patient, Miss D, was admitted to the Neurological Institute in September, suffering severe pain from metastatic carcinoma to the cervical spine. For many months prior to admission here, she had been receiving 3 grains of morphine, every 3 hours. Immediately following operation, all narcotics were stopped. A note by Dr E. G. Zabriskie of the neurological service on the seventh postoperative day reads as follows: "Seen today in consultation with Dr Scarff. The transformation is remarkable. She is complacent, shows no pain, is proud of the fact that she no longer uses narcotics."

A third patient, Mrs L, was admitted to the Neurological Institute suffering extreme pain in the back from a saccular aneurysm of the thoracic aorta. A letter from Dr S. G. Loman, her referring physician, states that while she had been under his care at the Englewood Hospital, he had been "unable to control her excruciating pain with hypodermic injections of morphine or demerol." Following unilateral prefrontal lobotomy, all narcotics were

abruptly terminated without any of the customary evidences of withdrawal. During her postoperative period in the hospital, this patient never requested further medication for the relief of pain. A letter from Dr Loman, dated October 14th, 2 months after her operation, reported that she was bright and cheerful, without pain, and without need of any analgesic medication.

One patient only in the series of 33 cases had postoperative behavior characteristic of narcotic withdrawal. This lasted for 72 hours and then receded.

Fourteen of the 15 patients with termination of drug addiction had a proved organic basis for the pain which necessitated the medication. One woman, however, deserves special mention because no organic basis for her complaints was ever established.

Case 28 had been under treatment for pain in the thoracic spine for 17 years. During this time, she had had numerous hospitalizations and three spinal fusions, none of which had altered significantly her professed pain. From November, 1946, until her admission to the Neurological Institute in September, 1948, she had been taking either dilaudid,  $\frac{1}{32}$  grain, or demerol, 100 milligrams every 3 hours. If these medications were delayed for even a short time, the patient became highly agitated.

The most careful examination by myself and by special consultants in related fields at this hospital never revealed an organic basis for her pain, nor any objective manifestation of organic disease.

On October 15th, unilateral prefrontal lobotomy was performed. Since that time, this patient has not only not complained of having pain, she has denied having pain. She has never had a single dose of narcotic or analgesic of any sort, nor has she expressed a desire for drugs during these 2 months. Since no organic basis for pain was ever established, it seems probable that the pain was psychogenic, and the drug addiction a primary one.

The value of unilateral prefrontal lobotomy in terminating drug addiction due to pain seems well established. The last case cited gives promise that the operation may have value also in the termination of primary addiction.

The mechanisms by which pain has been relieved and drug addiction terminated in these cases remain obscure. Certainly at this time they are limited to the realms of speculation, and I let the matter rest there.

#### SUMMARY

The results of unilateral prefrontal lobotomy performed for the relief of intractable pain

in 33 patients have been good in 66 per cent fair in 18 per cent, and poor in 15 per cent. In 15 patients of this series having careful psychometric evaluations before and after lobotomy, no significant impairment of intellect or personality could be found. In 15 of 16 patients heavily addicted to narcotics because of pain prior to operation abrupt termination of the narcotic has been effected immediately after operation without withdrawal symptoms. One additional patient, appearing to have a primary narcotic addiction, was likewise cured of her dependence on the drug.

These data indicate that unilateral prefrontal lobotomy is both an effective and an acceptable measure for the relief of intractable pain in many conditions where other measures cannot be applied.

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TABLE III—RESPIRATORY QUOTIENTS WITH BREAKDOWN AND BLOOD CHANGES IN PERIOD OF 24 HOURS DURING WHICH PATIENT RECEIVED ONLY INFUSION OF 1 LITTER OF COMBINED FAT EMULSION

Time hours	0	2	4	7	9	24
Oxygen uptake ml O <sub>2</sub> /min	297	393	432	344		270
Carbon dioxide ml CO <sub>2</sub> /min	215	326	339	264		197
Oxygen uptake liters O <sub>2</sub> /hr	17 82	23 58	25 92	20 64		16 20
Carbon dioxide liters CO <sub>2</sub> /hr	12 90	19 56	20 34	15 84		11 82
Total respiratory quotient	723	830	780	770		730
Nonprotein respiratory quotient	701	830	780	760		706
Percentage of food utilized						
Carbohydrates	0	47 35	22 48	19 22		0
Fat	78 58	36 90	63 04	62 47		76 35
Protein	21 42	15 75	14 48	18 31		23 65
Calories of food utilized						
Carbohydrates	0	53 37	27 58	18 66		0
Fat	64 90	41 60	77 32	78 49		57 3
Protein	17 76	17 76	17 76	17 76		17 76
Total blood lipid mgm per cent	680	790	760	670	750	680
Blood fatty acid mgm per cent	450	560	530	440	520	450
Blood cholesterol mgm per cent	210	200	202	204	208	215
Blood sugar mgm per cent	90	100	105	100	108	104
Pancreatic lipase	+ 1	- 8 5	+ 9 0	+ 2 3	+ 8 6	1 0
Amount infused ml		500	1 000			

ratio was 1.43. The bromsulfalein test showed a 40 per cent concentration of the dye after 5 minutes and a 1 per cent concentration after 30 minutes. The total blood cholesterol was 250 milligrams per cent, the esters were 142 milligrams per cent, and the ester cholesterol ratio was 57 per cent. Roentgenograms of the chest taken at weekly intervals were normal. Microscopic examination of sections of liver stained with hematoxylin and eosin and with osmic acid showed that the capsule was slightly thickened and the liver parenchyma was natural except for a moderate amount of intracellular fat. Occasionally about the portal canals there was a collection of small and large round cells. The bile ducts and sinusoids appeared normal (Fig 2).

CASE 2 H K, a white male, aged 49 years, was transferred from the medical service to surgery with a diagnosis of gastrojejunocolic fistula. Fourteen years ago a posterior gastrojejunostomy was performed for duodenal ulcer. About a year ago he developed a severe diarrhea with 10 to 12 daily movements. Weakness became progressively worse and his weight was reduced from 135 pounds to 90 pounds. He had additional signs and symptoms referable to multiple avitaminosis characterized by polyneuritis and cheilosis. The blood protein at the time of transfer averaged 4.4 grams per cent, albumin was 2.8 grams per cent, globulin was 1.6 grams per cent, and the albumin globulin ratio was 1.7. Physically the patient revealed the characteristic signs of prolonged

TABLE IV—CUMULATIVE NITROGEN STATUS IN A PATIENT RECEIVING INTRAVENOUSLY THE 10 PER CENT COMBINED FAT EMULSION

S P, Group 1, Case 2

Day	Calories from emulsion	Calories from food	Total intake	Nitrogen intake			Nitrogen output			Nitrogen balance
				Food N	Intake emulsion	Total N	Urine N	Fecal N	Total N	
1	1300	905	2205	6 6	6 0	12 6	8 45	85	8 45	+4 15
	1300	1164	464	11 7	6 00	17 70	14 58	1 46	14 58	+3 12
3	1100	1605	005	6 1	6 00	12 10	10 70	1 1	10 70	+1 40
4	1300	4 2	172	2 1	6 00	8 10	3 0	3	3 0	+5 1

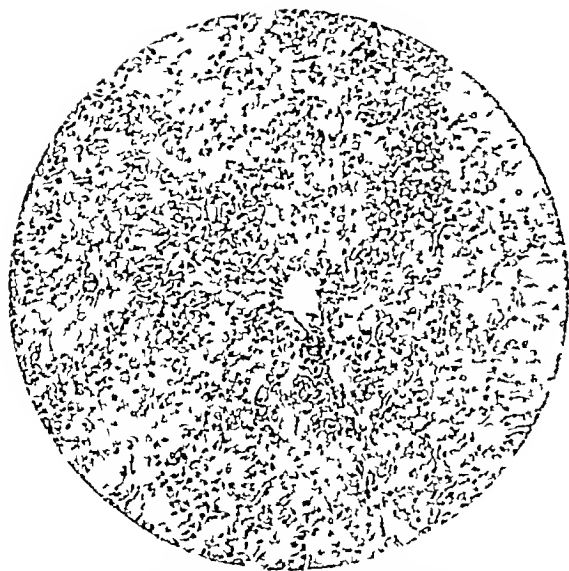


Fig 2 Low power magnification of hematoxylin eosin section from patient J. L. Group 2, Case 1 after 9 successive daily infusions of the 10 per cent combined fat emulsion

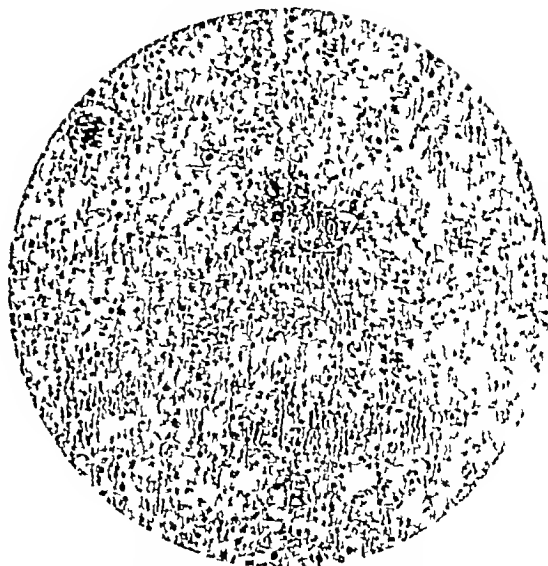


Fig 3 Low power magnification of hematoxylin eosin section of liver from H. K., Group 2, Case 2 after preoperative preparation with the 10 per cent combined fat emulsion

inanutition with generalized nutritional edema. He was prepared for operation on a regimen of 9 successive daily infusions of the combined fat emulsion. The efficacy of these daily infusions was dramatically apparent, for it played the major role in his daily subsistence since any food taken orally was rapidly lost through the gastrojejunal fistulous route before any nutritional benefits could be derived. The operation was conducted under cyclopropane-oxygen anesthesia. He received 2 blood transfusions during the course of the operation which consisted of the removal of the fistula and the restoration of the continuity of the bowel by means of posterior gastrojejunostomy, jejunojejunostomy and colocolostomy plus a complementary cecostomy. At the time of operation a liver biopsy was taken. The postoperative course was critical during the first week because of a secondary alkalosis due to excessive gastric suction. After restitution of chemical balance the postoperative course was uneventful. Microscopic sections of the liver showed that the capsule and hepatic lobules were of normal architecture. There was a mild lymphocytic collection in the periportal areas. Intracellular fat was present (Fig 3). One month after operation the total blood protein was 6.9 grams per cent and the albumin globulin ratio was 2.3. The alkaline phosphatase was 4.3 King Armstrong units, the blood urea nitrogen was 18.5 grams per cent, cholesterol was 103 milligrams per cent, cholesterol ester was 132 milligrams per cent and the ester cholesterol ratio was 68 per cent. On this date his weight was 127 pounds and all peripheral edema had subsided. All the postoperative roentgenograms of the chest were negative for any pneumonic infiltration. Postoperatively the patient also received the combined

fat emulsion intravenously. In a 24 hour special study period during which 1 liter of the emulsion was infused and no other nutrients permitted, data were obtained for the values of the respiratory quotient, the oxygen uptake, and carbon dioxide output in response to the infusion (Fig 4). Another series of tests showed that the patient was now maintained in positive nitrogen balance whereas previously he was in marked negative balance. Peripheral blood studies revealed that the emulsion had not caused any hemolytic anemia.

Adverse reactions relative to the present series of infusions were 8 per cent in the Group 1 series and 6 per cent in the Group 2 series. Of the reactions, most were of the pyrogenic variety with rapid subsidence of temperature within 24 hours. The most severe reaction was that of the constitutional type manifested by severe cough or nausea and vomiting. The latter occurred usually in patients who were in the advanced stage of inanition with anemia and hypovolemia. To obviate this type of reaction it was first necessary to correct for the anemia and to infuse smaller amounts of the combined emulsion until tolerance for larger volumes was obtained. Patients allergic to amigen were equally sensitive to the combined fat emulsion. Concomitant treatment with pyribenzamine permitted the full administration of the emulsion without interruption as

was demonstrated in Case 4, Group 2 Local phlebitis after multiple infusions did not develop Infiltration of the subcutaneous tissues of the forearm occurred accidentally on 3 occasions Surgical drainage was necessary in 1 patient and in the other 2 the fluid was absorbed from the tissues without slough Fat embolization to lung or brain either produced by the infusion or potentiated at a later date by the anesthetic agent did not occur in the group subjected to surgery

### DISCUSSION

In recent years, advances both academic and practical have been made in the knowledge of dietary fat and its role in nutrition Fats have been shown to be of significant importance in phosphorus and calcium utilization, as carriers of fat soluble vitamins and as essential for B vitamin effectivity (vitamin sparing action) In physiology, fat has been proved to affect the secretion of enterogastrone which in turn inhibits gastric motility From the biochemical standpoint newer knowledge has been attained on such phases of fat nutrition as the coefficient of digestibility of natural fats, the pathways of distribution of fat in the body, the role of the phospholipids in fat transport, extrahepatic fat metabolism, the lipotropic effect of protein, the hormone lipocain and newer theories on the degradation of fatty acids

Classic experiments in nutrition have shown that where fat alone was supplied to the fasting organism little protein was destroyed while in the absence of fat large quantities of endogenous protein were destroyed Nitrogen equilibrium was maintained best when the food intake comprised both protein and fat Quantitatively the ingestion of protein in excess of 3.5 times the amount lost during starvation was required for nitrogen balance but by the addition of fat to the latter the protein requirement was reduced from 3.5 to 1.6 for the restoration of nitrogen equilibrium Bloor found that the ingestion of fat was accompanied by a rise in the concentration of lipids in the blood while Magnus-Levy showed that there was a concomitant increase in heat production above that of basal metabolism Both of the latter values returned to the initial level,

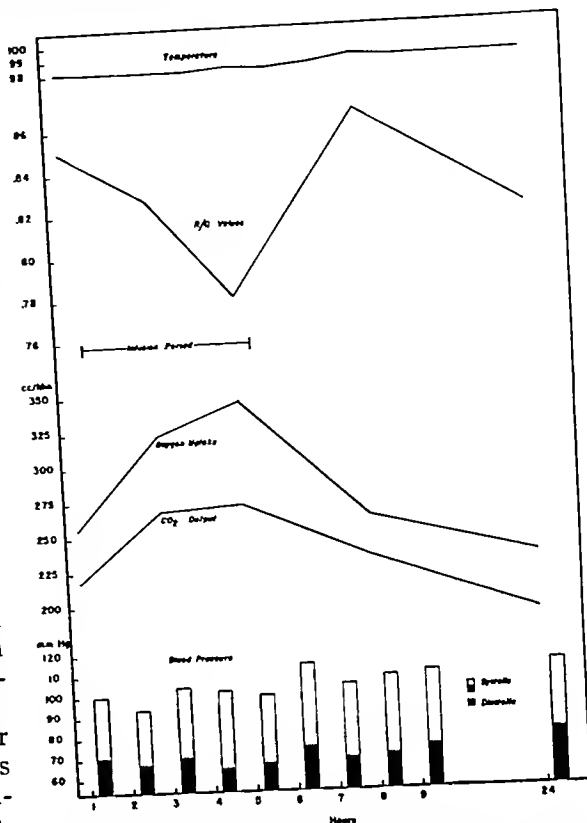


Fig 4 H K, Group 2, Case 2, the respiratory quotients, temperature, and blood pressure in response to an infusion of 1 liter of the 10 per cent combined fat emulsion

the blood fat very rapidly, the increased metabolic rate usually within 10 hours Lusk amplified the latter by showing that the respiratory quotients were altered primarily because of the metabolism of fat plethora In the present studies the biochemical functions of the body after the infusion of the combined fat emulsion were similar to those described after the ingestion of fat The intravenous injection of fat was accompanied by a temporary rise in the blood fat and the chylomicron counts of the blood During the acute phases of the infusion there was an increase in oxygen uptake (metabolic rate) and an alteration of the respiratory quotient Nitrogen equilibrium was more easily attained by use of the combined fat emulsion than could be obtained possibly by forced feedings through a tube or infusions of large volumes of protein hydrolysate and glucose solutions The potential clinical value of intravenous fat emulsion as recognized by



Holt and his coworkers was thus extended for adult use with equal benefits

In earlier studies by others on the effect of the intravenous fat on vital organs pathologic changes ranging from macrophage phagocytosis by mononuclear and foreign body giant cells to noncaseating granulomas were described in the lungs and the livers of experimental animals (1). Recently it was proved that the emulsifying agent particularly the unfractionated phosphatides were causative of such pathology. In the present studies gelatin was used exclusively as the stabilizer because of its proved nontoxic qualities. In no case did the gelatin render the emulsion toxic or interfere with renal function<sup>1</sup>. Except for the presence of intracellular fat and the occasional periportal round cell accumulation, no true granuloma or inflammatory reaction was found in the human liver sections. Our previous experience in animal experiments showed that the intracellular fat subsequently disappeared from the liver. Since no lung biopsy sections were obtained, pneumonic infiltration due to fat was checked by means of x-ray films of the chest which were negative. Further, autopsy examination of the lungs of patients from Group 1 failed to demonstrate the presence of any infiltrative lesions in this organ ascribable to the fat which had been administered.

<sup>1</sup>The caloric value of the gelatin fraction in the emulsion its contribution to nitrogen equilibrium its part in urinary nitrogen etc. were not calculated in the present studies although Brunschwig has reported some evidence of gelatin utilization.

#### SUMMARY

1 A series of 22 surgical patients were treated by intravenous infusions of a 10 per cent combined fat emulsion replacing solutions of protein hydrolysate and glucose.

2 Observations were made as to reactions caused by the emulsion and its possible effects on the liver and lung. The incidence of toxic effects encountered was sufficiently low to recommend its use for human patients.

3 Four detailed case studies were reported on the effect of the combined fat emulsion on metabolism and its role in support of nitrogen equilibrium.

4 The intravenous use of the combined fat emulsion appeared to be of definite advantage as a therapeutic adjuvant in partial and in major parenteral alimentation.

NOTE.—Since this report was submitted for publication a total of 100 patients have received infusions of the combined fat emulsion. Our studies were extended to the use of 15 and 20 per cent combined fat emulsions infused intravenously into human subjects. Deuterized fat homogenized with the present emulsion provided additional evidence of metabolic utilization of intravenous fat.

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# DIAGNOSIS OF PREINVASIVE CARCINOMA OF THE CERVIX

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**D**IAGNOSIS of early preinvasive carcinoma of the cervix has become more and more frequent. While a decade ago this type of cancer was seldom reported in the literature and was considered a rare type of malignant growth of the female genital tract, more recently preinvasive carcinoma of the cervix is a very common finding. This type of early cancer is most often detected in cancer prevention clinics during routine periodic pelvic examinations of assumingly healthy asymptomatic young women (7, 12, 13). In most of these cases pelvic examination reveals benign lesions or no lesions at all. The detection of early preinvasive carcinoma of the cervix and its control are due to the recent advances in methods of the detection of cancer in the female genital tract, such as the vaginal smear method or the performance of routine cervical biopsies or both (5).

While the biopsy still remains the only method of diagnosis of invasive carcinoma of the cervix if the biopsy forceps is able to remove a fragment of the visible lesion, the routine vaginal smear is the method for diagnosis of preinvasive carcinoma of the cervix when there is no suspicious lesion accessible for biopsy.

The material for this study was taken from the Strang Cancer Prevention Clinic of Memorial Hospital during the last 2 years. Some of the cases of preinvasive carcinoma reported in Table I were diagnosed by Dr E. Jones who was in charge of the laboratories of cytology until 1947.

The term preinvasive carcinoma which denotes a neoplastic lesion confined to the epithelium without infiltration beyond the basal membrane is also termed intraepithelial carcinoma or carcinoma *in situ*.

This type of cancer was chiefly described by Rubin, Meyer, and Broders, and more recently by Pund, Te Linde, and Foote and Stewart (5). Their studies emphasize methods of detection and treatment of preinvasive carcinoma of the cervix, and also emphasize the morphologic changes of the squamous epithelium as seen in tissue sections.

## DISCUSSION

The technique of collecting vaginal fluid and the staining procedure used in our clinic are those introduced and recommended by Papanicolaou. We also employ Papanicolaou's classification (12, 13) of smears as applied to the diagnosis of malignant cells, namely, those smears classified as I are negative, those as Class II are also negative for malignancy but show cells of benign lesions such as vaginitis, cervicitis, polyp, etc., those as Class III show cells with abnormal features and suggestive of malignancy, those as Classes IV and V are fairly conclusive or conclusive for malignancy. This classification has been used in our laboratory since 1947. Cases reported in Table I up to 1947 were classified as negative, suspicious, or positive.

Among the 10,000 new female patients seen in our clinic during the past 2 years, 30 cases of cancer of the cervix were detected. These 30 cases include invasive as well as preinvasive carcinomas of the cervix. In 28 of these 30 cases the diagnosis was first made by vaginal smears and consequently confirmed by biopsy. Of these 30 cases of carcinoma of the cervix, 21 cases (70 per cent) were of the early preinvasive type and 9 of the invasive type. Until 1948, 3 cases of carcinoma of the cervix, 2 of the preinvasive and 1 of the invasive type, were detected among 1,000 assumingly healthy, asymptomatic females examined in our clinic (12, 13). Among the 2,000 new patients examined during the first 6 months of 1948, 6 cases of preinvasive carcinoma were detected and 2 cases of the invasive type, which shows

From the Strang Cancer Prevention Clinic of Memorial Hospital Center for the Treatment of Cancer and Allied Diseases. Dr Elise L. Esperance, Director. Dr G. N. Papanicolaou, Head of Department of Laboratories of Cytology, New York, N. Y.

TABLE I

Case No Patient Hosp No	Age years	Findings on pelvic examination*	Vaginal smear reports†	Date of biopsy reports of intraepithelial carcinoma‡	Time interval between positive smear and confirm- atory biopsy	Treatment and follow up
1 H M 212	39	Erosion of cervix	5-46 negative 6-46 suspicious	5-31-46	none	Total hysterectomy
2 E C 1981	60	Vaginitis	11-46 suspicious	12-10-47	13 months	Total hysterectomy
3 S M 4999	40	Granular erosion of cervix	12-46 suspicious	12-5-46	none	Total hysterectomy
4 B C 5500	48	Laceration and erosion of cervix	1-46 positive	1-46	8 days	No record of treatment or follow up
5 R C 4850	35	Erosion of cervix	1-46 suspicious	1-46	27 days	Hysterectomy
6 F J 6516	45	Erosion and laceration of cervix	4-46 suspicious	4-46	none	No record of treatment or follow up
7 S E 5465	45	Erosion of cervix	1-46 suspicious	7-46	6 months	Radium therapy
8 D H 8716	40	Granular erosion of cervix	8-46 suspicious	8-46	none	Total hysterectomy
9 S F 7676	44	Erosion endocervical polyp	6-46 positive	6-46	none	Total hysterectomy
10 A L 11739	39	Erosion of cervix	2-13-46 suspicious	11-47	9 months	No record of treatment or follow up
			11-26-47 Class IV			
			12-11-45 positive			
11 H C 2220	42	Erosion laceration of cervix	3-20-47 Class II	5-47	18 months	Total hysterectomy
			5- 2-47 Class IV			
			3-26-47 Class IV			
12 N L 2220	50	Laceration and erosion of cervix	3-26-47 Class IV	4-47	15 days	Total hysterectomy
			3- 6-47 Class II			
13 C M 12086	37	Laceration and erosion of cervix	3-24-47 Class IV	3-47	none	No record of treatment or follow up
			2- 9-48 Class IV			
14 M E 11681	46	Erosion of cervix	2-16-48 Class IV	2-48 (chronic cervicitis) 5-48 (Inl ca)	3½ months	No record or treatment or follow up
			3- 8-48 Class III			
			4- 8-48 Class III			
15 C D 1825	56	Senile vaginitis	4-16-48 Class IV	4-48	8 days	Total hysterectomy
			1-30-48 Class III			
16 R A C 16960	41	Laceration of cervix	1-30-48 Class III	2-48	4 days	Total hysterectomy
17 J M 16420	35	Granular area contact bleed- ing of cervix	12-16-47 Class III	12-47	14 days	Total hysterectomy
			12-30-47 Class V			
18 G A 18,10	37	Erosion of cervix	5-20-48 Class III	6-48	20 days	No record of treatment or follow up
			6-11-48 Class IV			
19 S R 1, 17	40	Erosion of cervix	1945 Class IV	6-48	3 years	No record of treatment or follow up
			1946 Class IV			
			1947 Class IV			
			1948 Class III			
20 M H 19381	47	Erosion of cervix leucoplakia	7- 6-48 Class IV	7-48	none	No record of treatment or follow up
21 R J 16954	56	Negative	7-23-48 Class III	7-48	7 days	No record of treatment or follow up
			1-30-48 Class IV			

\*In none of these cases was carcinoma suspected clinically

†Until January 1947 reports were given as negative, positive, or suspicious. Later on the Papanicolaou classification was applied.

‡Diagnosis of the biopsies was made in the laboratory of pathology of Memorial Hospital.

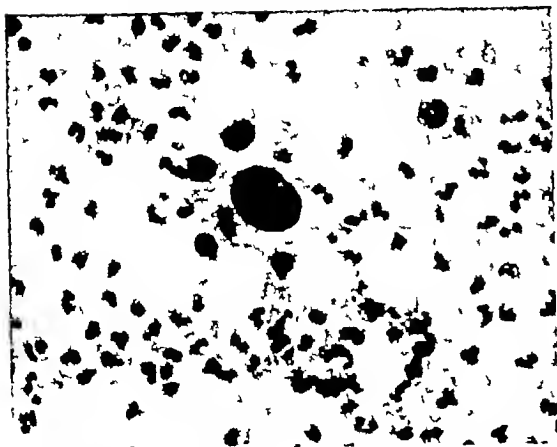


Fig 1 Isolated malignant cell of a case of intraepithelial carcinoma of the cervix



Fig 2 Isolated cells of intraepithelial carcinoma of the cervix

an increase in the percentage of detected pre-invasive as well as of invasive cancers of the cervix in our clinic. Thus, 4 cases of carcinoma of the cervix, 3 of the preinvasive type and 1 of the invasive type, were detected among each 1,000 asymptomatic patients examined in our prevention clinic since January 1948 in contrast with the 3 cases per 1,000 patients detected during 1946 and 1947. In addition there are 5 more cases in which repeated vaginal smears were reported as highly suspicious or positive (Classes III and IV) for preinvasive carcinoma of the cervix during 1948 without a confirmatory biopsy up to present time. Further exploration, such as repeated biopsies, is advised in these 5 cases.<sup>1</sup>

Table I enumerates the 21 cases of preinvasive carcinoma of the cervix all of which were confirmed by biopsy. All 21 patients were asymptomatic in relation to the female genital tract, and the pelvic findings as recorded in the clinical charts were apparently those of benign lesions. However, in 8 cases of the 21, biopsies were taken at the same time as the vaginal smears. Biopsy was performed not because malignancy was suspected, but because the lesions seemed to be more extensive or presented somewhat atypical appearance, such as granular erosion with laceration or contact bleeding. Consequently, in all the

remaining cases biopsies were performed on account of positive or suspicious smears. There were 2 false negative smears (Cases 1 and 13) among the 21 cases of preinvasive carcinomas (10 per cent). In these 2 cases the smears were negative while the biopsies were positive for preinvasive carcinomas. Subsequent smears were reported as positive. This demonstrated that a single negative smear does not always rule out cancer of the female genital tract.

The lapse of time between the first positive or suspicious smear and the positive biopsy is very significant. In 3 cases (Cases 2, 11, 19) smears were reported as positive 1 to 3 years prior to the positive biopsy for preinvasive carcinoma, in 3 other cases (Cases 7, 10, 14) the interval was from 3 to 9 months. Repeated exploration of the cervix and endocervix of a patient showing positive or suspicious smears was done until a positive biopsy was obtained. Whether therapy should be given after failure by a biopsy to confirm the positive cytologic report is still debatable.

In Cases 3 and 4 positive smears and biopsies were demonstrated in 1946, but subsequent smears and biopsies have given negative results. The explanation may be that the small preinvasive cancerous foci were removed entirely by the biopsy forceps and that there has been no relapse or metastases up to present time.

The ages of the patients with preinvasive carcinoma of the cervix range from 35 to 56

<sup>1</sup>Three cases of these 5 which were reported as positive were recently confirmed by biopsies as carcinomas *in situ*. The other 2 cases which were reported as suspicious have not as yet been confirmed by biopsies.



Fig 3 Cells found in cases of intraepithelial carcinoma of cervix

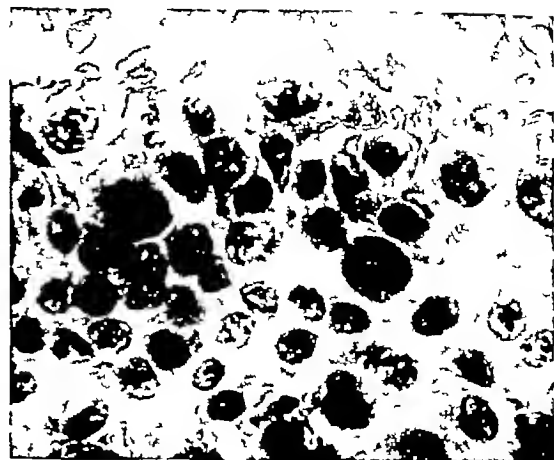


Fig 4 Cluster form of malignant cells of intraepithelial carcinoma of the cervix

years. It is of some interest to note that of the 21 patients with preinvasive carcinoma of the cervix, 7 (33 per cent) were Jewish. This point is stressed because of the numerous reports that carcinoma of the cervix is extremely rare among Jewish women.

#### CRITERIA OF MALIGNANCY OF PREINVASIVE CARCINOMA OF THE CERVIX

Vaginal smears of invasive carcinomas show malignant cells with specific cellular charac-

teristics of malignancy. The criteria of the malignant cell of invasive carcinoma were first described by Papanicolaou and then by other authors.

Vaginal smears of preinvasive carcinomas show malignant cells with certain cellular characteristics highly suggestive of early non-invasive carcinoma of the cervix.

Smears of preinvasive carcinoma of the female genital tract reveal the following types of exfoliated cells: (1) malignant cells suggestive

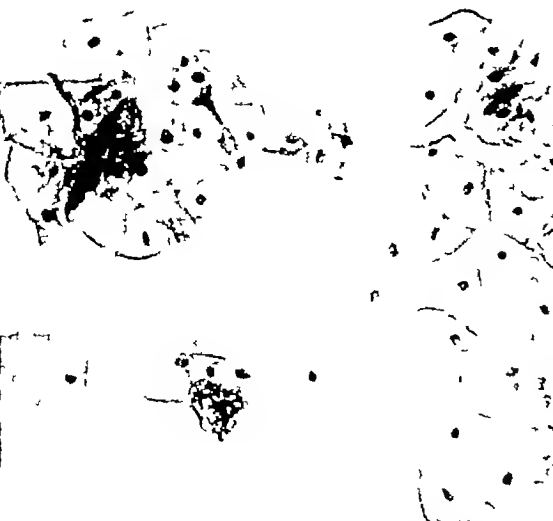


Fig 5 Normal superficial epithelial cells showing normal nuclei

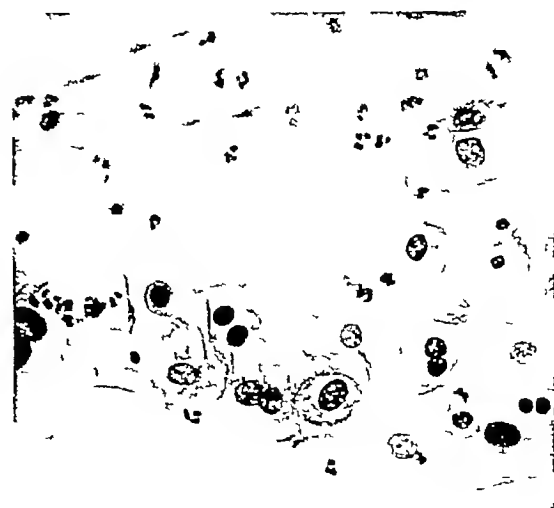


Fig 6 Superficial epithelial cells showing nuclear abnormalities

of preinvasive carcinoma, (2) cells with some malignant potentialities, (3) cells of an inflammatory type

Malignant cells of the squamous type are present either in isolated or in cluster forms. There are two types of isolated cells suggestive of preinvasive carcinoma. The first type of cells originates from the deeper basal layer. They are rather small in size. The nuclear shape varies from round to oval and with a thickened nuclear membrane. The nucleus is prominent, hyperchromatic, and large in proportion to the cytoplasm. The nucleoli are prominent, large, and the cytoplasm is present in the form of a small and thin rim. The cytoplasmic borders are indistinct and hazy (Figs 1 and 2).

Another type of isolated malignant cell suggestive of preinvasive carcinoma of the cervix may also be seen in the smears. In this second type of cells the nuclear cytoplasmic ratio is well preserved, the cytoplasm appears acidophilic with irregular edges. The nucleus is bizarre shaped, irregularly outlined, and may appear to be one dark grayish mass or to have a dark granular content. The nucleolus is indistinct. This second type of cell also originates from the deeper basal layer (Fig. 3).

Both types of cells may be found in the same smear. Whether one type of cell is a stage of transformation to the other type is difficult to ascertain. These two types of malignant cells may also be found in cluster forms. Loss of cellular pattern and overcrowding of these abnormal cells are the characteristic features for the cluster form (Fig. 4).

Frequently smears containing these cells suggestive of preinvasive carcinoma of the cervix contain also cells originating from the superficial epithelial layer. These superficial cells have a normal cytoplasm but show nuclear changes of quite a suspicious character, such as hyperchromatism, enlargement, etc. The presence of these abnormal superficial cells alone without the presence of abnormal cells of the deeper layers may also reveal carcinoma *in situ* in about 50 per cent of such cases (Figs 5 and 6).

Smears of preinvasive carcinoma of the cervix show quite frequently inflammatory type of cells, such as clusters of polymor-

phonuclears, red blood cells, basal cells having a halo around the nucleus or marked vacuolization of the cytoplasm. This is due to the fact that a benign inflammatory lesion is associated with the preinvasive cancer or the preinvasive cancerous focus itself is secondarily infected. In the absence of a secondary infection of the preinvasive cancerous focus or of a benign inflammatory lesion there is no inflammatory type of cells demonstrated in the smears.

Thus in the cytology of preinvasive carcinoma the pathologic findings in smears usually corroborate those in tissue sections. Nevertheless characteristics of cellular malignancy of invasive or noninvasive type can quite often be better demonstrated in smears from the isolated cells rather than from tissue sections. Strikingly enough the exfoliated malignant cells in preinvasive cancer are detected prior to the appearance of a visible malignant focus.

The vaginal smear method is an efficient and reliable test for the detection of preinvasive carcinoma of the cervix. This method of screening in cancer prevention clinics is simple, and the degree of accuracy of course depends on the care with which the smears are taken, the time given for the reading of each slide, and the training and experience of the cytologist. The great advantage of this method is primarily that we are able to discover the preinvasive type of cancer of the cervix earlier than would otherwise be done. In our series most of the patients would have been treated at a much later date if the vaginal smear had not been used as a screening method.

Various recent publications and editorials (3, 4) gave different statistical data on the percentage of detected preinvasive carcinomas of the cervix by this screening method and also emphasized the high cost of this test (3). We believe that 10 minutes of reading of the vaginal and cervical smears of each case is quite sufficient and that the elimination of all "not negative" smears (Classes III to V) should be done by a well trained cytologist in centralized laboratories. The cost of such a procedure will certainly be much lower than that given by certain authors in their recent publications.

We believe that detection of 3 to 4 cases of early preinvasive carcinoma of the cervix by this method among 1,000 assumingly healthy females is quite an encouraging result

Our experience indicates that the accuracy of this test depends upon remembering the following. Each smear must contain vaginal and cervical fluids. A single negative smear does not mean that the patient is free of cancer since 10 per cent of such smears may be expected to be falsely negative. It is always desirable to confirm the positive or suspicious smear first by other smears and subsequently by biopsy.

#### SUMMARY

Clinical and cytological studies of 21 cases of preinvasive carcinoma of the cervix are presented. These cases were detected in apparently healthy asymptomatic female patients by means of the vaginal smear method.

The study consists of a clinical analysis of the findings in 21 cases based on the age of the

patient, race, examination of the pelvis, and time interval between the positive vaginal smear and the confirmatory biopsy.

The criteria of malignancy of the exfoliated cell of preinvasive carcinoma seen in the vaginal smear are discussed.

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## VESICOINTESTINAL FISTULAS

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**P**RAXAGORAS described the first case of vesicointestinal fistula in the second century. In the nineteenth century Cripps placed the entity on a firm footing with his treatise on "The Passage of Air and Feces Through the Urethra." Since then the attention of both general surgeons and urologists has been attracted by this interesting lesion and to date in the neighborhood of 700 cases have been formally recorded in the literature. In the past two decades the most exhaustive review is that of Kellogg bringing the literature up to date to 1936 and including a detailed analysis of 37 cases, reported by others between 1925 and 1936. Since then additional reviews and case reports have appeared by Higgins, Winsbury-White, Reagen, Fernier, Rusche and Bacon, Mayo and Miller, Peters, Barnes and Hill, Lazarus and Marks, Ewell and Jackson. It is evident from these studies that vesicointestinal fistulas fall into four general classes from the etiological standpoint, namely congenital, traumatic, neoplastic, and inflammatory.

Table I gives the statistics of several recent series, including our own.

Inflammatory and neoplastic fistulas comprise more than two-thirds of the reported cases and many more of the inflammatory type have been reported than of the neoplastic. However, it must be pointed out that the quoted statistics are misleading. Sutton's series, for example, includes only vesicosigmoidal fistulas which had been operated on, while other series include all types of vesicointestinal fistulas. Single case reports are very apt to be of the inflammatory type, and fistulas resulting from carcinoma are not thought of sufficient interest to report. Hence, a long series of reported cases is much less likely to give a true picture of the relative frequency of the various types than are the much shorter

From the Henry Ford Hospital

series seen by single individuals or groups, such as the Higgins Cleveland Clinic series or Ewell's or ours. These latter all show carcinomatous fistulas to be the most numerous, followed by inflammatory fistulas, with the other two types trailing far behind.

This report is based on 25 cases of vesicointestinal fistulas seen at Henry Ford Hospital. Among these were no congenital cases, 3 were traumatic, 14 neoplastic, and 8 inflammatory in origin. The sex distribution indicated a predominance of men, there being 18 males and 7 females. Thirteen of the fistulas were rectovesical, 11 sigmoidovesical, and one ileovesical.

The condition was most common in the middle and older age groups because of the higher incidence of neoplasms and diverticulitis of the colon in these people. In our series the youngest patient was 30 years of age, the lesion in this case being secondary to diverticulitis of the sigmoid and the oldest patient was 73, the fistula having followed a radical perineal prostatectomy for carcinoma. The average of the entire series was 50.2 years.

### THE DIAGNOSIS

The symptomatology upon which a presumptive diagnosis is frequently made usually includes one or another of the following: pneumaturia, the passage of fecal material and particles of food with the urine, and the passage of urine through the bowel. Other symptoms which occur with some regularity are those of vesical irritability. Not infrequently such symptoms as burning, frequency, and painful urination may antedate the actual formation of the fistula, and in the absence of other suggestive symptoms, may be misleading for long periods of time. Lazarus and Marks have pointed out that such symptoms may exist in the "prefistula" or "incipient fistula" stage particularly when the inciting



TABLE I—STATISTICS OF RECENT SERIES

	Higgins col lected	Kellogg's col lected	Ewell	Cleveland Clinic Higgins	Sutton	Henry Ford Hos pital
Congenital	18	3	0	3	0	0
Traumatic	59	20	1	1	3	3
Neoplastic	91	16	7	22	2	14
Inflammatory	160	57	3	8	29	8

lesion is primary in the bowel. One patient in our series presented just such a picture and is worth presenting in some detail.

#### CASE REPORT

The patient was a 53 year old man who had symptoms of frequent painful urination and a persistent pyuria with a small bladder capacity. The symptoms had been present for over 10 years. There had never been any pneumaturia, passage of urine from the bowel or fecal material in the urine. Cystograms showed no fistulous tract. Cystoscopy showed no sign of a fistulous opening. He was considered to be a case of interstitial cystitis and so treated with little benefit. At one time he was admitted with a perforated sigmoid and peritonitis which he successfully weathered with the help of a transverse colostomy. During this time the urinary symptoms subsided only to recur when the colostomy was closed. At that time a barium enema showed multiple diverticula of the sigmoid and descending colon. A transverse colostomy was again performed and during a subsequent operation, when the rectum and sigmoid were resected, a distinct fistulous connection between the sigmoid and bladder was found.

The combination of persistent bladder and lower bowel symptoms should always call for exhaustive studies to rule out the existence of a fistula.

Conversely, the onset may be sudden and explosive in its nature as illustrated by another patient in this series. He was a man of 49 who had been treated for mild gastrointestinal symptoms unassociated with urinary disturbances or pyuria. Suddenly he began to void considerable amounts of gas and fecal material in the urine. Further study and operation showed a carcinoma of the sigmoid which had extended into the bladder wall and ulcerated through the mucosa.

Symptoms may also include lower abdominal discomfort and rectal pain referable to the inflammatory or neoplastic changes taking place in the bowel or peritoneal cavity.

The actual presence of the fistula and its precise location are often difficult to demonstrate. Cystoscopy, cystogram, barium enema, proctoscopy, instillation of dyes into the rectum and bladder, and biopsy of suspicious areas are commonly utilized. Equally commonly they fail to provide a satisfactory answer. Barnes and Hill point out, in their series of 14 cases, that cystoscopy showed changes in 13 but in only 2 could the fistulous opening actually be seen, in 11 cystograms the fistula was demonstrated in only 3, and of 6 barium enemas none showed the tract. This is in general agreement with our own findings. In cases secondary to diverticulitis the barium enema will often show the bowel changes even though the actual fistula itself may not be apparent. In conjunction with the symptoms, however, these findings are an important clue in this group of cases. Occasionally all the diagnostic studies are fruitless and recourse must be had to surgical exploration, as illustrated by the first case quoted above.

#### CONGENITAL FISTULAS

Congenital fistulas are rare lesions and none were encountered in our series. When they occur there is almost invariably an associated congenital imperforate anus. Early colostomy and subsequent attempts at perineal plastic procedures with excision of the fistula and possibly cystostomy are recommended as the most logical sequence.

#### TRAUMATIC FISTULAS

Three cases, all rectovesical, in this series resulted from trauma. In general, traumatic causes of fistula are not common, as emphasized by Higgins. In a survey, by Robinson, Culp, and associates, of injuries to the genitourinary tract in the European theater during the recent war, it was pointed out that of a group of 100 perforating lesions of the bladder in 64 of which there were associated injuries to the bowel only a single case of fistula was found. In recent years surgery has become more prominent as a cause of this lesion. Two of our cases were incident to prostatic operations, both for carcinoma. The other followed a severe fracture of the pelvis. Other causes usually cited are penetrating wounds, instru-

mental delivery, ingested foreign bodies such as toothpicks, pins, and bone fragments, foreign bodies left in the peritoneal cavity during operations, vesical calculi, x-ray and radium. The inclusion of the latter in this group when they have been used to treat neoplasms may be open to question unless one can demonstrate microscopically that no evidence of tumor cells remains. The cases in our series related to x-ray or radium therapy have been included in the neoplastic group. The diagnosis of fistulas following trauma should not prove difficult except possibly in cases due to migrating foreign bodies.

Fistulas resulting from physical violence tend to heal spontaneously, aided perhaps by indwelling catheters, chemotherapy, and rarely colostomy. Our patient recovered with the aid of a Foley catheter and sulfadiazine. Those due to perforation by foreign bodies may also heal spontaneously following the removal of the foreign body. We have seen none of this type. Unfortunately, there is less of a tendency toward spontaneous healing in fistulas following operation. Individualization is necessary. Colostomy or cystostomy may be advisable and occasionally may suffice. If not, these procedures may be necessary as preliminaries to operation on the fistula in order to permit adequate resolution of edema and inflammatory reactions which might otherwise doom the procedure to failure. One of our cases of postoperative fistula illustrates this point and merits more detailed discussion.

#### CASE REPORT

The patient was a 73 year old man in whom a rectovesical fistula developed following a radical perineal prostatectomy during which the rectum had inadvertently been entered. About 8 weeks after the initial operation, an attempt was made to correct the fistula. The tract was excised and a Whitehead type of procedure performed on the rectum. The opening in the bladder was inverted and an attempt was made to interpose muscle between the bladder and rectum. The urine was diverted through a suprapubic cystostomy. The fistula recurred shortly thereafter, and the patient went home with the cystostomy and returned to the hospital 15 months later. He was prepared with the use of a Miller-Abbott tube, sulfasuxidine, and the bowel cleansing regimen commonly used before major procedures on the large intestine. At operation the fistulous tract was exposed through the old perineal scar. There

were minimal inflammatory and scar tissue reactions present. The fistula was excised, the bladder defect was inverted and repaired in two layers with chromic catgut, and the rectal defect was repaired in layers using catgut sutures for the mucosa and silk for the muscle coat. Muscle was interposed between the lines of repair. A colostomy was not done, but the Miller-Abbott tube was left in place and chemotherapy continued after operation. Convalescence was satisfactory and observation several months later found him with clear urine, voiding normally, and with no rectal leakage.

We believe this case illustrates the value, in the proper management of postoperative fistulas, of bowel and urinary antiseptics, diversion of the urinary stream, bowel defunctionalization, and the desirability of waiting until all inflammatory reaction has abated. It may also illustrate the value of nonabsorbable sutures in the muscular wall of the bowel.

The final patient in this group has steadfastly refused treatment for a rectovesical fistula which occurred after a suprapubic enucleation of a prostate which proved to be carcinomatous.

#### NEOPLASTIC FISTULAS

The distribution in this group was as follows. Four were secondary to carcinoma of the sigmoid, 4 to carcinoma of the rectum, primary malignancy of the bladder accounted for 4 cases and of the cervix for 2 cases. In the literature, carcinoma of the vagina and prostate are also reported as a cause of fistula.

As anticipated, exploration in the 8 cases due to cancer of the large bowel disclosed extensive inoperable lesions. Palliation by means of colostomy, cystostomy, or both was all that could be offered these patients. There are, however, cases on record in which radical excision of the carcinomatous mass involving the bladder and bowel has been successfully accomplished.

In 2 of the patients whose primary lesion was in the bladder, a similar situation prevailed. In one of these the fistula developed terminally after a ureteral transplant had been performed for recurrent cancer. In the other, thought clinically and at operation to have a sigmoid neoplasm but found at postmortem to have a primary cancer of the bladder, a palliative colostomy was done. The third patient was found at operation to have a ves-

icoileal fistula and the portion of the ileum involved was excised, an end-to-end anastomosis done, and a segmental resection performed for the bladder tumor. The patient was subsequently lost to follow-up, but at the time last seen was free of recurrence of the fistula. The fourth patient is one in whom a rectovesical fistula developed 3 years after excision of a bladder tumor followed by radium and x-ray treatment. He has, at present, extensive inguinal metastases, but he seems content to pass virtually all the urine per rectum.

Both vesicointestinal fistulas secondary to carcinoma of the cervix also had x-ray and radium treatment. Neither has had any therapy directed at the fistula. In one patient the microscopic study showed no tumor cells, the fistula evidently having resulted from radiation necrosis.

Our experience in this group of cases is in accord with that generally recorded. While in rare cases it may be possible to excise the growth and thus hope for a cure of both the tumor and the fistula, in the vast majority of cases palliation is all that can be hoped for. Colostomy is the most efficacious measure, suprapubic cystostomy may sometimes be necessary, occasionally a cutaneous ureteral transplant may add to the patient's comfort.

#### INFLAMMATORY FISTULAS

There were 8 cases of fistula of inflammatory origin in the present series. Two of these, both rectovesical, complicated a tuberculous enterocolitis. The 6 remaining were secondary to diverticulitis of the colon and all were sigmoidovesical.

This inflammatory group is by far the most interesting, first because of the great change in the etiology which has taken place over the years, paralleling progress in medicine, surgery and public health and improvement in medical practice, and second because these patients offer a challenge to the surgeon.

The list of inflammatory causes which have been reported includes syphilis, typhoid, actinomycosis, amebiasis, appendiceal abscess, prostatic abscess, perineal and perirectal abscess, diverticulitis of the bladder, tuberculosis of the bladder, bowel, or peritoneum, ter-

минаl ileitis and most frequently, diverticulitis of the colon and adnexal disease in women. Many of these causes are no longer reported—others are rare. The most frequent cause at present is diverticulitis of the colon, chiefly in men. The change in sex incidence and in etiology is illustrated by a comparison of the reports from the Mayo Clinic by Sutton in 1921 and Mayo and Miller in 1940.

In the former series of 34 cases, 26 were in women and 8 in men. Only 6 of the fistulas were due to diverticulitis, the majority of them resulting from salpingitis. In the latter series, 54 more sigmoidovesical fistulas were added, 45 in men, 9 in women. None followed salpingitis while 32 were due to diverticulitis.

Diverticulitis, therefore, merits special attention in relation to the problem of vesicointestinal fistula, not only because of its apparent increase in incidence, but also because the fistulas which result not infrequently lend themselves to successful surgical treatment. This is especially so since the advent of chemotherapy, antibiotics, and new techniques.

Diverticulosis of the colon has been estimated as occurring in between 5 and 8 per cent of patients with bowel symptoms of sufficient intensity to warrant x-ray examination, and diverticulitis may be expected to occur in about one-fifth of these patients. While uncomplicated diverticulosis is generally best managed by medical means, obstruction, perforation, and fistula formation convert the problem into a surgical one. The vast majority of fistulas occur between the sigmoid and the bladder, the proximity of the sigmoid to the bladder and the tendency of the inflamed diverticulum to adhere to the bladder doubtless accounts for this. The latter also accounts for the fact that the fistulas are most frequently on the left side of the bladder.

Inflammatory fistulas rarely heal spontaneously. Earlier writers treated them by diet and medicine with occasional success in cases of lues or tuberculosis. A few spontaneous recoveries are on record. Other methods used were removal of bladder stones, dilatation of rectal strictures and rectal and bladder irrigations.

Later isolated attempts at cure or palliation by surgery were made—colotomy and

cystostomy especially In 1886 Cripps wrote "The idea of abdominal section with a view to separating the intestine from the adherent bladder and closing the opening might at first be thought possible, but after reviewing numerous specimens and the accounts of post-mortem examinations, the proceeding, I fear, will be seldom practicable"

In 1899 Pascal, in his comprehensive review, referred to Dumenil and his suggestion of colostomy in 1884, and to LeDentu and his attempt to remedy the condition by a trans-vesical approach, and to Czerny who advocated laparotomy In 1915 Cunningham summed up the possible operative treatment as follows

- 1 Abdominal section, separation of intestines from the bladder, repair of openings in both organs or resection of both bladder and gut

- 2 Perineal operations, separation of bladder from gut, packing of wound and drainage of bladder by means of a retained catheter

- 3 Colotomy

- 4 Suprapubic cystostomy

In 1921 Sutton stated that 23 of his 34 patients were cured by operation and that there were 4 operative deaths He gave no details of the operations but apparently it was a one stage resection of all diseased tissue Of course most of his cases were due to salpingitis Strangely enough cures were obtained in all the tuberculous fistulas, but he does not state how many of the fistulas of tuberculous origin were not operated on In this period single stage operations of which colostomy was a part are reported

A paper on this subject was published by John Morrissey in 1931 At that time his list of surgical possibilities was the same as that of Cunningham published 15 years earlier He made the significant statement that he favored colostomy In the discussion Rankin stated that he favored Morrissey's idea of a preliminary colostomy and had tried it in 3 patients successfully After this time the stage procedure was gradually accepted and at present is generally used Preliminary colostomy is performed as the first stage, excision of the fistula and involved portions of the bladder and bowel as the second, and finally restitu-

TABLE II

	Sutton 34 cases 1906-1920	Mayo & Miller 54 cases 1921-1940
Men	8	45
Women	26	9
Diverticulitis	6	32
Acute salpingitis	9	0
Tuberculous salpingitis	3	0

tion of the bowel continuity as the final stage The reduction in mortality and recurrence rates have confirmed the multiple stage operation as the procedure of choice in the majority of cases Bowel rest, and local and general rehabilitation are facilitated, and these factors are important for a successful outcome

Of our 6 cases of fistula resulting from diverticulitis, 4 were treated by the multiple stage method Three are completely cured The other was markedly improved but a small fistula recurred Her symptoms are so minimal that she wants nothing more done One of the 2 remaining was treated by simple incision and drainage of a pelvic abscess resulting from a perforated diverticulum of the sigmoid which communicated with the bladder Pyuria and an intermittently draining sinus persist but the patient refused further treatment when last seen The final patient in this group was managed by a one stage procedure consisting of excision of the fistula, the involved portion of the bladder, and most of the diverticulum, and a suprapubic cystostomy She remains cured 1 year following operation This case is worthy of brief special mention

The universally admitted beneficial results of the sulfa drugs and the antibiotics on bowel surgery and surgical mortality rates in general, plus the newer methods of preoperative and postoperative care, particularly intestinal defunctionalization suggest the possibility that selected cases of vesicosigmoidal fistula may be managed by a one stage procedure These patients should be those in whom the fistula is associated with a minimum of inflammatory reaction and in whom the sigmoid is easily mobilized

#### CASE REPORT

The patient, a 62 year old woman complaining of passing gas and food particles in the urine, was found

to have a vesicosigmoidal fistula. She was prepared with bowel antiseptics and a cleansing regimen. Eleven days after admission operation was performed with the advice and assistance of Dr Lawrence Fallis. A midline lower abdominal incision was made and the peritoneum opened. A loop of small bowel was found adherent to the posterior surface of the bladder, and the sigmoid was densely adherent to the left posterolateral wall of the bladder. The bowel at this point seemed considerably thickened. However, it was fairly readily mobilized, and more detailed examination showed a diverticulum of the sigmoid attached to the bladder at the site of the fistula. The bladder was opened and the indurated thickened area was excised. The bladder was then repaired about a de Pezzer catheter. The diverticulum of the sigmoid was largely excised and the defect brought about by this closed with Lembert sutures. The anterior peritoneum was then closed in such a way as to extraperitonealize the sutured portion of the sigmoid. A drain was placed to the peritoneum at this point and an antiseptic pack was inserted down to the extraperitonealized portion of the sigmoid. Sulfu drugs, penicillin and intestinal intubation were continued postoperatively. The course was completely uneventful. Three and one-half weeks after operation the suprapubic wound was healed, she was voiding normally, and the urine was clear. A year later she remains well.

In this connection, we are privileged to cite a recent patient of Dr William Wishard and Dr Willis Gatch, of Indianapolis. A vesicosigmoidal fistula was found in a woman of 75 and after preparation of the bowel by cleansing and antiseptics, a one stage operation without preliminary colostomy was performed, a portion of sigmoid being resected and an anastomosis done. The patient has done well.

#### DISCUSSION

We are not advocating single stage operations for all vesicosigmoidal fistulas. In earlier days the mortality from this procedure was high. Balch, in discussing Higgins' paper, stated that at one hospital he found 4 operations of this kind had been done with 4 deaths. The safest procedure in the majority of instances is no doubt the multiple stage operation, but in selected cases the one stage operation may shorten the period of disability and prevent the trauma of repeated operations.

There is some difference of opinion as to the preferable site for the colostomy. Some advocate colostomy in the left lower quadrant so as to avoid redundant bowel above the fistula. Others favor a transverse colostomy in the

upper right quadrant to leave a clean field in the lower left quadrant for the succeeding stages. In our series we used the latter method.

#### SUMMARY AND CONCLUSIONS

A series of 25 cases of vesicointestinal fistula is reported. The causes of such fistulas and the methods of treatment are reviewed. The following conclusions seem justified:

- 1 Vesicointestinal fistulas are not common.
- 2 The largest number are caused by carcinoma of the bowel or bladder.
- 3 Most traumatic fistulas heal spontaneously.
- 4 Diverticulitis of the colon accounts for the great majority of the inflammatory type.
- 5 The new method of cleansing and sterilizing the bowel has rendered operation safer and surer.
- 6 In most instances a stage operation with preliminary colostomy is the method of choice.
- 7 In selected cases in which all the inflamed area of bowel can be excised or extraperitonealized, a one stage operation may be done.

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# THE ANATOMY OF THE HERNIAL REGIONS

## I Inguinal Hernia

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**O**VER a period of several years, the anatomy of the regions of inguinal, femoral, and obturator hernia has been studied anew in a large number of laboratory specimens. During the progress of the investigation, several specimens were encountered which served ideally for the purpose of teaching hernial relationships to classes in applied anatomy. The comparative method of presentation was followed, in so doing, fundamental morphological concepts were strengthened by emphasizing similarities and differences, and the suitability of a certain hernial technique for hernioplasty in one area was suggested for another region on the basis of fundamental likeness in structure. The plan proved to be so instructive that its employment in publications seemed to be warranted.

The three hernial regions are separated by relatively short distances, however, the elements which form their walls vary greatly in respect to strength and displaceability. These features may be outlined briefly, preparatory to more detailed discussion.

Of the three regions, the inguinal possesses the most readily displaceable barricade against herniation, consisting as it does of three superimposed layers, at least two of which are, usually, chiefly fascial in character, further weakening may occur in those cases in which a persistent peritoneal diverticulum, the processus vaginalis, offers a ready-made route through the abdominal parietes.<sup>1</sup> The

femoral region holds an intermediate position in respect to resistance to herniation, the canal through which a femoral hernia passes into the thigh is bounded on three sides by bone or ligaments, and on the fourth by a fascial sheath investing large blood vessels. Of the three, the obturator is the strongest, the small obturator canal, beginning as a small orifice in a heavy ligamentous plate, is surrounded by pelvic parietal musculature internally and closed externally by the superimposed muscles of the ventral aspect of the thigh.

### MATERIAL AND METHODS

More than 500 body-halves have been studied for the anatomy of the inguinal region, smaller numbers for the structure of femoral and obturator areas. In the following accounts the statements will be based chiefly upon features encountered in the specimens illustrated (Figs 1 to 3), they are, however, supported by data which need not be specifically cited but which are in general agreement with the descriptions presented. For the discussion of femoral and obturator, anatomical drawings of recently dissected specimens have been prepared.

### OBSERVATIONS AND DISCUSSION

1 *Superficial fascia* In each of the selected specimens hereinafter described, and in others more recently studied, the superficial fascia over the superior, or pubic, portion of the scrotum is divisible into two layers. The outer of the two is continuous with the superficial (Camper's) layer of the superficial fascia of the abdomen, the inner with the deep (Scarpa's) layer. On the abdomen the deeper of the two layers is easily distinguishable from the outer investing, or innominate, fascia of the external oblique aponeurosis.

Contribution No. 503 from the Anatomical Laboratory of Northwestern University Medical School.

<sup>1</sup>In direct inguinal herniation the protruding mass displaces parietal vessels which in their normal disposition are not prolonged upon vascular nervous, and associated structures in this respect the direct inguinal hernia differs from the three types discussed in the present articles. The reader who may be interested in an illustrated account of the anatomy of direct inguinal hernia is referred to an earlier contribution emanating from the Anatomical Laboratory (Qt Bull Northwest Univ M School 1941 15 10 04).

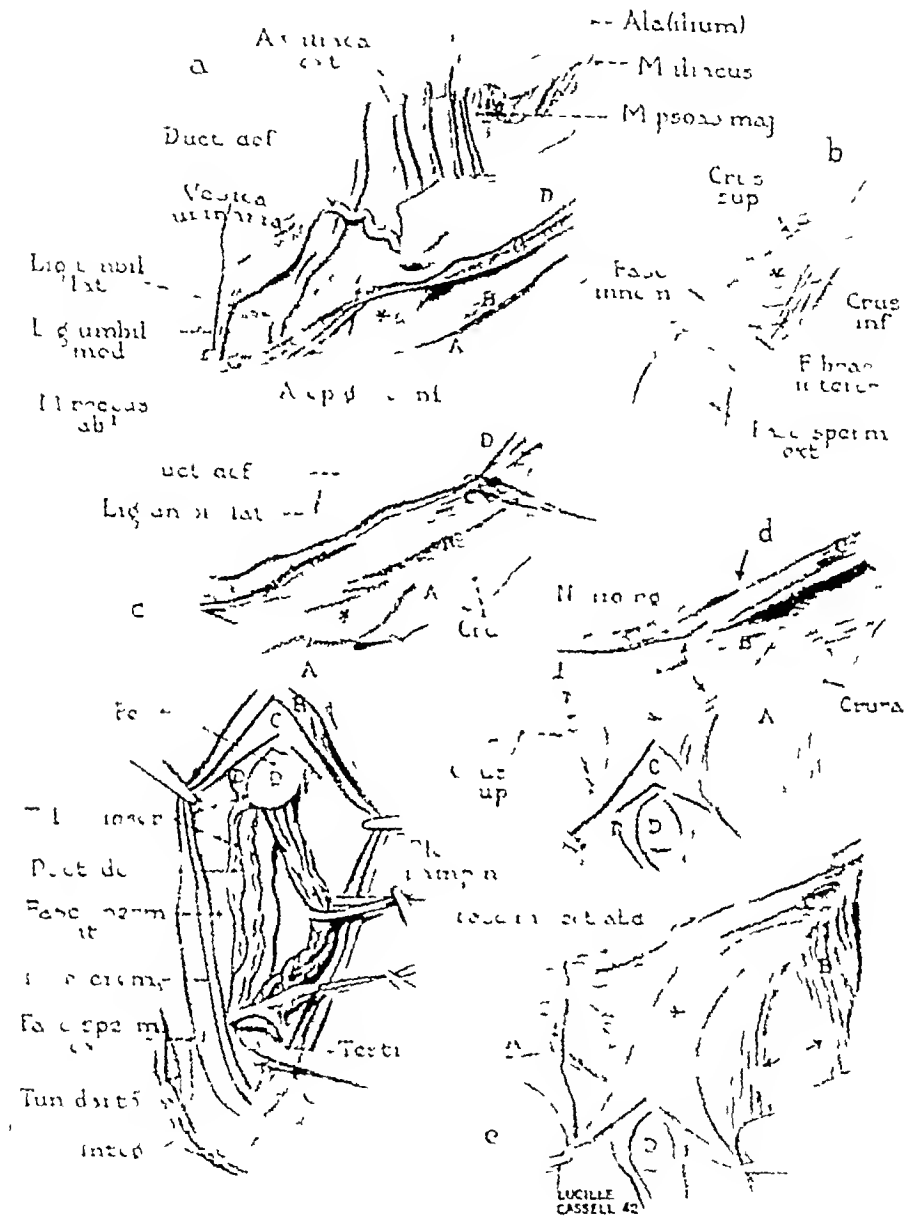


Fig 1

Figs 1a to 1e. Dissections of inguinal and funicular layers in a specimen with bilateral indirect inguinal hernias. Specimen I (left half illustrated). I indicates external oblique, B, internal oblique, C transverse abdominal, D, retroperitoneal (subserous) tissue, D, peritoneum. The hernial mass has been removed from the serous sac. For these successive dissections the specimen was transected above the iliac arch, and the abdominal wall was sectioned transversely. The skin and superficial fascia were removed, the muscular layers separated from each other. This separation was continued where the layers became funicular about the spermatic cord. Fig 1a. The

peritoneal aspect of the inguinal wall viewed from above and behind. The genitofemoral nerve is held by forceps. By removing the peritoneum, D, in the area around the abdominal inguinal ring, the oblique course and relation of the inguinal canal (at \*) are demonstrated. Fig 1b. T area of the subcutaneous inguinal ring seen from the outside. The dilated processus vaginalis is here covered superiorly by the external spermatic fascia, derived from the innominate fascia of the external oblique layer, in which are lodged the intercrustral fibers. The fault in the aponeurosis of the external oblique aponeurosis is triangular (at \*).

(Continued on opposite page)

2 *External oblique aponeurosis* The inguinal part of the external oblique layer is an aponeurotic continuation of the more proximal, muscular, portion (Figs 1a, 1c, and 1d) Like the fleshy portion of the stratum, it is invested on both surfaces by fascia, the external one of which is the fascia innominata (Fig 1b)

As the aponeurotic fibers approach their insertion at the linea alba, they fuse, anterior to the rectus muscle, with those of the internal oblique muscle along a curving line which is concave outward, near the pubic symphysis this line of fusion coincides with the midline of the body By this indentation a sub-aponeurotic space is provided which a large intramural hernia could occupy, in either male or female As the fibers which make up the inguinal ligament pass to an attachment upon the pubic tubercle, they depart from the neighboring aponeurotic bands which descend, as the superior crus, to an insertion at the pubic symphysis Between these diverging columns a triangular intercrural cleft exists, the apex of which may reach the muscular part of the external oblique layer at the level of the anterior superior iliac spine Only the external and internal investing fasciae bridge the intercolumnar, aponeurotic, gap (Fig 1b, at \*), in this gap the two fascial layers are applied to each other back-to-back

At the medial extremity of the triangular cleft, and just cranial to the pubic tubercle, the spermatic cord passes beyond the plane of the parietal layers and receives its investment of fascia There the two fascial lamellae fuse to form the thin external spermatic fascia, in which a varying number of intercrural fibers occur (Figs 1b and 1c) A herniating mass,

after following an intraparietal course, needs only to press farther apart the already divergent crura and dilate the fascial tubes in order to gain a funicular or scrotal position

3 *Internal oblique muscle* The internal oblique layer is also trilaminar in character, being composed of a musculoaponeurotic portion covered on the outer and inner surfaces by fascia The external investing fascia is a well-defined layer which is readily separable from the contiguous inner fascia of the external oblique layer The internal investing fascia, however, is difficult to separate from the external fascia of the transversus layer at the level of the interspinous line, but readily demonstrable in the area nearer the inguinal canal Together, the lamellae form the cremasteric fascial layer, in which scattered muscle fibers are present (Figs 1a, 1c to 1e at B)

Even when the inguinal part of the internal oblique layer is predominantly muscular, fleshy fascicles become scattered near the hernial orifice Some are prolonged inferiorly as part of the wall of the hernial sac Both muscular and aponeurotic elements are usually, fragmentary in the inferomedial part of this layer (muscle fibers at arrows in Figs 1d and 1e) Just as investing fasciae bridge across the intercrural fault in the external oblique, so also the comparable fasciae of the internal oblique stratum extend across the interfascicular spaces, and remain to represent the whole layer in instances in which muscle-fibers are wanting (areas marked by asterisks in Figs 1d and 1e) The funicular part of the layer is, therefore, chiefly fascial as it constitutes the dilated and saccular covering for the hernial contents Such sparse distribution of cremasteric muscle is to be ex-

and is bounded by columnar portions of the aponeurosis (superior and inferior crura) Fig 1c The external oblique and internal oblique layers (A and B, respectively) have been drawn forward, the dissection has been carried to the level of the testis, and the layers of the spermatic cord (lettered as in Fig 1a) have been incised successively to expose the constituents of the cord and their investments The preperitoneal layer forms a definite sheath for the internal spermatic artery, the pampiniform plexus and the ductus deferens (sheath opened to show the contents) Fig 1d, The external oblique layer has been incised vertically and then turned aside to expose the broad, funnel-like, funicular portion of the internal oblique stratum (at \*) The upper arrow indicates the point at which the transversus fascia sends off a lamella to invest the rectus mus-

cle The smaller arrows point to margins of the muscular portion of the internal oblique, between which edges the layer is wholly fascial (compare Fig 1e) The lower muscle fibers are prolonged upon the cord as the cremasteric muscle In the reflected portion of the external oblique the aponeurotic crura and the intercrural fascia (at A) are evident Fig 1e, The transversus stratum (at C) is shown by incising and reflecting the overlying portion of the internal oblique layer By continuing the incision toward the scrotum, the internal spermatic fascia (at \*) is exposed Distally the latter envelope has been opened to show the preperitoneal (subserous) connective tissue and the peritoneal (serous) sac, D The margins of the fascial portion of the internal oblique layer, B, are indicated by arrows (compare Fig 1d)



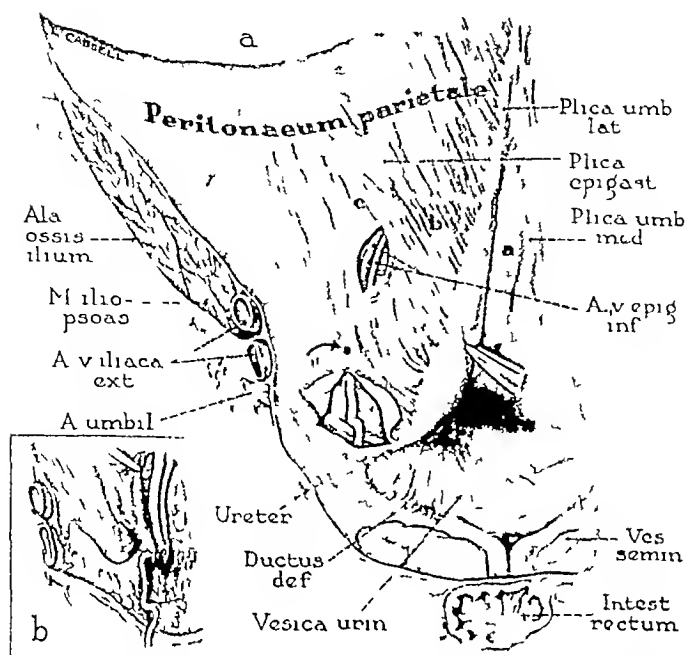


Fig 2a Dissection of the internal surface of the left half of the anterior abdominal wall of specimen II, below the umbilical level, showing peritoneal folds, foveae, abdominal orifice of the processus vaginalis and important preperitoneal structures. The specimen was sectioned coronally through the ala of the ilium just dorsal to the tuberosity of the ischium, then cut in paramedian plane to the right of the midline. The peritoneum is intact except where locally slit and turned aside to expose the inferior epigastric vessels and the ductus deferens (where the latter crosses the umbilical artery) and the external iliac vessels en route to the abdominal inguinal ring. The peritoneal fossae are lettered *a*, supravesical, *b*, medial inguinal, *c*, lateral inguinal. The arrow points to the abdominal orifice of the vaginal process of the peritoneum. The lateral umbilical fold has been elevated to demonstrate the depth of the medial inguinal fovea. Fig 2b, Further exposure of the structures near the abdominal inguinal ring. The peritoneum has been reflected to expose the epigastric vessels and the umbilical artery as the latter passes deep to the ductus deferens. The preperitoneal layer is exposed medial to the epigastric vessels and inferior to the external iliac vessels.

ected, since as the sac becomes enlarged, fleshy muscle fibers become separated by progressively greater interdistances. The cremasteric fibers, at their origins, commonly lie in the lateral and posterior segments of the mouth of the funnel-like prolongation of the internal oblique layer about the spermatic cord (lowermost arrow in Fig 1d). Even when abundant, the fibers in the funicular layer spread out in such a way as to leave only the medial aspect devoid of muscle fibers<sup>1</sup>.

<sup>1</sup>In a recent study of 110 body halves in which no hernias occurred the cremasteric fibers in 64 per cent of cases were limited to the lateral segment of the proximal funicular portion

4 *Transverse abdominal muscle* Like the external oblique and internal oblique, the transversus stratum is trilaminar in character. Usually the muscle-fibers of the transversus layer do not extend as far inferiorly as the abdominal inguinal ring, nor do heavy aponeurotic bands occupy this distal zone. The area of herniation, then, is mainly fascial (Figs 1c to 1e). However, while principally fascial, scattered aponeurotic fibers were found in 93 per cent of 300 specimens recently examined,

of the internal oblique layer at inguinal level. At a mid-scrotal level however the muscle fibers were found in the anterolateral segment of the funicular layer in 61 per cent of cases.

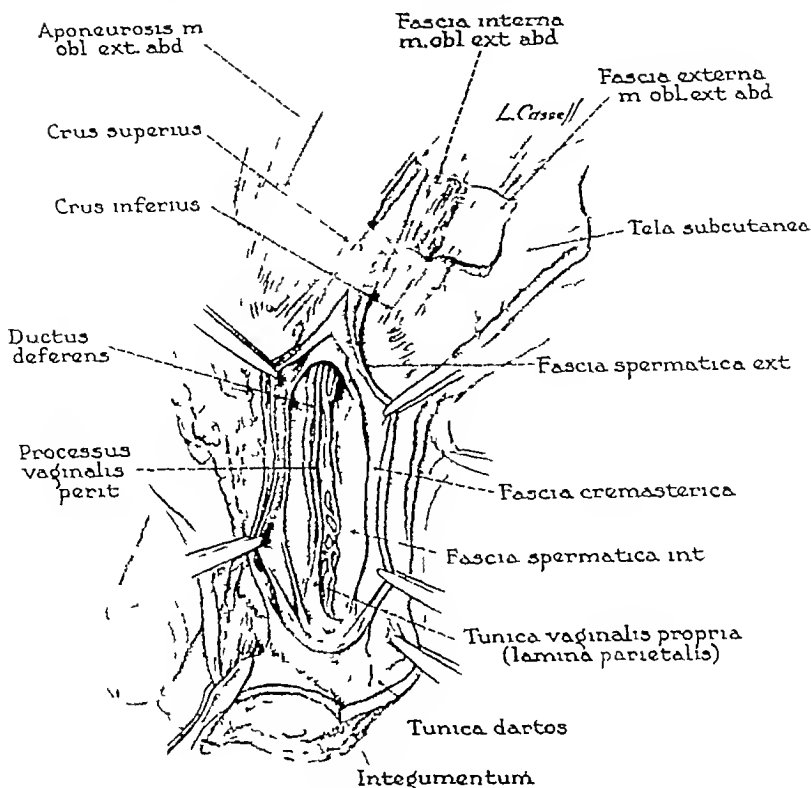


Fig 3 The external parietal layer and the funicular continuations of the several inguinal layers (same specimen) Left inguinal region from the exterior In the inguinal region the external oblique is exposed by reflection of the superficial fascia In a quadrangular area over the superior portion of the intercrural fault, the external investing (innominate) fascia is reflected in order to demonstrate the corresponding internal investing fascia, the two thin fascial layers, conjoined, form the external spermatic fascia In the scrotal area the external spermatic fascia and the other two funicular coats (cremasteric and internal spermatic fasciae) have been incised and turned aside to show the processus vaginalis and the constituents of the spermatic cord (duct and vessels) The funicular part of the vaginal process, although minute, is an unruptured strand from the abdominal orifice of the inguinal canal (at arrow in Fig 2a), through the length of the canal, and in the scrotum to the testis The process widens distally to become the tunica vaginalis propria of the testis The preperitoneal stratum, because areolar in character, is not removable as a distinct layer In the inguinal region the superficial fascia contains a heavy deposit of fat, in the scrotum the dartos muscle replaces fat

here, again, where heavier tissue ends, the two layers of investing fascia fuse, to become a single stratum distal to the abdominal ring The internal, stronger, contributing layer is termed the transversalis fascia, the external, weaker, element possesses no special name, and is commonly disregarded in standard accounts Together, on the cord, these layers form the internal spermatic fascia (Fig 1e, at \*)

In the specimen illustrated, the fused muscle-fasciae form the only contribution from

the transversus layer to the covering of the cord, testis, or associated hernial mass, no muscle-fibers are present The internal spermatic fascia, thus derived from the fascia on either side of the transversus abdominis muscle, is thin, despite its thinness, the investment is easily dissectable from the serous sac and the cremaster coat to which it is related on internal and external aspects, respectively Although muscle fascicles are usually wanting and well-defined aponeurotic fibers always absent, the layer may contain blood vessels

The parietal part of the transverse abdominal muscle extends neither as far inferiorly nor as far medially into the inguinal region as does the overlying internal oblique muscle. Inferomedially, at the rectus sheath, the aponeurotic fibers fuse chiefly with similarly directed bands of the internal oblique proper and form a bilaminar fascial offshoot just lateral to the rectus muscle to invest that muscle (Fig 1d at uppermost arrow). In the layer which passes posteriorly to the rectus muscle, small groups of aponeurotic fibers pass to the midline, to the pubic tubercle, pecten, and symphysis.

5 *Preperitoneal connective tissue* Over the serous sac the preperitoneal, (retroperitoneal, or subserous) layer is thin, yet dissectable as a complete stratum (Figs 1c and 1d at D'). In some specimens, however, the stratum is so slight in bulk that it constitutes nothing more than a cleavage plane between internal spermatic fascia and peritoneum.

6 *Peritoneum* In a series of several hundred specimens without hernial sac or patent processus vaginalis, it was observed that not the slightest peritoneal protrusion, or even small foveate depression occurred at the abdominal inguinal ring. In many of these the inguinal layers were as completely fascial as those encountered in the current specimens. In those cases in which the vaginal process of peritoneum persists, the serous sac, once it is occupied by a hernial mass, readily dilates the surrounding fascial, or musculofascial tubes, derived from the three inguinal layers.<sup>1</sup>

The authors agree with writers who believe that the presence of a patent serous diverticulum is the major predisposing factor in the formation of an indirect inguinal hernia.

7 *Retroperitoneal structures* Among the structures which are lodged in the fibrous stratum between the transversalis fascia and the peritoneum, the inferior epigastric artery deserves special mention, because it is mark-

edly displaced by the hernial mass. When an indirect hernia undergoes enlargement, the hernial orifice encroaches upon the medial area of the inguinal region. The obliquity of the inguinal canal is thus lost as the abdominal inguinal ring enlarges in an inferomedial direction, finally to lie deep to the site of the subcutaneous ring. As the hernial sac migrates downward and medialward, the inferior epigastric vessels are likewise forced toward the lateral border of the rectus muscle, thus reducing the area of Hesselbach's triangle. The artery comes to lie under the hernial sac, the sac itself is stopped in its excursion by the lateral edge of the muscle. Since the abdominal inguinal ring comes to lie directly behind the subcutaneous inguinal ring, the original canal—oblique in course and possessing appreciable length—is converted thereby into superimposed fenestrae whose cylindrical space is no longer than the combined—and very slight—thickness of the inguinal wall.

#### CONCLUSIONS

The external oblique stratum, in the inguinal region, is composed of aponeurotic fibers invested on each surface by a fascial layer. The internal oblique layer is formed mainly of muscle fibers similarly invested by fasciae. The transverse abdominal layer is formed in like manner, however, in its inferomedial portion muscle fascicles are usually wanting, being sometimes replaced by fragmentary aponeurotic fibers. In those instances in which both fascicles and fibers are absent, the investing fasciae, fused, complete the layer inferiorly.

In its course through the inguinal wall the spermatic cord carries downward an investment from each of the three layers. The lower, fascial, part of the transversus layer becomes tubular about the spermatic cord in the plane of the abdominal wall, the tube resembling a curved pipe emerging from a flat surface. The internal oblique stratum does not invest the cord tightly at its proximal end, but surrounds the cord as a broad infundibuliform investment. There is no reduplication to form an "intermediate inguinal ring", therefore, the mouth of the funnel is usually over twice the size of the abdominal inguinal ring. After

<sup>1</sup>On the left side of Specimen II the vaginal process is of small size (Figs 2a and 2b and 3 fig 3). The abdominal orifice is approximately 1.5 mm. in diameter. There is no elevation of peritoneum over the inferior epigastric vessels; the lateral umbilical fold is 2.5 cm. high. A fetal type of urachus is present which produces an ill-defined middle umbilical fold. The vaginal process lies 6.5 cm. lateral to the midline of the specimen. The sacular segment of the process is but 0.3 cm. deep. The process is continued as a dissectable strand to the testis where it broadens to become the tunica vaginalis propria (Fig 3).

acquiring its cremasteric coat, the cord passes forward between the aponeurotic crura of the external oblique layer, carrying with it the external spermatic fascia, in tubular form, from the triangular area between the two aponeurotic crura

In advanced cases of indirect inguinal herniation, the external and internal rings are superimposed upon each other, the sac, having moved downward and medialward in fascial tissue, ultimately reaches a point where further excursion is hindered by the rectus muscle

Each of the strata which invest the spermatic cord reflects in general the character of the source layer on the inguinal wall. The contribution from the external oblique is entirely fascial, it consists of the conjoined fasciae which invest the external oblique aponeurosis. Fused into a single layer at the subcutaneous inguinal ring, it forms the external spermatic fascia.

The layer derived from the internal oblique (the cremasteric layer) is carried downward, not from the definite margins of an aponeurotic fault or cleft, but rather from a layer which regularly contains muscle fascicles in its inguinal portion. Since the fascicles displaced to cover the spermatic cord are few and attenuate, the cremasteric coat is predominantly fascial.

The portion of the transversus layer (the internal spermatic fascia) which contributes developmentally to the set of funicular coats, and, therefore, to the hernial coverings, is

that part which is situated between the arching transversus musculature superiorly and the transversalis fascia inferiorly. The layer represents a fusion of the thin outer lamina of investing fascia and the thicker inner one, the latter being the transversalis fascia.

The preperitoneal connective tissue is usually a definite layer on the inguinal wall, but it is variable in character on the hernial sac. On the inguinal parietes and within the pelvis, it houses the iliac vessels with their branches and tributaries together with the lymphatic glands and vessels. Of these retroperitoneal and retrofascial structures, the inferior epigastric vessels bear an important relation to the enlarged abdominal inguinal ring in indirect hernia, they are displaced, to lie beneath the hernial mass.

The peritoneal sac originally passes through the wall in an oblique or indirect course. Finally, when its course becomes direct, the sac gains contact medially and caudally with the displaced inferior epigastric vessels. These vessels are pressed into a position behind the rectus muscle, the muscle then constitutes the medial boundary of the hernial orifice, the triangular space of Hesselbach being obliterated. As a consequence, the inferior epigastric vessels, in being thus displaced, pass from the medial to the inferior aspect of the sac. In company with these vessels, which cross the floor of the abdominal ostium, are also situated the iliac artery and vein, the ductus deferens, the internal spermatic vessels, and certain of the external iliac lymph glands.

Fig 1

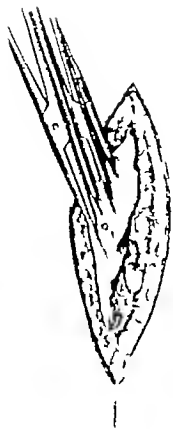


Fig 2

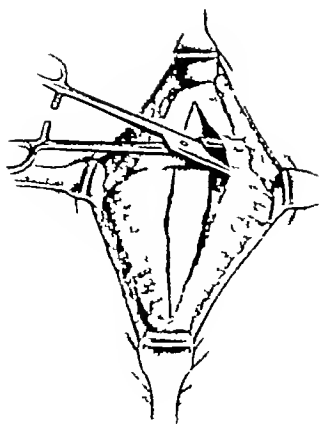


Fig 3

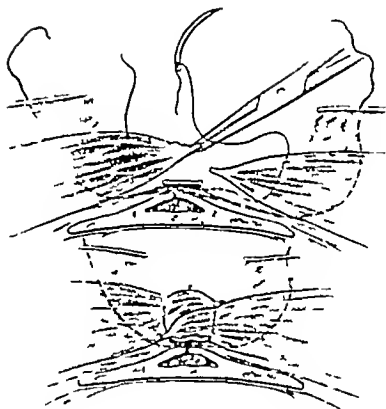
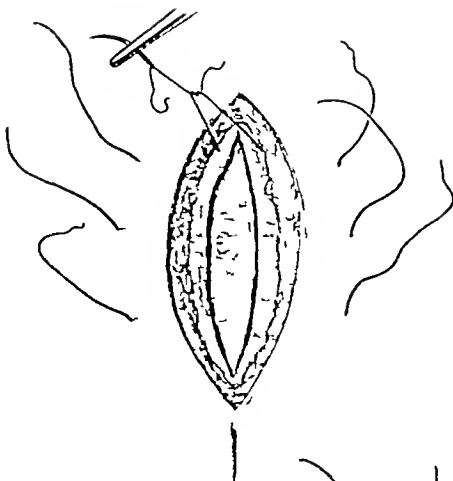


Fig 4

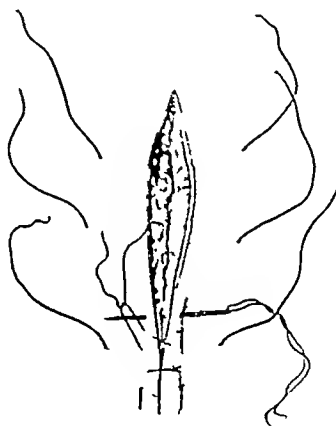


Fig 5



Fig 6

*D. H. Mohardt*

Fig 1 Excision of pilonidal sinus  
 Fig 2 Incision of sacral fascia and development of musculofascial flaps  
 Fig 3 Introduction of retention sutures and suturing of musculofascial flaps

Fig 4 Cross section of Figure 3  
 Fig 5 Approximation of skin by means of mattress sutures  
 Fig 6 Application of gauze roll dressing and tying of retention sutures to maintain pressure

*Pilonidal Sinus — John H Mohardt and Albert C DeFuria*

## PILONIDAL SINUS

### Results in Ninety-two Consecutive Cases Treated by Primary Closure With Gluteus Maximus Sliding Musculofascial Graft

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IN 1946, Charles Pope described a new method of primary closure for pilonidal sinus (8) and together with Hudson (9) reported a series of 79 operations performed in this manner with excellent results. After all affected tissues are completely excised, the defect is repaired by means of a sliding musculofascial graft of gluteus maximus muscle and the wound is primarily closed. The salient features of the technique employed are depicted in Figures 1 through 6.

An elliptical incision is used whenever possible with the points of the ellipse in the median raphe. However, all diseased tissues must be removed. Therefore, lateral extensions are made whenever necessary. The incision is deepened to the sacral fascia and the sinus tracts are completely excised (Fig 1).

The sacral fascia is incised one-fourth to three-eighths of an inch medial to the origin of the gluteus maximus muscle and mobilization of a flap of muscle is undertaken as shown in Figure 2. The narrow border of sacral fascia attached to the muscle flap is preserved to prevent the sutures from pulling through. A line of cleavage is readily encountered upon disengaging the sacral attachment of the gluteus muscle and the musculofascial flap is developed by forcible blunt dissection laterally with the finger. The same procedure is carried out on the opposite side. Bleeding is generous but is surprisingly easily controlled with warm packs and the application of pressure for a few minutes. Only then is ligation of any remaining bleeders with plain No. 00 surgical catgut carried out to obtain complete hemostasis.

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Three or 4 wire retention sutures are introduced through skin, fat, gluteus muscle, and sacrococcygeal fascia as shown in Figure 3. The musculofascial flaps are sutured in place, the dead space being eliminated by means of No. 20 cotton suture as depicted in Figures 3, 4, and 5. No suture material is introduced into the subcutaneous layer of fat, and the skin is closed with No. 0 silk or No. 20 cotton. A deep mattress suture is used which everts the skin edges, particular attention being given to eversion of the skin edges at the inferior pole of the wound. If necessary, further approximation of the wound edges is gained by interrupted sutures which are placed between the mattress sutures (Fig 5).

The wire sutures are tied over a roll of gauze sponges (Fig 6) and abdominal pads are applied to cover the wound neatly. An elastic type of adhesive is then used to maintain pressure.

The present report deals with a review of 92 consecutive cases of pilonidal sinus thus treated. All of these patients were operated upon at the Veterans Administration Hospital, Hines, Illinois, during the period 1946-1948. Our experience confirms the excellent results obtained by this new closed operative method, and we believe we are justified in stating that the operation is applicable in all cases of pilonidal sinus, except in the rare type in which bone, dural, or spinal canal involvement coexist, that these patients are dismissed free of symptoms and apparently cured in a relatively short period of time, and the state of the tissues locally following this operation fortifies against recurrences.

It is not the intention of this report to evaluate the different types of surgical procedures which have been described in recent

years The operative treatment for pilonidal disease falls into 1 of 3 categories, namely, (1) the closed or primary suture method, (2) the open method with or without packing, and (3) a modified or semi-closed method

The closed or primary suture method is theoretically and practically the ideal operation However, certain fundamental difficulties of healing are encountered in this area when primary closure of the wound is attempted following excision of the diseased tissue The difficulty lies, primarily, with the dead space directly over the sacral and coccygeal fascia, and the need of obliterating this dead space with tissues which are nourished by a rich blood supply and which are adequate to fill the defect after bloc excision Motion, moisture, heat, trauma, and contamination are commonly regarded as additional factors unfavorable to healing in this region

Many techniques have been advanced in an attempt to secure adequate closure of this sacral dead space, incisions undermining the fat laterally producing flaps of skin and fat approximated by tension sutures of various ingenious designs supplemented with pressure dressings, sulfonamides, and penicillin parenterally, orally, locally, or both, and lateral incisions to permit approximation of the skin and fat without tension by the closed or semi-closed methods (6) Shute and his colleagues performed primary closure with a musculofascial flap as have Miscall and Holder As Pope (8) points out, their procedure requires greater lateral dissection to mobilize the flaps, lays fascia against fascia, and all tissue layers are apposed and sutured in the midline Others attempting satisfactory primary closure have tried skin grafting (2) or resorted to marsupialization of the incised sinus (3) It is, therefore, evident that the closed procedure is not new

In 1936, Kleckner conducted a statistical study of the recurrence rate of pilonidal sinuses operated upon by members of the American Proctologic Society Of 4,596 patients operated upon there was a recurrence rate of 23.29 per cent for the closed method and 11.13 per cent for the open method Bacon cites a large series reported by Breidenback and Wil-

son in which they obtained 94 per cent cures by the open method and 56 per cent by the closed method

The various methods all have their shortcomings Primary closures as previously performed resulted in frequent failures due to the factors previously mentioned especially the avascular base of the defect and the filling of the defect with tissues with little resistance to infection (4)

The open operation resorted to when the defect is so large that closure cannot be effected primarily is chiefly objectionable because of the long morbidity and the resulting thin scar closely adherent to the sacrum which may be easily traumatized The same objections apply when a compromise is resorted to utilizing the semi-closed procedure when primary closure would cause too great tension on the tissues

The operation involving the mobilization of the gluteus maximus muscle overcomes many of the disadvantages of all other types of pilonidal sinus operations This method permits the interposition of a gluteus musculofascial sliding graft between fat and bone, affording a resilient base for the scar in the fat

This method has a wide application as it obliterates the cavity over the sacrococcygeal region, eliminates the formation of a delicate, thin, easily abraded and broken scar, reduces scarring to a minimum, prevents deformity of the soft tissues, furnishes the tissues with a rich blood supply, supplies a mobile, elastic, resilient covering several layers thick to cushion the sacrococcygeal region over the defect, and furnishes a scar that is resistant to trauma

This series is a surgical review of 92 consecutive cases in which patients were seen during the past 2 years All of the cysts were sacrococcygeal in location, were at least inflammatory, were symptomatic, and in all instances were operated on by the closed procedure Cases of simple sacrococcygeal dimple were not included in this group Seven of the 92 cysts were quiescent at the time of operation, and all patients not demonstrating a definite sinus, associated with a history or definite troublesome symptoms or active inflammations, were not included in this report

Many of these patients required incision and drainage of an abscess, hot wet packs and sitz baths preoperatively. All cysts were termed inflammatory by reason of the pathologic report or by the presence of a purulent discharge. Many patients averaged from 3 to 7 days of preoperative care and some were operated upon in fairly active stages of localized inflammation. The immediate preoperative steps were directed to obtaining a clean operative field. This was accomplished by cleansing enemas with tap water the evening before and the morning of the operation until the returns were clear. The pubic, perineal, sacral, and anal hair was shaved over a wide area. Regular diet was allowed until midnight preceding the day of operation. Penicillin, 20,000 to 30,000 units, was started 24 hours preoperatively and continued postoperatively every 3 hours for at least 7 days. A nonresidue diet was prescribed and bowels were allowed to move spontaneously. The patients were permitted to get out of bed the day following operation or shortly thereafter if they so desired, and no particular position in bed was insisted upon postoperatively. Patients, however, were prohibited from sitting squarely on their buttocks for fear of splitting open the wound.

The results show that of the 92 cases 79 or 85 per cent, healed completely within 20 days. This group includes perfectly healed wounds and those with only minor cutaneous irritation and superficial small breaks in the skin. Thirteen patients required treatment longer than 20 days for persisting sinus, abscess, infection, and these required treatment of not longer than 5 weeks, except for 3 cases in which the wounds were opened and packed and virtually constitute repair by the open procedure. In the entire group of 92 cases the average time required for complete healing was 16 3 days. When severe infections occurred, the deeper structures and muscle layer remained intact and healing was relatively rapid with good covering of tissue still present over the sacrococcygeal region. Treatment consisted of incision and drainage when required, warm moist packs, frequent dressings, and irrigations with sodium chloride. Additional course of penicillin intramuscularly or sulfa

compounds or both were the chief adjuncts of therapy.

It is to be noted that all patients were discharged as healed except for 1 patient who left the hospital with his dressing and sutures on the fifth postoperative day. A follow-up study, including examination by one of us, a physician in the patient's locality, and by questionnaire, disclosed that of 51 patients contacted, all reported favorable results, that is, freedom from recurrence of drainage, except 7. Two returned with a recurrence and were re-operated upon. Five state that they have had drainage on several occasions, probably are recurrences. This constitutes a recurrence rate of less than 15 per cent to date. Thus far, about 85 per cent of all sinuses can be expected to be completely healed without recurrence and of all cases 85 per cent can be expected to be completely healed within 10 to 20 days.

The principles governing operation are no different in this region than elsewhere, infliction of a minimum of trauma, avoidance of contamination, control of bleeding by a minimum of fine ligatures and sutures, elimination of dead space, approximation of all tissue layers without tension by shunning tight suture, whether retention, skin or mattress, and careful bandaging and postoperative care of the bowels to prevent soiling, contamination, and for protection against trauma. Unless abscess occurs no subsequent dressings are necessary until the seventh to the tenth day when the sutures are removed. Continued adhesive binding of the wound is practiced to prevent undue strain and trauma for an additional few days.

#### CONCLUSIONS

1. Block excision with primary closure is the ideal operation for pilonidal cyst when rapidity of healing can be accomplished in the great majority of cases. Excision of all pilonidal tissue and tracts is necessary to assure against recurrence.

2. The closed operative method is not new and is practiced successfully in many cases.

3. The gluteus maximus muscle sliding graft operation is based on sound principles of surgical treatment and is applicable to all



cases except those involving bones, dura, or cord

4 The operation adequately fills all dead space with vascular muscle substance permitting resilient closure free from tension on tissues and furnishes an adequate protective pad of tissue over relatively avascular sacrococcygeal bone and fascia

5 It is our opinion that the operation itself is mainly responsible for the successful outcome in many cases, but certainly penicillin and sulfonamide therapy is a requisite

6 The results of this series justify its claims for further trial

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# CARCINOMA OF THE EXTRAHEPATIC BILE DUCTS

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ON several occasions reports based on series of cases of carcinoma of the extrahepatic portion of the biliary tree have been made from the Mayo Clinic. Among these reports are those of Marshall in 1932, of Judd and Gray in 1932 and of Renshaw in 1922. Except for these and a few other such contributions from the clinic and a few from elsewhere (18, 36, 37) only isolated cases or a small number of cases have been reported by one observer.

Cases which form the basis of this report were encountered at the clinic in the forty years from 1907 through 1946. Because in many of the cases encountered in the earlier years of this period specimens available were not large enough to permit gross or microscopic examination or because perusal of the records of clinical, pathologic, and surgical findings in other cases indicated that the origin of the tumors was questionable, only 90 cases are included in this study. Unquestionably many cases of carcinoma of the extrahepatic ducts were omitted, nevertheless, microscopic or clinical proof of the site of origin of the tumor was lacking at the time this study was made.

## INCIDENCE

To determine the approximate incidence of carcinoma of the extrahepatic bile ducts at operation the records of operations at the clinic for a 10 year period from 1937 through 1946 were examined. During these 10 years, about 14,000 operations were performed on the biliary tract at the clinic. The diagnosis of malignant lesion of the bile ducts was made 66 times or about once in each 210 operations on the biliary tract. Forty-one of these cases were accepted for this study. In addition, during the same period, in 4 cases malignant

disease of the extrahepatic biliary ducts was discovered at necropsy, which made a total of 45 acceptable cases during the 10 year period. The frequency of carcinoma of the extrahepatic bile ducts is compared with that of nearby structures as determined from the same series of 14,000 operations. The extrahepatic bile ducts were affected in 66 cases, the ampulla of Vater, in 44 cases, the gall bladder in 107 cases, and the pancreas in 521 cases.

As another means of determining the relative frequency of the condition, records of about 12,000 consecutive necropsies performed at the clinic were studied. This revealed an incidence of the disease of about 0.26 per cent. Other authors have found this incidence variously as 0.424 (11), 0.073 (21), 0.4 (18), and 0.45 (23) per cent.

Renshaw has given credit to Durand Fardel in 1840 for recognizing carcinoma of the common duct and for reporting the first case, and likewise, to Schueppel in 1878 for recognizing the first case of primary carcinoma of an hepatic duct.

## ETIOLOGY

The etiology of the disease remains obscure since the specific cause of carcinoma remains an enigma. Inciting conditions were considered in more detail in the complete thesis. Certainly in a person who may be hereditarily susceptible to carcinoma in this region, the factor of long-continued irritation or inflammatory disease may play an important part. Robson and Dobson, White, Ewing and McGinn all thought that gall stones might play some role in the production of this disease. In our series the incidence of gall stones was 57 per cent. This incidence is much greater than that found in the clinic population as a whole, or in any comparable group. This experience, therefore, seems to corroborate previous findings supporting the supposition that cholelithiasis is a contributory factor in the pathogenesis of carcinoma of the extrahepatic bile ducts. Furthermore Boyd, Bar-

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Abdgment of thesis submitted by Dr. Neibling to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of M S in Surgery.

TABLE I—RELATIVE FREQUENCY OF MAJOR SYMPTOMS ACCORDING TO VARIOUS AUTHORS

Author	Cases	Sex		Per cent of cases				
		M	F	Jaundice	Pain	Palpable gall bladder	Marked anemia	Correct clinical diagnosis
McLaughlin	4	3	1	3 cases	May occur	50	Uncommon	0
Kirshbaum and Kozoll	62	44*	18*	92	42	30	Profound 19 cases	20
Stewart, Lieber and Morgan	6† 95†	73	31	100	53	26	Varying	20
Shapiro and Lifvendahl	12	9*	3*	100	83	50		0
Present series—Neibling Dockerty and Waush	90	48	42	87	61	38	Uncommon	8½

\*Correction for known preponderance of men over women in hospital as differentiated from normal population revealed 55 per cent males in Kirshbaum's series and a ratio of 9 to 6 in Shapiro's series.

†Cases of personal series.

‡Cases abstracted from literature.

§An additional 53 per cent of cases was thought due to malignant biliary obstruction but the correct site not named.

low and Dick have mentioned the close relation of the constituents of bile to carcinogenic agents and Rolleston and McNee, McLaughlin, Lee and Totten, and Rothenberg and Aronson have mentioned the ulcerative or inflammatory lesions and their relation to carcinoma of the bile ducts. That the disease can occur in the absence of the gall bladder is evident from the reports of Robertson, Robertson, and Bower from Thannhauser's case in which only a rudimentary gall bladder was found.

Papillomas in a small number of cases may be related etiologically to malignant disease. Zenker and Rolleston and co-author have supported such a theory. In our series, however, tumors of papillary type were encountered in only about 5 per cent of the cases, a papilloma as the etiologic factor, therefore, is not well substantiated in the majority of our cases. The appearance of such a tumor may be noted in Figure 1.

#### SEX AND AGE

The sex and age incidence in our series compare favorably with a series of good size from other institutions (18). The youngest patient of this group was a woman 23 years old. This patient seems to be the youngest whose case has been reported thus far. The majority of patients were in the 50 to 70 years of age group and there was about equal distribution in the younger and older groups. In the 30 to 39 year group were 1 man, 2 women, in the 40 to 49 year group, 6 men, 6 women, 50 to 59 year group, 11 men, 15 women, 60 to 69 year

group, 23 men, 16 women, 70 to 79 year group, 6 men, 2 women, 80 to 89 year group, 1 man, a total of 48 men and 42 women. The mean age was 61.4 years for men and for women 56.4 years.

#### SYMPTOMS

The relative frequency of the three major symptoms, jaundice, pain and loss of weight, in our cases shows that 87.5 per cent of men and 85.7 per cent of women were jaundiced at the onset of the disease, 56.2 per cent of the men and 66.6 per cent of the women were suffering from pain, and 79.1 per cent of the men and 78.5 per cent of the women had lost weight near the clinical onset of the disease. These factors together with a general summary of the number of cases reported and the findings of sex and age for a few of the larger series reported from other institutions may be noted in Table I.

Jaundice is the most important and most frequent symptom of the disease and occurred in about 87 per cent of our cases. The frequency with which pain was reported in this series is rather surprising in that 61 per cent of the patients had pain at some time in the course of their disease. Drapiewski in reporting on carcinoma of the pancreas likewise mentioned that pain occurs frequently. In his series about 64 per cent of patients had pain. Both carcinoma of the pancreas and carcinoma of the bile ducts are supposed to be characterized by a silent type jaundice but as these series illustrate, this is frequently not the case. The pain which may be associated with car-

carcinoma of the bile ducts characteristically is intermittent and in most cases ceases when jaundice develops. This is probably the reason for the usual concept of painless jaundice and the fact that pain often may be overlooked even by the patient.

Loss of weight is a rather constant accompaniment of the disease. The average patient lost about 26 pounds (11.8 kgm) in about 4 or 5 months prior to admission to the clinic. As a comparison, the average patient had been jaundiced for only about 2 months.

Fever or chills were rare accompaniments of the disease and when one or the other did occur it frequently seemed to accompany a secondary condition, such as a stone impacted in the duct. The small size of these tumors and the consequent small amount of degeneration within the tumor do not tend to produce fever.

#### CLINICAL FINDINGS

On physical examination of a patient with this disease, jaundice is probably one of the important findings. Frequently considerable pigmentation is present and a dusky hue may be noted. The depth of the jaundice is illustrated by the mean value of serum bilirubin for the entire group which was about 25 milligrams per 100 cubic centimeters with a direct reaction.

The observation (8) that when obstruction of the bile duct is due to a malignant lesion the gall bladder is found dilated and when obstruction of the duct is due to stone the gall bladder is collapsed holds good in the majority of cases. Thus the finding of a palpable gall bladder is of great diagnostic help. In only about 38 per cent of this series of cases was the gall bladder considered palpable. The gall bladder was found enlarged at operation in about 41 per cent of cases. Actually the correlation between the finding of a palpable gall bladder on examination and the proof that the gall bladder is enlarged at operation is poor. Enlargement of the liver is a more dependable finding and was noted on physical examination in 70 per cent of the cases in our series. The enlargement of the liver, inflammatory reactions about the gall bladder and gall stones probably are the most common causes of a mistaken clinical diagnosis of distended gall bladder.

Tenderness on palpation of the abdomen was noted in 38 per cent of the cases. It did not occur more frequently in cases in which either the liver or the gall bladder was enlarged. It would appear that it more frequently was associated with the various inflammatory reactions of concomitant disease of the gall bladder. Cognizance of this may help to prevent an incorrect diagnosis of simple benign biliary disease.

#### LABORATORY DATA

The usual laboratory examinations are not of great value in the diagnosis. Profound anemias are the exception and the concentration of hemoglobin and the erythrocyte count are only slightly decreased. Likewise, in an occasional case in which the concomitant inflammatory components to the disease are marked, leucocytes may number 12,000 or 15,000 per cubic millimeter of blood. The leucocyte counts in most cases and the mean for the series, however, were within normal limits.

The value for serum bilirubin was elevated to an average of about 25 milligrams per 100 cubic centimeters and the reaction was direct in the cases in which jaundice was associated. Indirect positive reactions were rare and generally occurred in the presence of considerable damage to the liver, as a secondary feature of obstruction.

Acholic stools were a regular accompaniment of jaundice and were noted in about 91 per cent of the cases in which jaundice was present. Biluria was in proportion to the jaundice.

Duodenal contents were aspirated in 65 per cent of cases in which jaundice was present. In 50 per cent of these cases no bile was present, in 8 per cent a trace of bile was found on one examination and none at other examinations. In 30 per cent only a trace of bile was present at any examination and in only 12 per cent was a free flow of bile found. Blood was found in the aspirated duodenal contents only 4 of the patients, and may be considered a rare finding in patients who have carcinoma of the extrahepatic bile ducts. The presence of blood in the duodenal contents was diagnostically of no help in locating the origin of the tumor within the extrahepatic bile duct.

TABLE II —PREOPERATIVE DIAGNOSIS AND THE NUMBER OF PATIENTS WITHOUT JAUNDICE IN EACH GROUP

Preoperative diagnosis	Total patients	Number without jaundice
Carcinoma of the pancreas	31	1
Malignant obstructive jaundice	14	0
Carcinoma of the bile ducts	7	1
Common duct stone or malignancy	9	1
Common duct stone	14	3
Cholecystitis with stones	5	5
Cholecystitis	1	1
Intrahepatic jaundice	2	0
Obstructive jaundice	1	0
Obstruction of the common duct and biliary fistula	1	0
None exploratory operation for indeterminate abdominal condition	2	2

## PREOPERATIVE DIAGNOSIS

The preoperative diagnosis given first by the clinician was correctly stated to be malignant disease with biliary obstruction in 61 per cent of cases. However, in only about 8 per cent was the location given as definitely in the bile ducts. In 38 per cent of the cases the condition was thought to be due to carcinoma of the head of the pancreas and in 16 per cent to be due to malignant obstruction of the bile ducts, but the exact location was not named. In the remaining 39 per cent of cases the condition was thought not to be due to malignancy. The majority of patients of this group were thought to have stones of the common duct, or cholecystitis with stones or allied conditions. Of interest is the fact that all 5 of the patients thought to have cholecystitis with stones were not jaundiced. Correlation of the patients' diagnoses with the absence of jaundice may be noted in Table II.

## SURGICAL TREATMENT

Numerous and varied operations have been attempted to eradicate the disease. Renshaw credited Baudoin with performing the first hepatocholeangio-enterostomy in 1896 and Cotte for suggesting a hepatocholeangiojejunostomy of the Y type. W. J. Mayo was one of the first to utilize the end-to-end anastomosis. Numerous reports (4,7,14,15,27,29)

TABLE III —AVERAGE LENGTH OF LIFE OF PATIENTS WHO HAVE DIED AFTER ONSET OF JAUNDICE AND AFTER OPERATION BY LOCATION OF LESION

Location	After jaundice		After operation	
	Patients	Average survival months	Patients	Average survival months
Common duct	25*	7.5	27*	4.8*
Juncture of common hepatic and cystic ducts	27	3.8	31	2.6
Hepatic ducts	21	4.3	23	2.6
Cystic duct	0		3	†
Diffuse origin	1	1.3	4	2.1
Total	74*	5.1	88*	3.2

\*Two additional patients are not included although both were jaundiced prior to operation. One is alive 7 months and the other 2 years and months after operation.

†Exact period of survival is unknown but known to be less than 2 months in any of the cases.

since have mentioned the use and some of the advantages of block resection of the duct with end-to-end anastomosis. The Whipple type of procedure also has been advocated by some (6,29).

In our series all types of operation from simple biopsy to the Whipple procedure were attempted. Resection of the involved portion of the duct seemed to give the best results. The subsequent anastomosis was made either by bringing the sectioned ends of the duct together as an end-to-end anastomosis or by anastomosis of the end of the duct to the duodenum or jejunum. This series seemed to confirm the impression gained in other series in which reconstructive operations were performed on the biliary tract that a Roux type of anastomosis is neither necessary nor advisable. The stomach, if mobile enough for use in the anastomosis, is also satisfactory as is probably any portion of the gastrointestinal tract. W. J. Mayo showed many years ago that even the colon can be used with a good result for the anastomosis. Palliative internal or external drainage operations were not successful in our series, this observation substantiates the findings of others (4,9,10,28,30). However, there certainly could be no objection to cholecystogastrostomy for drainage and relief of jaundice provided that the tumor will allow passage of bile through the gall bladder.

External drainage procedures in cases of malignant lesions in the bile ducts as in cases of a carcinoma of the pancreas or ampulla are not satisfactory. The problems of fluid and electrolytic balance consequent to establishment of an external biliary fistula usually outweigh the advantage of temporary relief of jaundice for a patient who is already debilitated by carcinoma.

Because of the proximity of these lesions to many vital structures, it is doubtful whether any more radical surgical approach to the problem will become satisfactory. Attempts at wider resection frequently are followed by disaster as illustrated by certain reported cases (5) in which the hepatic artery was sectioned in the region of the tumor with resultant infarction of the liver and death from hepatic insufficiency. It seems that extirpation of the involved segment of duct will be successful only in the absence of extension of the disease. Patients of this series who have lived the longest time after operation are in this group.

*Course after operation.* The survival rate is very poor even when optimal conditions for resection are present. The mean period of survival after operation for all patients was only 3 or 4 months, and the mean period of survival from the onset of jaundice was only a month more (Table III). One patient is still alive 2 years and 2 months after operation. Survival for this length of time occurs too seldom to change what must necessarily be a pessimistic outlook.<sup>1</sup>

Previous observers have stated that the disease was seen early in its course (22) or that widespread metastasis is unlikely (17). It would appear from a general study of our 90 cases in which 63 per cent of the patients had metastasis at the time of operation and the average patient had been notified of illness by the onset of jaundice only about 8 weeks before operation, that the disease is not being seen early in its course. This is substantiated by the fact that in 14 per cent of cases the disease was not far enough advanced to cause jaundice and yet in three-fourths of these



Fig 1 Papillary carcinoma of low grade in the common hepatic bile duct (X 31)

cases metastatic lesions or extension was noted at the time of operation.

#### PATHOLOGIC FINDINGS

Grossly the material was not such as to lend itself to any method of classification although generally the types of lesions present were villous (38), diffuse and nodular as Walters and Snell and others (13) have mentioned. The majority of lesions appeared as circumscribed, firm, infiltrated, grayish white nodules often obstructing the lumen of the resected duct and associated with dilatation proximally. Figures 2 and 3 illustrate this type. In a few instances a polypoid lesion was noted with actual obliteration of the duct. In the more diffuse lesions there was cordlike thickening of the involved portions. The similarity of some of these types to benign stricture has been pointed out by Bell. Extension or metastasis in many cases was the first indication to the surgeon that the condition was in fact not on an inflammatory basis. Metastatic deposits in more than a third of the cases were noted in the liver which in many instances also showed the obstructive phenomenon of hydrohepatosis (Fig 4).

Carcinoma of the hepatic ducts was found in 23 cases, carcinoma at the juncture of the cystic and common ducts in 31, carcinoma of the common duct in 29 (Fig 6) and carcinoma of the cystic duct in 3. In 4 cases the tumors were so diffuse that the exact point of origin could not be determined (Fig 5 and Table IV).

<sup>1</sup> Since preparation of this article this patient has returned and was found to have an inoperable recurrence at the site of the anastomosis.



Fig 2 Carcinoma of the common bile duct halfway between the cystic duct and the ampulla of Vater



Fig 3 Carcinoma of the common hepatic bile duct

Microscopically all of our tumors were of the adenocarcinoma type. Other investigators have reported a similar finding although an occasional squamous-cell epithelioma of the duct has been noted, and one author mentioned sarcoma although he did not report a case. Figures 1 and 7 illustrate some of the microscopic characteristics of the disease.

Microscopically three general types of adenocarcinoma were present in our cases: (1) a fibrous or scirrhous form, (2) a mucous form (Fig 7), and (3) in 5 cases a papillary form (Fig 1). The microscopic features are given in more detail in the complete thesis, but we wish to elaborate on certain modes of spread seen in these carcinomas and to relate these to the clinical features of pain and jaundice.

#### INVOLVEMENT OF NERVES

The literature on carcinoma of the bile ducts scarcely mentions the involvement of nerves

by the disease. Moore was one of the few to suggest that pain in carcinoma of the bile ducts may be due to spread of the lesion to the nerves, and Masuda reported involvement of nerves in 12 of his 15 cases. In our series involvement of nerves was studied, but serial sections or large numbers of sections were not made specifically to locate the nerves. Despite this, in 46 of the 90 cases nerve filaments were identified in sections examined. In 29 cases (63 per cent) of this group the nerves have been invaded by tumor cells. The involvement was found most frequently in the perineural sheath. Whether involvement in the sheath constituted involvement of a true space along which tumor cells might travel as in lymphatics or blood vessels, or whether the sheath merely offered a ready plane of cleavage is not clear. Less commonly the invasive tumor cells directly replaced or invaded the

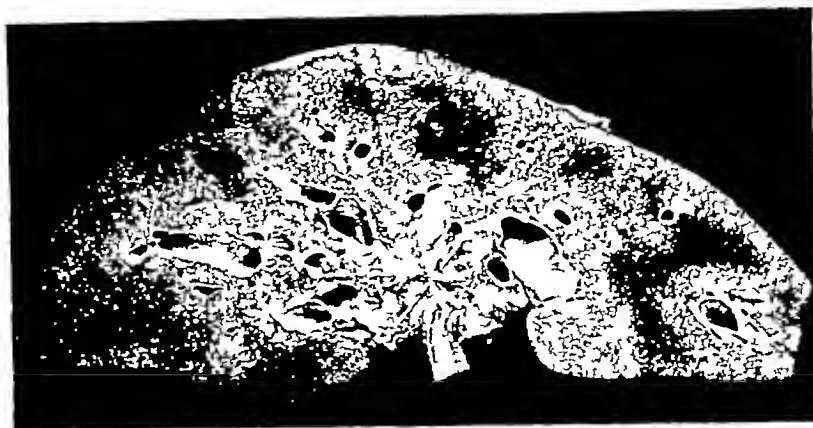


Fig 4 Hydrohepatosis in a case of carcinoma high in the hepatic duct. Anatomic obstruction from the tumor was lacking.

nerve bundles. This phenomenon was found in a number of cases and in some acini of tumor cells highly productive of mucus had formed a pocket of that substance within the nerve bundle. Figure 8 illustrates involvement of nerve by carcinoma. This series might be favorably compared with that of Drapiewski, who, after specifically searching for involved nerves in carcinoma of the pancreas, found invasion of nerves in 84 per cent of his cases.

Two results of neural invasion should be considered: pain and the possible physiologic cause of jaundice. Pain occurred at some time in 20 of the 29 cases in which the nerves were involved by tumor cells. As is rather characteristic of the disease, the pain ceased after the development of jaundice in 12 of the 20 cases. In 5 some distress continued after the develop-

ment of jaundice, and in 3 jaundice did not develop.

In 17 cases nerves were noted in the sections but no involvement by tumor cells was found. Only 9 of these patients had pain. This is a relatively smaller number than was found in the group in which nerves were involved.

The relationship of the involvement of nerves, metastasis and pain was studied. It

TABLE IV — GRADE OF MALIGNANCY AND LOCATION OF LESIONS 90 CASES

Location	Grade of malignancy				Total
	Grade 1	Grade 2	Grade 3	Grade 4	
Common duct	5*	13†	9	2	29
Juncture of common hepatic and cystic ducts	3	16*	0	3	31
Cystic duct	1	2	0	0	3
Hepatic ducts	8†	10	4	1	23
Diffuse spread	1	0	1	2	4
Total	18	31	23	8	90

\*Two patients of this group had papillary tumors.  
†One patient of this group had a papillary tumor.

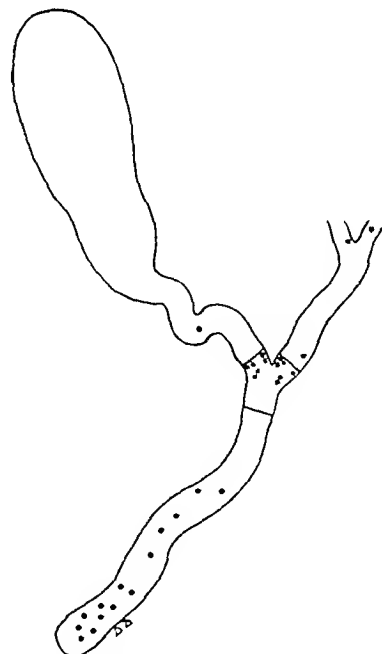


Fig 5 Location of lesions of the extrahepatic bile ducts.





Fig 6 Carcinoma of the common bile duct showing origin from the duct wall ( $\times 31$ )

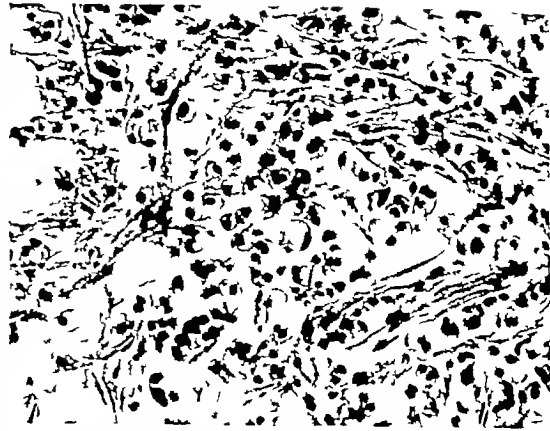


Fig 7 Carcinoma, grade 4, at the juncture of the common and cystic ducts with numerous signet ring cells filled with mucus ( $\times 70$ )

was found that in all 5 cases in which nerves were involved and pain persisted after the onset of jaundice, clinically demonstrable metastasis was present at the time of operation, whereas in 10 of the 15 cases in which nerves were involved and pain was present before but not after the onset of jaundice, metastasis or direct extension was noted at the time of operation. Although they were not recognized at the time of operation, in 2 of the remaining cases the subsequent course indicated that metastatic lesions were present. Thus in 15 of 20 cases (75 per cent) in which both involvement of nerves and pain were present metastasis also was present at time of operation.



Fig 8 Nerve involved by extension from carcinoma of hepatic duct ( $\times 31$ )

In 17 cases nerves were noted in sections studied but they were not involved. In 9 cases pain occurred. The pain in 7 occurred before the onset of jaundice and in the remaining 2 both before and after the onset of jaundice. In 7 of the 9 including the 2 in which pain was present both before and after onset of jaundice, extension or metastasis was noted at the time of operation. In 5 of the 8 cases in which no pain had occurred prior to operation extension or metastasis was noted at the time of operation.

#### MECHANISM OF JAUNDICE

Jaundice is rather uniformly found in cases of carcinoma of the extrahepatic bile ducts, and yet, the mechanism for the production of jaundice is indefinite. Many observers accept the idea of obstruction of the duct by the tumor as the main mechanism, yet in our series as in other series, many of the tumors did not anatomically obstruct the duct (Fig 4). Frequently at operation or necropsy a probe can be passed through the duct with little resistance or moderate pressure on the gall bladder may empty it. Nevertheless, the patient may appear to have had jaundice of the type produced by complete obstruction with acholic stools, dark urine, and absence of bile in the duodenal contents. In some cases pressure on the duct from without, which Ewing suggested as a cause of jaundice, may be sufficient to obstruct the duct. However,

the frequency with which actual cholangiectasis or hydrohepatosis is seen makes one wonder why the pressure of bile itself was not sufficient to force passage of the bile through the same channels that permit easy passage of a probe

Milles and Koucky suggested that the flow of bile proper might offer an essential stimulus to the rhythmic emptying of the gall bladder and the muscular contraction of the common duct. This concept may well help to explain dilatation, in some cases, of the gall bladder and ducts above the tumor

Drapiewski in commenting on carcinoma of the head of the pancreas postulated a physiologic block resulting from invasion of the wall of the duct by tumor cells and consequent inhibition of the contractibility of the lower end of the common duct. Such a cause also must be considered in the production of obstruction in cases of carcinoma of the extrahepatic ducts

Involvement of nerves and the role of the nerves in producing physiologic obstruction have been overlooked thus far. Support is given to this suggestion by the fact that in 28 of 29 cases in which nerves were involved, jaundice was present. A mechanism based on a nervous factor in the production of a physiologic rather than an anatomic type of obstructive jaundice may be postulated

Jaundice then may be the result of one or both of two mechanisms: (1) an anatomic mechanism with true obstruction of the duct or (2) a physiologic mechanism, which may be related to loss or lack of contractibility from invasive processes or from loss of essential nerve impulses because of involvement of nerves, or to lack of stimulus from bile flow

#### SUMMARY

Carcinoma of the extrahepatic bile ducts was found in about 0.5 per cent of all cases in which operations were performed on the biliary tract at the Mayo Clinic in a 10 year period. In our series of 90 cases it occurred 14 times more frequently among males than among females. The average age of the patients was about 55 to 60 years.

Jaundice was the most common complaint of 87 per cent of patients in the series prior to

operation. Pain occurred in 61 per cent of cases at some time in the course of the disease. Loss of weight was the earliest sign of something amiss. Fever and chills were rare.

The concentration of direct reacting serum bilirubin averaged about 25 milligrams per 100 cubic centimeters. Acholic stools were noted in 91 per cent of the cases of jaundice. Aspiration of duodenal contents showed a decrease or absence of bile in the presence of jaundice.

In our series of 90 cases 26 per cent of tumors were located in the hepatic ducts, 35 per cent at the juncture of the common, cystic and hepatic ducts, 32 per cent in the common duct, and 3 per cent in the cystic duct. Four per cent of the tumors were diffuse, and no definite point of origin along the duct could be determined.

Nerves were involved in 63 per cent of cases in which nerves were found in the sections. Pain occurred more frequently in cases in which involvement of nerves was found than in other cases.

Jaundice may be due to physiologic as well as anatomic obstruction of the duct. This physiologic obstruction may be due to inhibition of nerve impulses.

Tumors of this series were all adenocarcinomas, many of which were productive of abundant amounts of mucus. Only 5 per cent of tumors assumed a papillary form.

The disease was rapidly fatal and was usually far advanced in its course when operation was performed. Metastasis or extension occurred early in the disease. Even in a small group of cases operated on prior to development of jaundice metastasis was evident in 75 per cent. The average period of survival after operation was only about 3 or 4 months and after onset of jaundice it was only about 5 months.

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# DETERMINATION OF THE STRENGTH OF THE CANCELLOUS BONE IN THE HEAD AND NECK OF THE FEMUR

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**I**N the treatment of fractures of the neck of the femur by internal fixation, success or failure depends in part on the ability of the cancellous bone of the femoral head to hold the proximal end of the fixation appliance. To determine whether the holding force of the cancellous bone throughout the

head and subcapital area of the neck of the femur was uniform or not was the purpose of the experiment

## MATERIALS AND METHODS

The 94 femora used in this experiment were secured from cadavers. The moisture content of all bones was kept constant by immersion in water. The number of males and females

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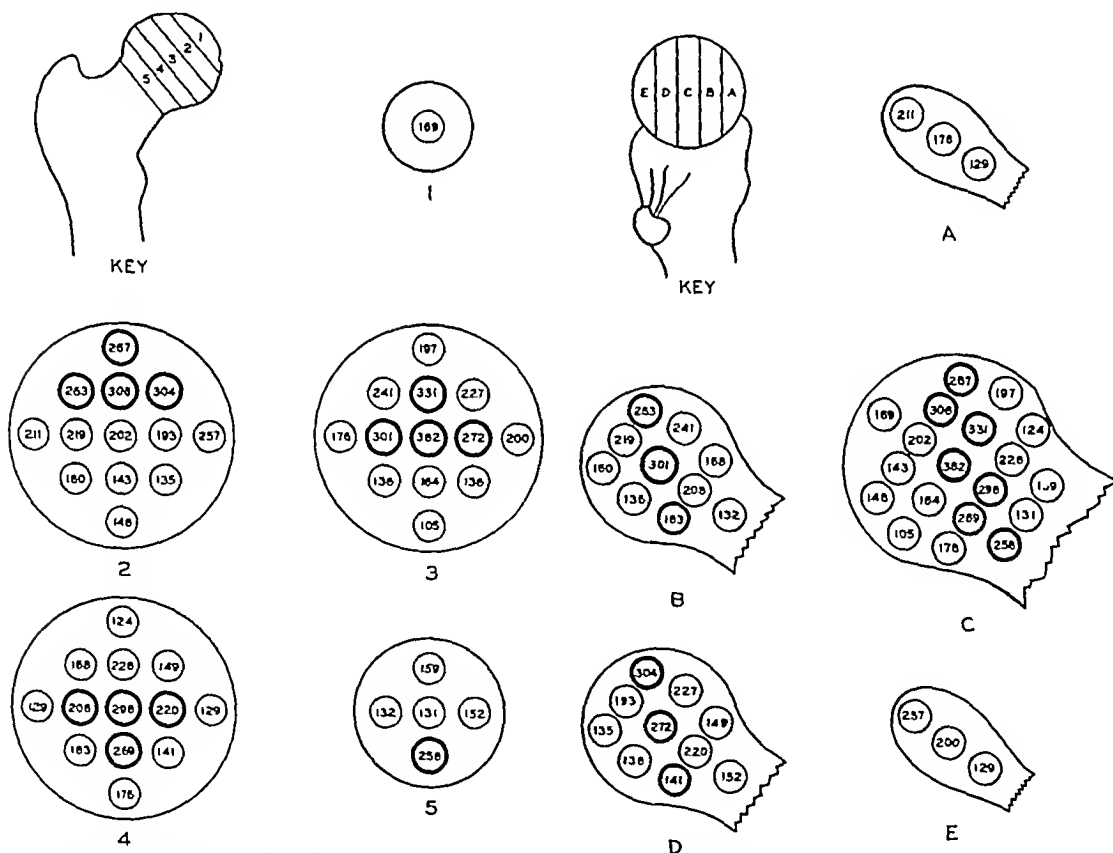


Fig 1 The average force (in pounds) required to crush each zone in the 5 cross sections is illustrated. The areas of greatest strength are encircled by heavy lines.

Fig 2 Rearrangement in 5 frontal planes of the experimental findings showing zones of greatest strength as illustrated in Figure 1.



Fig 3 Roentgenogram of head and neck of femur showing compression and tension lamellae

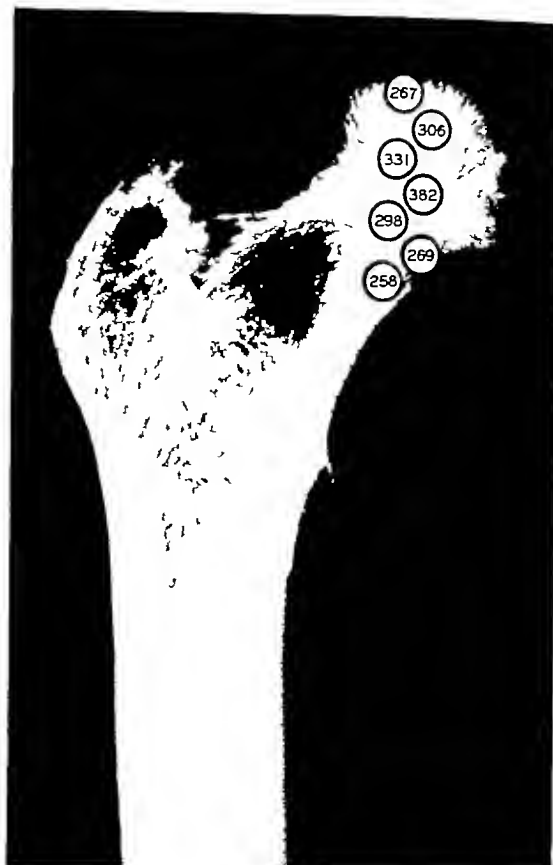


Fig 4 The relationship of the lamellae to the area of greatest strength is illustrated

and the average ages are shown in Table I. The bodies from which the bones were derived were from institutional inmates whose physical activities closely simulated those of the average patients who suffer fractures of the neck of the femur. The findings are thus of practical value to the surgeon.

Consecutive cross sections of bone,  $\frac{1}{4}$  inch thick, were prepared from the head and proximal

portion of the neck. A flat-nosed metal punch,  $\frac{1}{4}$  inch in diameter, was used to crush the bone in specific areas of each section as illustrated in Figure 1. To avoid errors due to impact and friction the punch was driven at a uniform rate by a constant speed motor and adjusted to enter the bone to a depth of  $\frac{1}{8}$  inch. The force required to crush the bone without producing compression was measured in pounds. The machine was accurate to within 0.2 per cent.

TABLE I—FEMORA USED FOR DETERMINING THE HOLDING FORCE OF THE CANCELLOUS BONE

Sex	Femora		Average age
	R	L	
Male	R	31	60.9
	L	29	
Female	R	16	70.8
	L	18	
Total	64		65.5

#### FINDINGS

The average force (in pounds) required to crush the bone was almost equal in corresponding zones in the series of right and left femora. Study of Figures 1 and 2 indicates that the maximum holding force of the cancellous bone of the head and subcapital region of the neck

of the femur lies along a tract extending from the medial end of the inferior cortex of the neck to the middle of the superior aspect of the head. It is greatest where the stress and tension lamellae are intersecting.

#### DISCUSSION

The findings bear a close relationship to the internal architecture of the femoral head and neck. The weight of the body is transmitted via the acetabulum to the head of the femur. The load is first borne by the superior surface of the femoral head, whence it is transferred to the inferior cortex of the neck, the latter gradually thickening from a medial to lateral direction as more and more weight is conveyed to it. Figure 3 is a roentgenogram of the proximal end of a femur. The stress or compression lamellae are seen passing from the inferior neck cortex medialward and upward, fanning out as they ascend. The arching tension lamellae may also be observed extending from the superior and medial aspect of the greater trochanter to the inferior and medial aspect of the head. In Figure 4 the zones of greatest strength in individual cross sections are arranged in their relationship to these la-

mellae. The anatomical and physiological importance of this arrangement of the lamellae is emphasized by Dixon (1910) and Koch (1917).

To take advantage of this anatomical feature in the internal fixation of femoral neck fractures, the fixation appliance should be directed in a more vertical or oblique manner than is the general practice. Thus the distal end of the fixation device would be anchored in solid cortex laterally, the shaft would rest on the thickened inferior cortex of the neck, while the proximal end would be embedded in that area of the head in which the cancellous bone possesses the maximum holding force.

#### SUMMARY AND CONCLUSION

The holding force of the cancellous bone of the head and subcapital area of the neck of the femur was determined in 94 femora. The area of greatest holding force was found to extend along a tract between the medial end of the inferior cortex of the neck and the middle of the superior surface of the head.

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# ULTRARAPID BLOOD TRANSFUSION

## Clinical and Experimental Observations

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THE advantages of rapid blood transfusions are readily appreciated especially in the treatment of patients in profound shock when blood pressure readings are very low or cannot be obtained, and when peripheral pulse is barely or not at all perceptible.

A simple method for the rapid introduction of blood (intravenously) was devised by one of us (V. K. P.) and consists of a small oxygen tank to which is attached a standard reduction valve and gas flow meter. A sterilized rubber tube is attached to the valve and at the other end a needle (gauge 15). The needle is inserted through the cork in the air vent of an inverted blood filled transfusion flask (Baxter) and the standard tubing with drop filter assembly attached to the outlet in the usual fashion for administering blood by the gravity method. When the valve on the oxygen bottle is opened, oxygen passes through the air vent into the space above the blood in the flask and by exerting pressure here the outflow of blood is accelerated. The assembly can be made from equipment already at hand in the operating room and requires no special additional apparatus (Figs. 1-2). A size 15 needle is employed for insertion into the antecubital vein.

This method of rapid transfusion has been employed with satisfaction in over 100 instances and now is employed routinely on our service when indicated.

In one patient there was sudden collapse and death during the operation about 10 minutes after 500 cubic centimeters of blood had been injected in the course of 5 minutes. The operation, consisting of laparotomy in an attempt to excise a recurrent carcinoma of the corpus, had been under way about 20 minutes

when the sudden general collapse ensued. Artificial respiration, cardiac massage, intracardiac injection of adrenalin failed to revive the patient. Complete necropsy (including head) revealed no evident explanation for the sudden fatality. The heart was small and contracted. The lungs did not exhibit edema or congestion. There was no venous engorgement and no evidence of fat or air embolism. (There was no evidence to indicate that the latter could have occurred.) It was the general consensus that the fatal outcome in this case was not due to the transfusion. (Transfused blood compatible, etc.)

So far the method described has been employed only for intravenous administration of blood but it could also be used for intra-arterial transfusion. Kay and Haefler have reported a somewhat similar method for intra-tortic rapid transfusion of blood in one instance as a life saving procedure and with apparent success. The oxygen under pressure in their apparatus was used for oxygenation of the blood. Pressure for injection was obtained from the oxygen tank at first but later a sphygmometer operated by hand was employed for maintenance of pressure in the flask to accelerate the transfusion. The method we describe must be carried out under the direct supervision of a physician who devotes full attention to the procedure.

Protocols from some of the operations in which ultrarapid blood transfusions were employed are presented in the following paragraphs.

CASE 1. M. M. female, aged 40 years. Radical vaginorabdominal panhysterectomy with pelvic lymph node dissection was performed. Course was uneventful during first hour then during period of 20 minutes blood pressure dropped from preoperative level of 110/70 to 80/70. Only saline had been given intravenously. A transfusion of 500 cubic centimeters of citrated whole blood was injected in 3

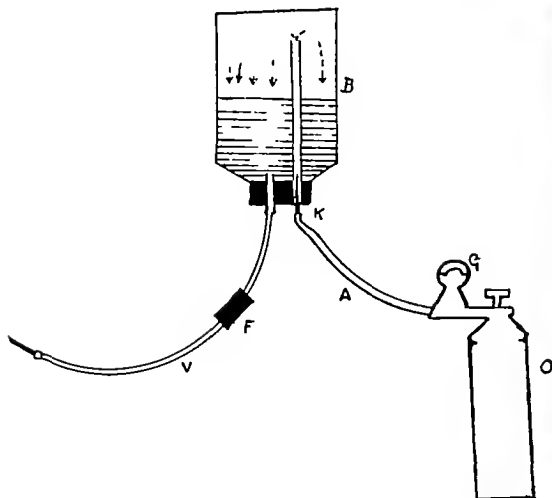


Fig 1 Diagram of high pressure blood transfusion assembly *B*, inverted flask containing blood (Baxter), *O*, oxygen tank, *G*, airflow meter, *A*, sterile tubing from oxygen tank to No 15 gauge needle, *K*, which is inserted through air vent, *F*, drop filter in sterile tubing, *V*, leading to needle which is inserted into the vein. The oxygen led into *B* exerts downward pressure on surface of blood forcing the latter into intravenous tubing at increased speed

minutes. The blood pressure immediately returned to 100/70 and became stabilized at this level. Prior to transfusion anesthetist reported forehead was cold, moist, and clammy, after transfusion face became warm and dry. Convalescence from operation was uneventful.

**CASE B** T S, male, aged 65 years. Resection of massive leiomyosarcoma of sigmoid colon weighing 3300 grams, partial colectomy, and end-to-end anastomosis were performed. During first 20 minutes of operation considerable bleeding occurred as the tumor was being rapidly mobilized. Blood pressure dropped from 130/70 to 80/70. Two thousand cubic centimeters of citrated blood were delivered in 13 minutes during which time actual excision was carried out. There was an immediate rise in blood pressure to 120/70 at which level it was stabilized during the remainder of the operation which took 1 hour. Convalescence from operation was uneventful.

**CASE C** (Example of one rapid transfusion sufficient for massive resection of all pelvic viscera) C R, female, aged 36 years. Panhysterectomy with pelvic node resection, total cystectomy, pelvic colectomy, and bilateral ureteral implantation into colon and colostomy were performed—an abdominoperineal operation. During first hour and 50 minutes of operation blood loss was minimal, intravenous saline was administered by gravity. Blood pressure was 100/80. During the perineal stage the blood pressure dropped suddenly to 66/50. Five hundred cubic centimeters of whole blood were injected in 1 minute and 50 seconds. Blood pressure was 92/80 at end of transfusion. One minute later it was 104/80



Fig 2 Photograph of assembly for rapid transfusion for blood under oxygen pressure. Materials required are part of routine equipment in any operating suite or emergency room

and remained at this level until end of the operation. Convalescence was uneventful and the patient was discharged.

**CASE D** (Example in which it is the impression of the authors that the patient's life was saved by ultrarapid massive transfusions) Far, female, aged 52 years. Resection of large multiple recurrent masses of leiomyosarcoma from retroperitoneal region was performed. Preoperative blood pressure was 130/80. When the abdomen was opened and the intra-abdominal tension released there was sudden hemorrhage, and 1500 cubic centimeters of blood rapidly accumulated in the aspiration bottle. The blood pressure and pulse could not be obtained. The patient was breathing very shallowly and was very pale and cyanotic. 1700 cubic centimeters of blood were injected during 7 minutes with immediate return of blood pressure to 100/80 and pulse rate determinable at 120 per minute. At the close of the operation 1 hour and 10 minutes later, the blood pressure was 110/60, pulse 100. During convalescence there was no evidence of hepatic damage from "citrate intoxication." Five months later she was seen again as an out patient, had been doing a moderate amount of housework and felt well. However,

there was recurrence of the neoplasm in the lower abdomen and no further treatment was considered

In many other instances 500 cubic centimeters of citrated blood were injected in  $1\frac{1}{2}$  to 3 minutes

The question arises as to whether or not high speed transfusion may entail certain risks by too rapidly increasing the circulatory volume and thereby cause cardiac dilatation with failure. Information in this direction was sought by the following experiments carried out in dogs

I Dogs will tolerate rapid intravenous infusion of isotonic (5 per cent) glucose solution in large quantities

*Experiment 1* Dog 19, weight 21.9 kilograms. Nembutal anesthesia was used. Oxygen pressure assembly for ultrarapid intravenous (femoral vein) infusion. One thousand cubic centimeters of 5 per cent glucose were injected in  $4\frac{1}{4}$  minutes, no pause. One thousand cubic centimeters of 5 per cent glucose were injected in  $2\frac{3}{4}$  minutes,  $2\frac{1}{2}$  minute interval. One thousand cubic centimeters of 5 per cent glucose were injected in 2 minutes.

During a period of  $11\frac{1}{2}$  minutes 3000 cubic centimeters of 5 per cent glucose were injected. Thirteen minutes after the last injection there were râles throughout both lungs, respirations appeared labored, pulse varied from 140 to 150 per minute, the abdomen appeared distended, and felt cold. The systolic blood pressure remained at practically constant levels, 110, 120 millimeters of mercury.

After several hours the animal recovered and the next day appeared normal.

*Experiment 2* Dog 28, weight 17.2 kilograms. Procedure carried out as above. Five hundred cubic centimeters of 5 per cent glucose were injected in  $1\frac{1}{2}$  minutes, 1 minute interval. One thousand cubic centimeters of 5 per cent glucose were injected in  $3\frac{1}{2}$  minutes, 4 minute interval. One thousand cubic centimeters of 5 per cent glucose were injected in  $3\frac{1}{2}$  minutes.

Over a period of  $8\frac{1}{2}$  minutes 2500 cubic centimeters of 5 per cent glucose were injected.

In this animal pulmonary edema did not develop and recovery was satisfactory. Blood pressure remained constant. The animal died 1 week later presumably of infection of the operative wound in the left inguinal region.

*Experiment 3* Dog 27, weight 16.4 kilograms. Procedure carried out as above. One thousand cubic centimeters of 5 per cent glucose were injected in  $2\frac{1}{2}$  minutes. Increase in blood pressure (systolic) from 135 millimeters to 145 millimeters of mercury, 3 minute pause. One thousand cubic centimeters of 5 per cent glucose were injected in  $4\frac{1}{2}$  minutes, 6 minute pause. Five hundred cubic centimeters of 5 per cent glucose were injected in  $3\frac{1}{2}$  minutes.

Over a period of  $19\frac{1}{2}$  minutes 2500 cubic centimeters of 5 per cent glucose were injected. Following injection respirations were labored, blood pressure remained at 135 millimeters of mercury (systolic). Recovery was complete in a few hours.

II In dogs not previously bled, rapid intravenous injection of large quantities of heparinized citrated blood apparently overloads the circulatory system and causes fall in blood pressure. The blood employed in these experiments was obtained by exsanguination of other dogs.

*Experiment 4* Dog 21, weight 22.7 kilograms. Nembutal anesthesia was used. Oxygen pressure assembly for ultra rapid intravenous (femoral vein) infusion of dogs blood. Three hundred cubic centimeters of blood were injected in 3 minutes. Pulse increased from 136 to 180 per minute. Respiration rose from 14 to 20 per minute. There was no change in blood pressure (120 systolic). Two minute interval. Two hundred and fifty cubic centimeters of blood were injected in 6 minutes. Pulse rose to 200, respiration 12, blood pressure fell to 110 (systolic). One minute interval. Three hundred cubic centimeters of blood were injected in  $3\frac{1}{2}$  minutes. Pulse 200 (arrhythmic), respiration 8-12, blood pressure 110 (systolic). Two minute interval. Six hundred cubic centimeters of blood were injected in  $4\frac{1}{2}$  minutes, pulse 180, respiration 11, blood pressure fell to 90 (systolic). Received 1500 cubic centimeters of blood during 20 minute period. At close of experiment 20 cubic centimeters of 10 per cent solution of calcium gluconate were injected. Following recovery from anesthesia animal appeared normal.

*Experiment 5* Dog 16, weight 12.8 kilograms. Rapid infusion of blood as above. Six hundred and twenty cubic centimeters of blood were injected in 10 minutes. Pulse rose from 92 to a rate too rapid to count, respiration dropped from 18 to 12, blood pressure (systolic) rose from 111 millimeters of mercury to 120 millimeters. No rest period. Four hundred cubic centimeters of blood were injected in 7 minutes. Pulse too rapid to count, respiration and blood pressure unchanged. Two minute interval. Two hundred cubic centimeters of blood were injected in 3 minutes. Pulse too rapid to count, respiration 16, blood pressure 115 millimeters (systolic). One thousand two hundred and twenty cubic centimeters of blood were injected during period of 22 minutes. Recovery uneventful.

*Experiment 6* Dog 22, weight 18.7 kilograms. Rapid infusion of blood as above. Five hundred cubic centimeters of blood were injected in 4 minutes. Blood pressure fell from 128 millimeters of mercury to 90 millimeters (systolic). Pulse from 120 to a rate too rapid to count, respiration 16 to 18. No rest period. Five hundred and fifty cubic centimeters of blood were injected in  $4\frac{1}{2}$  minutes. Blood

pressure rose from 55 to 85 (systolic), respiration 16 to 20, animal appeared cyanotic. Clonic convulsions. No calcium gluconate injected. Received 1550 cubic centimeters of blood during period of 13½ minutes. Recovery complete and uneventful.

*Experiment 7* Dog 17, weight 12.4 kilograms. Rapid infusion of blood as above. Seven hundred and fifty cubic centimeters of blood were injected in 10 minutes. Blood pressure fell from 140 (systolic) to 50 and then returned to 110, 1 minute rest period. Seven hundred and fifty cubic centimeters of blood were injected in 9 minutes. Blood pressure fell from 120 to 43 (systolic). Three minutes after injection animal died (respiration ceased). Necropsy revealed heart dilated but lungs were not congested. The liver appeared large.

*Experiment 8* Dog 27 A, weight 22.3 kilograms. Rapid infusion of blood as above. Two hundred cubic centimeters of blood were injected in 2 minutes, no rest period. Four hundred and fifty cubic centimeters of blood were injected in 3 minutes. Blood pressure 130 millimeters (systolic), respiration 14, pulse 120. One minute rest period. Blood pressure 120 millimeters (systolic), respiration 20, pulse 180. Three hundred and fifty cubic centimeters of blood were injected in 3 minutes. Blood pressure fell rapidly from 120 to 35 millimeters (systolic), respiration to 10 and at end of injection animal was dead. One thousand cubic centimeters of blood were injected in 9 minutes. Necropsy showed the heart to be dilated and filled with blood, the liver was congested and enlarged, no pulmonary edema.

#### EXPERIMENTAL RESULTS

The studies on dogs indicate that relatively very large quantities of water (as an isotonic glucose solution) may be injected intravenously and the acute pulmonary edema that ensues in some instances, is recovered from, without apparent permanent disturbances. It would seem that the entire organism rapidly absorbs the water which passes out of the circulation into the tissues.

In regard to relatively large quantities of blood injected, 4 of the 5 animals exhibited evidence of overloading of the circulation with obvious impairment in cardiac action as evidenced by fall in blood pressure and increase in pulse rate with irregularity. In contrast to the situation where water is injected blood plasma proteins (and the red cell mass) do not rapidly pass out of the circulation but remain within it affording a rapid and more stable increase in the circulating volume than obtains when isotonic glucose is injected. Two of the 4 animals that exhibited deleterious effects died at the close of the injection experi-

ments. The appearance of the blood pressure curves resembled those that might have been obtained had the animals been subjected to severe hemorrhage with the development of shock. This is paradoxical, however, because of the fact that in these experiments excess blood was added rapidly to the circulation rather than being taken from it by rapid loss from hemorrhage.

It would appear that rapid injection of blood in large quantities to human patients might be harmful if there were no shock due to blood loss but inasmuch as blood loss is the indication for rapid transfusion the danger does not appear until blood loss has been compensated for and blood pressure has returned to normal.

#### DISCUSSION

Without entering into detailed discussion, it would seem, in the authors' opinion, that the advantage of intra-arterial transfusion is the rapidity of increase in the circulating volume which this method affords (2). Ultrarapid transfusion via the venous system, possible by the method here described, affords the same advantage.

There are two factors which constitute serious dangers in the employment of ultrarapid blood transfusion by oxygen under pressure in man. First, the possibility of rapid overload of the heart by excess quantities of blood injected into the circulation producing cardiac dilatation and failure. With patients in shock due to blood loss this danger does not exist at first but once approximate replacement has obtained and blood pressures are near the patient's normal, care must be exercised in continuing transfusions. Second, the possibility of embolism. A physician must devote full attention to the procedure and avoid emptying the infusion system by the oxygen under pressure with oxygen then being injected into the vein.

Ultrarapid transfusion is indicated during operations when there is sudden circulatory collapse from severe hemorrhage. The prompt restitution of blood pressure to adequate levels obviates the severe noxious effects of general tissue anoxia which are directly proportional to the length of time that the patient is in

shock. It would also thus prevent a duration of shock until the irreversible stage is reached. Ultrarapid transfusion also is indicated in those cases in which there has been appreciable blood loss and before evidence of shock has been manifested. This is a prophylactic measure for shock.

Another advantage of ultrarapid transfusion would appear to be the facility it affords for coping with numbers of patients needing emergency transfusion for shock such as would obtain in civilian disasters or in military action. Several transfusion sets as described

would permit the transfusion of one to two or more units of blood or plasma per patient in a relatively much shorter time than if a similar number of patients received the same treatment by the gravity method and obviously many more patients could be transfused in a given interval than could be possible with the gravity method.

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# CONTINUOUS LUMBAR PARAVERTEBRAL SYMPATHETIC BLOCK MAINTAINED BY FRACTIONAL INSTILLATION OF PROCAINE

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**I**N many diseases and injuries of the extremities, it is desirable to interrupt the sympathetic impulses for a few hours or even for several days

Numerous methods of abolishing vasoconstrictor tone have been used. Alcohol intoxication has long been known to cause a striking degree of vasodilatation in the skin. Scott and Morton (10) described this phenomenon as occurring under general anesthesia. The value of spinal anesthesia for paralyzing the sympathetic nerves to the lower extremities has been reported by Brill and Lawrence, Morton and Scott (9), and others. Sir Thomas Lewis was the first to advocate blocking of the peripheral nerves for relief of vasospasm. In 1926, Brown used artificial fever produced by injecting foreign proteins intravenously to produce vasodilatation. Alcohol may be injected around the sympathetic ganglia to block the impulses for longer periods. The work of Leriche, White (17), and many others has made paravertebral injection of a local anesthetic the most commonly used method of obtaining temporary paralysis of the sympathetic nerve supply to the extremities. The intermittent injection of a local anesthetic agent is used frequently, both as a therapeutic measure and as a diagnostic test to determine preoperatively the results which can be expected from a surgical sympathectomy.

Most of the methods are impractical from a clinical standpoint. The administration of a general anesthetic is obviously not a desirable method of producing paralysis of the sympathetic nerve supply to an extremity. The use of foreign proteins to produce a febrile re-

sponse and accomplish the same purpose is also impractical. Spinal anesthesia is not without risk and the patient's extremities are temporarily paralyzed. In some vasospastic conditions this paralysis is undesirable since it would be preferable to have certain patients ambulatory while the sympathetic impulses to the extremities are interrupted. Complications such as neuritis and the dangers accompanying improper injection limit the usefulness of alcohol injections. Although rare instances have occurred in which procaine hydrochloride has been injected into the subarachnoid space which occasionally extends out over a spinal nerve, or into a blood vessel, paravertebral procaine block is one of the safest and the most widely used of the methods mentioned.

Procaine injected around the sympathetic chain interrupts the impulses for only a short period. Particularly when a procaine block is being used therapeutically, the injection frequently must be repeated at intervals. Often there is considerable discomfort associated with this procedure. Many patients object to it and a few will refuse. Of less importance is the fact that repeated blocks are time consuming for the surgeon.

In an attempt to overcome the disadvantage of having to do repeated lumbar sympathetic blocks, when indicated, and to increase the therapeutic uses of this method of interrupting the sympathetic impulses, we have performed a continuous paravertebral sympathetic block maintained by intermittent injection of procaine hydrochloride through an indwelling tube left in place for several days. This method has been used on 15 patients with no complications.

## EQUIPMENT

The equipment, which is the same as that used for a continuous spinal anesthetic, in-

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Fig 1 Lateral and anteroposterior views of the Tuohy catheter in place beneath the transverse process of the second lumbar vertebra. Arrow points to tip of catheter

cludes a No. 16 Tuohy needle with a Huber directional point, and a No.  $3\frac{1}{2}$  Tuohy catheter,<sup>1</sup> a No. 23 needle with a blunt end, a plug to fit into the hub of the needle, and a sterile test tube. We have found that a half length of a Tuohy catheter is long enough to serve our purposes. The cost of the equipment is small.

#### TECHNIQUE

With the patient lying on the side opposite the one to be injected, the Tuohy needle is inserted according to the technique of Labat just beneath the transverse process of the second lumbar vertebra. The Huber directional needle point is toward the midline. The catheter is then inserted through the lumen of the needle until it reaches the distal end of the needle. While the catheter is held in place with one hand the needle is removed by sliding it off the catheter with the free hand (Fig. 1). A blunt pointed No. 23 needle is inserted into

the free end of the catheter. Procaine is injected through the catheter at the site of the lumbar sympathetic chain. We have used 8 cubic centimeters of 1 per cent procaine mixed with 30,000 units of penicillin for each injection. Between injections the needle is closed with the metal plug, and, with the catheter still attached, it is placed in a sterile test tube, which in turn is closed with a sterile cotton stopper. An abdominal pad is placed over the catheter. This pad and the test tube are fixed to the side of the patient with adhesive. These steps are illustrated in Figure 2.

Since there is a possibility of local infection around the catheter when it is left in place for a number of days, penicillin has been injected with the procaine. No evidence of such infection has occurred to date.

By diffusion the procaine comes in contact with the second and third lumbar ganglia and frequently reaches the first lumbar ganglion. To demonstrate this, a block was performed on a young male, by the method described, and 8 cubic centimeters of 35 per cent diodrast was injected through the Tuohy catheter. Roentgenograms were taken 5 minutes after the injection to show the diffusion of the contrast media (Fig. 3).

In the 15 patients on whom this procedure has been used there was either subjective or objective evidence, or both, of a satisfactory block with the exception of 1 case. Thermocouple measurements of skin temperatures were made before and after the block in each case, and in some instances oscillometric readings were recorded at the same time. Voluntary suggestions of subjective responses by the patients were noted.

White (18) and others have reported that a procaine block produces temporarily all the effects of sympathetic ganglionectomy, i.e., complete blocking of the vasomotor nerves, for a period of from 2 to 4 hours. Objective and subjective findings in a number of our cases of single injections confirmed this statement. In each of these it was found that the maximum elevation in skin temperatures lasted  $2\frac{1}{2}$  to 3 hours after the block. At the end of 3 to  $3\frac{1}{2}$  hours, the temperature readings were slightly elevated, but were decreasing toward the preblock level. Although this

<sup>1</sup>The Tuohy catheter is similar to a ureteral catheter except that the distal opening is at the end instead of on the side near the end.

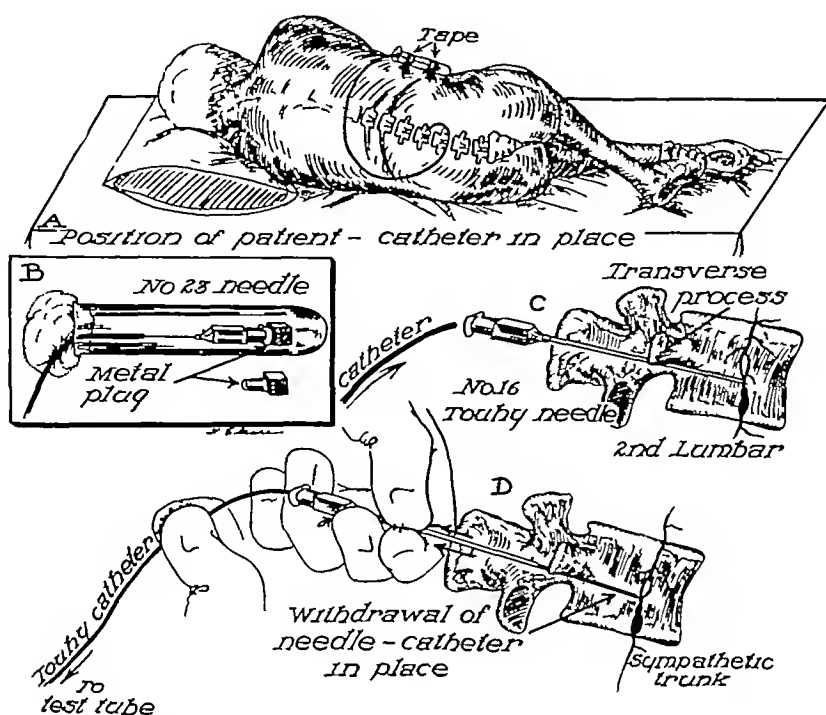


Fig 2 Diagrammatic sketch of continuous paravertebral lumbar sympathetic block. A, Patient on side with Tuohy catheter in place. B, Distal end of catheter in sterile test tube with needle inserted in catheter and metal plug in hub of needle. C, Tuohy needle introduced beneath transverse process of second lumbar vertebra. Catheter being inserted into the needle. D, Needle being withdrawn and catheter left in place.

duration varies with the individual patient, we believe that injections every 3 hours give a fairly continuous interruption of the sympathetic impulses.

Seven of the patients listed in Table I had previously had single injection type of sympathetic blocks involving 2 to 4 lumbar ganglia. Two of them refused any further blocks of that sort but agreed to have a continuous procaine block tried. Both of the patients were extremely pleased with the procedure. The other 5 voluntarily stated that they much preferred the continuous block which did not have to be repeated.

Table I lists the patients on whom this procedure has been used and the results obtained.

#### DISCUSSION

**Acute thrombophlebitis** Ochsner and DeBakey treated 15 patients with acute thrombophlebitis with procaine blocks. They observed that pain was promptly relieved in

many cases after the first injection and in all cases after the second or third injection. The fever disappeared in 1 to 8 days and the swelling in 3 to 12 days. For lower extremities four needles were inserted from the first to the fourth lumbar ganglia and 5 cubic centimeters of procaine injected through each. They stated that the injections should be repeated every 48 hours as long as the fever persists. Others use the return of pain as their criterion for determining when to repeat the block. Interruption of the sympathetic impulses for the required length of time is more easily accomplished by maintaining a continuous type procaine block. The pain which recurs in some patients between single injections is continuously relieved.

**CASE 4** A 48 year old male had had acute thrombophlebitis of the right leg with severe pain for 2 days. A continuous block gave complete relief of pain. The edema began to subside gradually. On discontinuing the block after 4 days, his pain re-



TABLE I—SUMMARY OF PATIENTS ON WHOM THIS TYPE OF CONTINUOUS SYMPATHETIC BLOCK HAS BEEN USED

Case No Patient	Age years	Diagnosis	Duration of disease before block	Duration of block days	Results of block	Complications
*1 FM	63	Arterial insufficiency with arterio-sclerotic gangrene left little toe Large gastric ulcer	3 weeks (gangrene)	10	Good temperature response Pain relieved. Gangrene progressive Amputation required	None
2 LL	60	Varicose veins Chronic leg ulcer	6 weeks (ulcer)	3	Satisfactory response	None
3 LH	19	Chronic ulcer rt.	18 months	6	Good temperature response. Leg felt warmer to pt Ulcer much cleaner	None
*4 EF	48	Acute thrombophlebitis rt leg	4 days	8	Good response Complete permanent relief of pain	None
5 RS	61	Chronic venous insufficiency	20 years	2	Satisfactory block	None
6 CW	39	Bilateral venous stasis and chronic leg ulcers secondary to bilateral femoral and saphenous ligations Deep thrombophlebitis	1 year	6	Good response Pain relieved Edema diminished Sympathectomy	None
*7 GF	73	Occlusive arterial disease associated with thrombosis rt femoral artery	3 weeks (thrombi)	6	Good response Pain relieved Ulcers much cleaner (No sympathectomy required)	None
*8 WE	78	Occlusive arterial disease left femoral embolus	1½ days (thrombus)	6	Good response Pain disappeared 2nd day after block (no sympathectomy required)	None
*9 IH	59	Varicose ulcer with marked cellulitis lymphangitis	2 weeks (cellulitis)	4	Good temperature response Complete relief of pain Infection subsided	None
10 WL	84	Frostbite of feet Pneumonia Diabetes	3 hours (frostbite)	2	Slight temperature rise No significant change	None
11 WO	32	Buerger's disease Large ulcer rt. foot	9 years	4	Good response Complete relief of pain Sympathectomy	None
12 DS	65	Arteriosclerotic gangrene Cellulitis 5th left toe	3 weeks (gangrene)	3	Good temperature response Gangrene and cellulitis progressed Amputation required	None
*13 WD	31	Elephantiasis and cellulitis right leg	5 years (elephantiasis 2 days cellulitis)	5	Good response. Pain relieved Cellulitis subsided	None
14 EM	74	Arteriosclerotic gangrene left 2nd toe. Diabetes	3 months (gangrene)	4	Good temperature response Pain relieved Sympathectomy (amputation of toe required)	None
*15 CW	63	Ruptured arterial aneurysm (right femoral)	3 days	5	Slight temperature elevation rt thigh Pain diminished Sympathectomy performed with no additional benefit	None

\*See discussion in text for further elaboration of these cases

turned within 6 hours. The block was again started and continued for 4 more days, this time with permanent relief of pain. Pain is permanently relieved in some instances by a single injection block, but usually the relief lasts only 24 to 48 hours. The return of pain in less than 6 hours after a continuous block for 4 days in this patient suggests that he would have required many individual injections.

*Cellulitis associated with pain.* Although we are unaware of any previous use of sympathetic blocks in the treatment of painful cellulitis, Cases 9 and 13 are representative of this condition in the lower extremities. In each complete permanent relief of pain followed institution of a continuous procaine block of 4 or 5 days' duration respectively. When the

blocks were discontinued, the erythema and swelling had subsided. Although both patients received chemotherapy, they appeared to respond more rapidly than previous patients treated with chemotherapy alone. It is possible that the relief of vasospasm, in addition to relieving the pain, may have aided in overcoming the inflammatory process.

*Acute arterial deficiency.* Acute arterial deficiency may result from a gunshot wound, a traumatic laceration, an embolus, surgical ligation of a normal artery, ligation or excision of a peripheral aneurysm, or spontaneous rupture or thrombosis of an aneurysm. In all these conditions, the main vessel flow is effec-

tively blocked and may be still further occluded by both distal and proximal thrombosis

The effect of associated vasospasm on the collateral circulation is extremely important. The only possible blood supply to points distal to the obstruction or site of injury is through the collateral circulation. For varying reasons an added surgical sympathectomy is often inadvisable in these cases, even though its effect is urgently needed.

Gage and Ochsner reported a number of successful results following sudden occlusion of major peripheral vessels by repeated sympathetic blocks. Smithwick preferred alcohol injection in treating patients in shock or the average case of embolic occlusion. The injection of alcohol in this region is not without danger and complications. A continuous procaine block gives results comparable to those of a surgical sympathectomy, during the acute period, and avoids the disadvantages of alcohol injection.

**CASE 7** A 73 year old female had severe cardiac disease and right femoral thrombosis of 3 weeks' duration. Her leg was cool, somewhat cyanotic, and there were some ulcerations of the calf associated with marked pain. A continuous block of 6 days' duration relieved the pain and the ulcers became smaller and much cleaner. The ulcers subsequently responded to further conservative local treatment. Improvement in collateral circulation during this period was apparently sufficient to care for the nutrition of the leg.

**CASE 8** A 78 year old male had a left femoral embolus of 36 hours' duration. The left leg was cool, cyanotic, and extremely painful. On the second day following institution of a continuous procaine block, his pain disappeared, the color and temperature of the leg improved. The block was discontinued after 6 days. He was discharged 4 days later ambulatory and without any pain.

**CASE 15** A 63 year old male had an arterial aneurysm in the right thigh which ruptured. The aneurysm and accompanying femoral vein were excised and the femoral artery and vein ligated proximally and distally. The right leg became cold from the mid thigh down. A continuous sympathetic block was maintained for 5 days and there was a slight constant skin temperature elevation in the right thigh. The block was discontinued and a right lumbar sympathectomy done. Postoperative skin temperature determinations were the same as those obtained during the continuous block. The sympathectomy was no more effective than the continuous block. Ultimately the leg was amputated above the knee.



Fig 3 Lateral and anteroposterior views showing distribution of 8 cubic centimeters of 35 per cent diodrast in retroperitoneal space along lumbar sympathetic chain, following injection through Tuohy catheter

*Arteriosclerosis associated with vasospasm*  
Goodman, Messinger, and White stated that in arteriosclerosis associated with vasospasm if the extremity is cold and moist and there is a fair response to a temporary block of the sympathetic outflow, a single preoperative diagnostic procaine block often does not give an accurate prediction of the result which will follow a surgical sympathectomy. Most of these patients are elderly and often are poor operative risks. A continuous temporary chemical block for a number of days would seem to offer a better preoperative diagnostic test of the result to be expected from a surgical sympathectomy. In some instances, this obviates a needless surgical procedure.

**CASE 1** A 63 year old male had bilateral arterial insufficiency of the lower extremities, gangrene of the left little toe, and a large gastric ulcer which was suspected of being malignant. Although the patient was a poor candidate for any surgical operation, there was the problem of possible amputation of the left leg and subtotal gastric resection. Whether or not a sympathectomy would increase the circulation sufficiently to prevent spread of the gangrene and permit amputation only of the left little toe was un-

certain A continuous sympathetic ganglionic block of 10 days' duration was done while the patient was being prepared for subsequent surgery Although a satisfactory block with complete relief of pain was obtained, the gangrene slowly spread to involve the foot The progression of the arteriosclerotic gangrene, in spite of a chemically produced sympathetic ganglionectomy of 10 days' duration indicated that a surgical sympathectomy would have been futile A left mid-thigh amputation was performed His general condition improved rapidly and 2 weeks later a benign peptic ulcer was successfully removed by subtotal gastric resection

*Causalgia, painful neuroma, phantom limb, and stump pain of the lower extremity* Reports concerning the treatment of causalgia with repeated procaine blocks have been variable Ulmer and Mayfield in a series of 75 cases reported immediate temporary relief of pain lasting from 1 to 3 hours in every instance following a procaine block In some of their cases blocks were repeated 4 to 8 times Some of their patients were improved for long periods of time but none of them obtained complete permanent relief of pain Homans on the other hand reported permanent relief in some patients treated with repeated blocks Rasmussen and Freedman found that of 100 patients, 13 had complete permanent relief following 1 to 3 procaine blocks and 32 had sufficient relief of pain so that further treatment was not required Shumacker, Speigel, and Upjohn reported satisfactory alleviation of symptoms in 21 of 83 patients receiving 1 to 5 injections of procaine

White (16) and others have reported successful results in the treatment of painful neuromas, phantom limb and stump pain of the lower extremity with single or repeated procaine blocks As in causalgia, opinions of the authors have varied as to the success of repeated blocks if the first one did not give permanent relief

It is possible that in these conditions a continuous type sympathetic block for a number of days would relieve all of those who have in the past responded to single or repeated injections and, in addition, some who previously required surgical sympathectomy

#### CONCLUSIONS

The series of patients on whom a continuous type temporary chemical interruption of the

sympathetic impulses to the lower extremities has been used is small However, we have been impressed by the results obtained

A more continuous interruption of the sympathetic impulses is provided Decision as to the need for surgical sympathectomy is more conclusive by its more prolonged effect The effect of interrupting the block may be observed by injecting penicillin solution without procaine The block may be restarted by simply adding procaine again to the injections This is occasionally a desirable feature

The discomfort to the patient of repeated blocks is avoided It is as easily performed as the usual paravertebral block Subsequent injections can be made by the attending nurse

The chief disadvantage of this method is the possibility of infection around the catheter This has not occurred and we believe that injection of penicillin with procaine will help to prevent it

#### SUMMARY

A method of maintaining a continuous type lumbar paravertebral sympathetic block is described This is performed by placing a No 3½ indwelling catheter in the vicinity of the second lumbar ganglion and injecting procaine mixed with penicillin every 3 hours The equipment necessary and the technique of the procedure are given

Its effectiveness has been demonstrated in patients with acute thrombophlebitis and in those with painful cellulitis In these conditions the vasospasm and the pain are relieved continuously while the block is maintained This effect is achieved without the necessity of repeatedly placing needles in the region of the sympathetic chain It is suggested that not only is the continuous type block more convenient and less bothersome for the patient and the surgeon but also probably more effective in promoting the return to normal of the areas of inflammation

The method has been used in several patients with acute arterial insufficiency, such as embolism to the femoral artery In this type of condition, it is believed that a more satisfactory evaluation of the adequacy of collateral circulation after release of vasospasm can be made by a continuous type block than by a

single or repeated single blocks. There is also a good possibility that a prolonged block of 7 to 10 days' duration may satisfactorily tide the patient over the most critical stage of circulatory embarrassment. A sympathectomy may be made unnecessary in some of these cases. In others the sympathectomy may be delayed for a number of days until the patient is in better condition for the operation.

In patients with chronic arterial insufficiency, such as arteriosclerosis, this type of block may be of considerable value. Evidence of the presence or absence of vasospasm is provided. There is the added advantage with the prolonged block that the effect of the release of vasospasm upon the nutrition of the extremity can be evaluated much better. There may be *no real evidence of improved nutrition* to a cyanotic toe with a single block, whereas a prolonged block of 10 days' duration is more likely to give evidence of improved circulation. In such conditions, therefore, a better test is provided for determining what may be expected from a sympathectomy.

By being provided a more prolonged release of vasospasm and relief of pain in cases of causalgia and related conditions, some patients may be relieved who formerly required sympathectomy.

Theoretically and on the basis of these observations, it is felt that there may be a wide clinical application for continuous paravertebral sympathetic blocks.

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## REPAIR OF THE COMMON BILE DUCT OVER A BURIED CATHETER

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**I**NJURIES to the bile ducts during the course of operations upon the gall bladder or ducts and the strictures resulting therefrom are among the most distressing complications of the surgery of this region. Anastomotic procedures are prone to result in stricture and frequently too great a gap is present between the proximal and distal portions of the duct for anastomosis to be done. Anastomotic procedures between the cut proximal end of the duct and bowel are frequently followed by ascending cholangitis, recurring jaundice, and suppuration because of the loss of the sphincter of Oddi and stricture formation at the anastomosis. The use of the Roux-Y principle of a defunctionalized loop of small bowel as advocated by Pearse and Cole eliminates the reflux but still does not eliminate stricture formation at the anastomotic site.

The use of a rubber prosthesis for repair of the ducts was discarded because of the frequency of precipitation of bile salts with obstruction of its lumen. Sullivan's experiments with the repair over a rubber prosthesis resulted in the evolution of the T, or fishtail, tube which could be pulled out after a proper interval before precipitation of bile salts occurred but which frequently resulted in trauma to the repaired duct in its removal with resultant stricture formation.

The use of a vitallium tube by Pearse (13) seemed to eliminate this danger of obstruction and was enthusiastically used as a prosthesis for repair of defects in the ducts and for anastomotic procedures between cut ducts and bowel where the distal ampullary portion of the duct was not available. However, the fact that precipitation of bile salts and obstruction will occur in these tubes has been reported by

a number of authors. Pearse (13) in 1945, cited 12 cases of obstruction of 208 collected cases.

Neibling and Walters in 1947 obstructed vitallium tubes in which they were used. Neibling recommended the use of some prosthesis for repair which could be passed rather than one that was indefinitely in place.

The ideal prosthesis is one which is retained in place as long as desired to occur but which can be passed when time is over. Such a method is that reported by McArthur and reported by him as burying a catheter in the repaired duct. A long portion of the catheter is passed through the papilla into the duodenum; the constant duodenal tug upon the catheter gradually draws it into the intestine and is eventually discharged per rectum. If the patient wishes to leave it a certain length of time, this is readily accomplished by tying a ligature to the catheter and anchoring it to the abdominal wall. The catheter can be removed when desired and the catheter passed 3 to 7 weeks (Figs. 1 and 2).

In the 8 cases reported by McArthur in 1923 the shortest time in which the catheter passed was 27 days and the longest 63 days.

Repair over a buried tube was first reported by Jenckel in 1905. He put a catheter in the hepatic duct and buried the other end in the duodenum by the Witzel method. A fistula developed due to a tear in the tube, but healing occurred and was well 4½ years later.

De Graeuwe, Kehr, Voelcker, and Brewer reported cases by this method. In 1925, they had collected 24 successful cases. Three years after the first operation

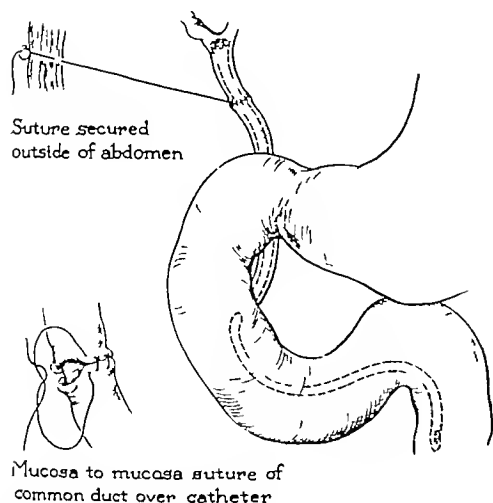


Fig 1 Case 1 Repair of a simple transverse injury of the duct over a catheter

and 1 year after its publication, Sullivan reported successful operations upon 8 dogs

In 1912, Arnsperger and Kimura performed the Sullivan operation on dogs at the Wilms' clinic. The tube usually passed about the thirty-fifth day, but all of the animals developed stenosis at the duodenal junction of the new channel.

Museneck, in 1926, operated upon a large number of dogs. Of 28 animals in which the Sullivan tube was used, 26 developed stenosis. In all, the duodenum was plastered up under the liver. In the 2 cases in which stenosis had not occurred, the tube had remained in place.

Halpern in his experiments found that epithelization of a defect did occur with little stenosis if ascending infection was minimal. However, ascending infection occurred in all but 5 of the 28 animals. He concluded that epithelization was more influenced by adequate blood supply than by the extent of the defect.

The present report adds the following 2 cases to the 8 reported by L. L. McArthur in 1923.

**CASE 1** No 304689 C W, a white woman, aged 41 years, had cholecystectomy performed on July 6, 1934. A chronic cholecystitis with stones was found. There was one stone partially in the cystic duct. The cystic duct was markedly distorted and was dissected with difficulty. The common duct was accidentally severed, but the error recognized and a No. 10 F rubber catheter was buried

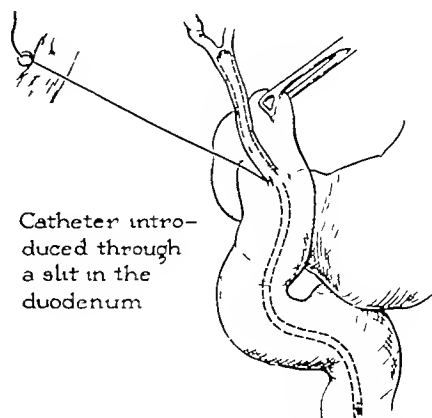


Fig 2 Case 2 Procedure used when the distal common duct was found to be completely obliterated

with one end well into the duodenum and the cut common duct repaired over it. She left the hospital at the end of 19 days with no bile drainage at the time of discharge. One and one-half months later she developed jaundice with diarrhea and abdominal pain for 4 days. Roentgen examination showed



Fig 3 Roentgenogram in Case 2 showing the position of catheter in repair of the common duct

about a 2 centimeter advancement of the tube from its position at the previous examination

The tube passed 17 weeks and 2 days after its insertion, not eroded and with the silk suture intact

In October, 1935, she complained of attacks of pain in the right upper quadrant and developed a mild jaundice which lasted 6 weeks, but which cleared spontaneously. Since then she has had no complaint

**CASE 2** No 321299 A young colored woman, aged 27 years, had a cholecystectomy and common duct exploration performed December 30, 1935. The gall bladder was packed with stones and there was a tortuous common duct through which a probe could not be passed. Simple drainage of the duct was performed. At the end of the fourth week, the biliary fistula persisting, diodrast was injected, which showed a definite constriction of the ampulla.

She was readmitted May 11, 1936 with a profound jaundice. The fistula had closed spontaneously after 3 months. She was reoperated upon May 13, 1936. The strictured area was opened and a No. 10 F catheter passed well into the duodenum and the proximal end passed upward into the dilated common duct. Nine weeks after operation, the catheter passed (Fig. 3).

She remained free of symptoms for 5 months, then was readmitted with fever, chills, and jaundice. She was reoperated upon and at this time the duct was severed above the fibrous stricture and approximated to a new opening made in the duodenum just distal to the site of the normal papilla. Again the anastomosis was done over a buried catheter with anchoring of a black silk thread to the skin as before. Her convalescence was uneventful and she was discharged 3 weeks after operation. Six weeks post-operative, at the clinical meeting of the Chicago Surgical Society at St. Luke's Hospital, the anchoring stitch was cut and the catheter passed per rec-

tum 2 days later. This patient has reported for observation at frequent intervals since and to date has remained perfectly well.

#### CONCLUSION

A buried catheter which is passed by the intestinal tug upon its distal portion makes a satisfactory prosthesis for repair of short defects in the common duct. It can be retained as long as desired for healing to occur, but can be passed when that time is over.

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## SYNOVIAL OSTEOCHONDROMATOSIS

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**S**YNOVIAL osteochondromatosis is a disease in which osteocartilaginous bodies develop in the synovial membrane and are extruded into the joint as loose bodies, or they may remain pedunculated and attached to the synovium. This condition usually occurs in the knee, but may occur in other joints, and in 1 of our cases the condition was found bilaterally in the elbows.

Synovial osteochondromatosis may be considered a benign neoplasm because it is an abnormal tissue growing without regular structure and because metastases do not occur.

In 1924 Jones reviewed the literature (5) and gave credit to Laennec for the first description of the condition in 1813.

Since the original observation there have been many opinions as to its etiology and histopathogenesis. Trauma and infection are factors in aggravation but are not thought to be primarily responsible. The reason for this report is to corroborate this theory, as in most of our cases the excitant factor of inflammation, or trauma, was obvious. In 1907 Lexer advanced the hypothesis that osteochondromatosis results from embryonal rests of the synovial membranes and suggested the similarity in development of cartilage and synovium (5). Geschickter states that the primitive connective tissue which exists normally in the synovium and at the point of reflexion of a normal joint capsule retains its power of forming both cartilage and bone. Persistence of strands of this connective tissue about the joints accounts for the cartilaginous and osseous masses found not only in osteochondromatosis, but in joint spurs, or osteophytes of chronic arthritis. Why such strands of embryonal connective tissue continue to exist in a completed joint structure is not clear. Neither is the mechanism understood of how trauma and infection may aggravate this type of con-

nective tissue, resulting in a condition which represents an overstimulation of a normal process (3).

The pathological findings grossly reveal many white cartilaginous spheroid bodies varying in size from flakes of  $\frac{1}{2}$  to 1 inch in diameter, either free or attached to the synovium. They are located in the synovial folds and also in any communicating bursae of the joint. The bodies may be found grouped in masses so that they may be removed in 1 piece. The synovium is markedly thickened and quite vascular. Microscopically the osteocartilaginous body has a superficial layer of fibrous tissue beneath which is hyaline cartilage. In the center it is composed of calcified cartilage and frequently osseous tissue but may contain hyaline cartilage alone. Normally the synovial membrane is composed of an external layer, the stratum fibrosum, and an internal more cellular layer, the stratum synoviale (6). In these joints the stratum synoviale is edematous and thickened, and the bodies can be seen growing in the synovial stratum and appear to be migrating inward. They may remain pedunculated on the synovium until they become detached and extruded into the joint cavity. Phemister states the synovial fluid contains proteins and salts, and believes the irritation by these bodies might enrich the fluid and thus be a nutritive source for further growth of the detached bodies, as hyaline cartilage is almost devoid of blood supply and is thought to derive its nutrition from the synovial fluid. In the pedunculated or attached bodies the bone that is formed is normal, but in the loose bodies the bone becomes degenerated (7).

The diagnosis of synovial osteochondromatosis might be suspected from the history and physical examination, but the roentgenograms are usually quite characteristic and demonstrate the presence of the bodies if they are calcified or contain bone. However, if the bodies are entirely cartilaginous, the x-ray

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Fig 1a

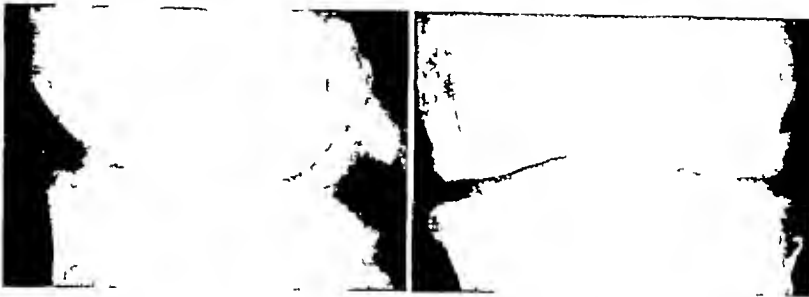


Fig 1c

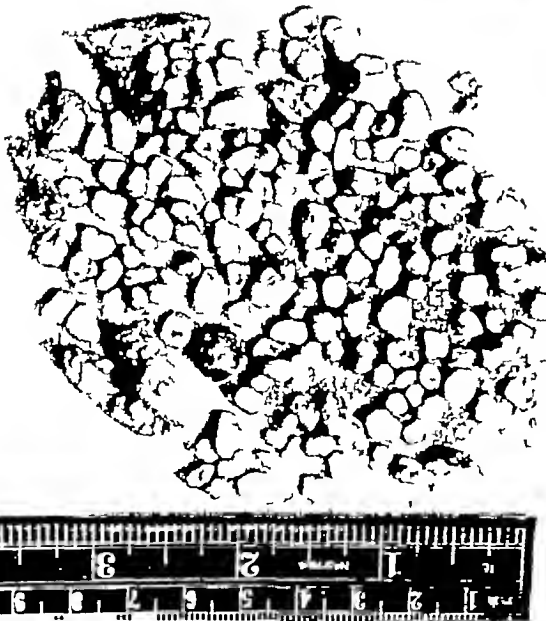


Fig 1b

Fig 1 Case 1 a, Preoperative roentgenogram showing multiple loose osteocartilaginous bodies in the knee joint b, Gross appearance of the bodies c, Postoperative appearance 8 years later Two bodies in the posterior compartment were not removed but clinically did not cause symptoms These bodies have increased 5 times their apparent original size and now resemble the condition seen in Figures 5 and 6

between the ages of 30 and 50, although no age group is exempt, as in 1 case reported the age was 62 years (Rixford) It occurs more often in males, and affects the knee, elbow, ankle, hip, and shoulder in that order of frequency (3) The symptoms consist chiefly of pain and limitation of motion The pain is usually mild, and the patient often presents himself for treatment many years after noticing the first symptoms which resemble those of chronic hypertrophic arthritis A dull ache with limitation of motion, occasional locking and grating sensations together with a noticeable swelling of the affected joint are the usual complaints On examination the joint deformity is apparent and localized Crepitant masses may be palpated Tenderness over the joint is generalized

findings may be entirely negative The condition is seen in middle aged adults usually



Fig 2a



Fig 2b



Fig 2c

Fig 2 Case 2 a, Preoperative roentgenogram showing the osteocartilaginous bodies in the right elbow b, Gross appearance of bodies and resected head of radius c, Post-operative roentgenogram of elbow showing 1 loose body posterior to the coronoid process that caused symptoms and was subsequently removed d, Left elbow, same patient, showing a few loose bodies and the hypertrophied radial head

The treatment is surgical eradication of the loose bodies, followed by synovectomy and removal of adjacent bursae and their contents in so far as possible. Treatment by irradiation has not been described and would probably not be effective in a benign, slow growing lesion of this type. Recurrences have been seen following surgical removal, and subsequent sarcomatous change has been reported necessitating amputation (5).

Degenerative changes, which resemble those in hypertrophic arthritis, occur secondarily, and result in extensive hiping and overgrowth



Fig 2d

of bone at the joint margins. For this reason, a complete removal of the patella in addition to synovectomy was done in 1 case with knee involvement. In the elbow, the head of the radius was resected as it was hypertrophied and overgrown with osteocartilaginous tissue. Pronation and supination were markedly



Fig 3a

Fig 3 Case 3 a, Preoperative roentgenogram of right knee b, Appearance of synovium removed from same knee

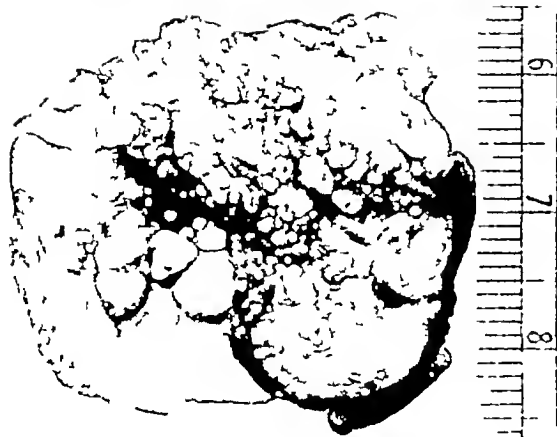


Fig 3b

limited at operation until resection was done in addition to eradication of the synovial membrane and osteocartilaginous bodies.

We believe that the following cases illustrate the aggravation of synovial osteochondromatosis by infection as in Case 1 (Fig 1), and by trauma as in the remaining cases (Figs 2, 3, and 4).

Osteochondromatosis is not the same as osteoarthritic spurs, or osteophytes which have broken off and become loose bodies, many such cases may have been erroneously considered as chondromatosis. Figures 5 and 6 reveal such cases in which the bodies removed were calcified cartilaginous bodies but the synovial membrane was free from the pathological changes described.

CASE 1 (Figs 1a, 1b, and 1c) W. M., male, age 34 years, noted a gradual progressive stiffness of the left knee, beginning 6 years previously. Pain on active motion of the knee had been moderate and was more severe in attempting extension. No history of locking was given. The past history revealed no injury or infection and the family history was irrelevant.

On examination the left knee was found to be semiflexed, and attempts at active or passive motion were limited through an arc of 10 degrees and were painful. The left knee was warmer than the right and there was a slight tenderness over the posterior aspect of the knee and on either side of the patella. Laboratory findings disclosed a white blood count of 11,700, normal Schilling count, and urine negative. X-ray examination by Dr. E. W. Spitzig, radiologist of Lutheran hospital, revealed many opaque bodies lying in the anterior and posterior compartments of the knee joint with degenerative changes at the joint margins.

On June 19, 1940, the knee joint was opened anteriorly through a medial longitudinal incision, and the loose bodies were eradicated and a synovectomy was performed. Extensive osteocartilaginous tipping about the articular margins was removed, and since considerable encroachment of this overgrowth was noted about the patella, not only along the margins, but on the inferior surface, the patella was removed and also both semilunar cartilages. In order to eradicate the bodies in the posterior compartment, it was necessary to incise the anterior cruciate ligament which subsequently was sutured with silk. Sheet cotton and bandage dressing were applied, and active motion was encouraged on the eighth postoperative day although it caused some pain. The course was uneventful and the patient was discharged after a few weeks. Weight bearing was allowed at 6 weeks. He received physical therapy biweekly for 12 weeks.



Fig 4a

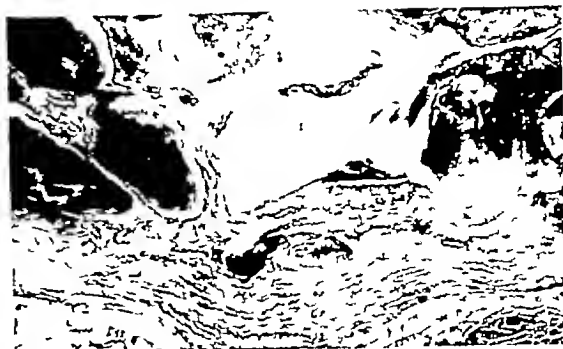


Fig 4b

Fig 4 Case 4 a, Preoperative roentgenogram of knee which was entirely negative b, Low power microscopic section showing cartilaginous nodule being formed in the synovia and others extruded into joint unattached c, High power microscopic section of a nodule with young cartilage cells and beginning calcification

with infra-red rays and massage as soon as he was discharged from the hospital. Re-examination after 2 years in August, 1942, showed a range of motion from 180 degrees to 80 degrees' flexion and in June, 1948, after 8 years motion from 180 degrees to 90 degrees which was entirely painless and there was no instability.



Fig 4c

CASE 2 (Figs 2a, 2b, 2c, and 2d) R. N., female, age 46 years, had noticed a progressive limitation of the right elbow with swelling and deformity. The patient attributed the cause to an injury which she said resulted in 2 broken elbows when she was 6 years old and she believed the right elbow had not healed properly. Because of such noticeable deformity she felt she could not wear short sleeves. The stiffness gradually progressed until she became unable to straighten the elbow or turn her wrist. Pain had been almost absent except occasionally when she felt a locking sensation. Examination revealed a deformity of the right elbow with a localized tumor posteriorly 1 inch proximal to the joint which was cystic and felt as though it contained loose buckshot. Extension was limited to 110 degrees and flexion to 90 degrees. There was crepitation on joint motion. Pronation and supination were limited at about 50 per cent and became very painful when motion was passively increased beyond this range. Laboratory findings were: white blood count 8,400, red blood count 4,700,000, calcium 7 milligrams, phosphorus 64, phosphatase 11. X-ray examination showed many opaque bodies lying in the olecranon bursa, and in the joint cavity together with hypertrophic changes about the head of the radius, which appeared hypertrophied. On August 31, 1942, the elbow was opened through a lateral incision over the head of the radius which was overgrown with cartilaginous tissue and appeared twice the normal size. Another incision was made on the medial side exposing a conglomerate mass of bodies in the posterior bursa which were re-

moved together with those in the medial part of the joint. The cavity was irrigated with saline through and through to wash out many tiny cartilaginous flakes. The synovial lining of the joint was removed as far as possible and also the bursal sac.

Motion was started actively on the sixth postoperative day. After 2 weeks, pronation and supination improved but was still limited by 30 per cent and the elbow extension was increased to 150 degrees and flexion to about 90 degrees and was only slightly painful. The postoperative course was complicated by a bleeding submucous myoma of the uterus which required gynecological intervention and surgery about 2 weeks postoperative. Otherwise there was an uneventful course so far as the arm was concerned. The motion was slightly improved and the patient was free of discomfort until 3 months later when several bodies, overlooked at the original operation, were palpated on the anterior lateral aspect of the arm. Under local anesthesia, exploration revealed the loose bodies behind the coronoid process. After several months motion was still markedly limited but the elbow remained free of pain.

CASE 3 J. E. D., male, age 65 years, had difficulty with his right knee for several years which cul-



Fig 5 Osteocartilaginous bodies lying free in suprapatellar pouch this is not a case of synovial osteochondromatosis, however



Fig 6 Similar to Figure 5 with osteocartilaginous bodies in posterior compartment and suprapatellar pouch without the synovial condition seen in osteochondromatosis

Laboratory findings were 10,150, red blood count 3,770,000, hemoglobin, 14.1, urinalysis, negative, Kahn, negative, hemogram—basophils, 2, eosinophils, 2, juveniles, 1, segmented lymphocytes, 23, monocytes 8, no sedimentation rate determination.

A medial parapatellar incision was made upon operation and a small amount of viscid clear yellow fluid escaped. The synovium was studded with small cartilaginous bodies. Patellectomy and posterior and anterior synovectomy were performed.

Postoperative course was uneventful.

Chronic inflammation of the synovial membrane with some fibrocartilage was found upon microscopic examination. The lining showed nodular fibrosis. The nodules of the synovial membrane revealed fibrosis, connective tissue with formation of cartilage, and, in the center of some of these, areas of bone formation.

**CASE 4 F L.** The patient had a painful knee for 4 years following a blow on his right knee when it bumped on a ladder rung. Seven to 8 months after the injury the right knee became increasingly stiff and painful. He then noted on movement the sensation of something being loose in the joint, and the pain in the knee had become a constant dull ache relieved a little by exercise. He was advised that he had arthritis and for 6 months before admission to the Washington University Clinics received physical therapy without benefit.

Examination of the right knee revealed it to be swollen, not hot or red, or excessively tender. On motion there was soft crepitus, flexion was not limited but extension lacked 5 degrees of normal. On palpation the suprapatellar pouch was bulging and transmitted a gritty mush feeling. Some slight tenderness was noted over the entire joint.

X-ray examination revealed no pathological process in the knee.

Laboratory findings revealed normal urine and the blood count showed red blood cells 4,750,000, white blood count 8,750, hemoglobin 14.5, hemogram—eosinophils 1, stab, 3, segmented, 68, lymphocytes 25, monocytes 3, Kahn, negative.

The patient's knee was explored through a medial parapatellar incision. The bulging capsule was opened which allowed the incision to become filled with a double handful of fine granules of cartilage about the size of rice grains. There was no free fluid. The synovium was shaggy and thickened and slightly reddened. The articular cartilage of the tibia was thin in several areas. The wound was irrigated and a partial synovectomy including medial meniscectomy was done.

Postoperative course was uneventful except for an accumulation of fluid which required aspiration on the ninth day and 85 cubic centimeters of old blood was removed.

The patient was able to go to work 6 weeks after operation and at that time there was no swelling or limitation of motion of the knee.

Microscopic examination of the synovial membrane revealed numerous small villous processes which were undergoing metaplasia into cartilage. In some areas calcification of this hyaline cartilage was seen (Figs 4b, 4c, and 4d).

#### SUMMARY AND CONCLUSIONS

1 Synovial osteochondromatosis is a rare affection of the synovial membrane of joints leading to the formation, by the synovium, of cartilaginous or osteocartilaginous bodies. This process may be considered a benign neoplasm because the bodies continue to be formed and grow but they do not metastasize.

2 Infection and trauma play an excitant role and must be considered definite etiological factors in the production of synovial osteochondromatosis.

3 Synovial osteochondromatosis should not be confused with the much more common loose body or joint mouse.

4 Therapy consists of surgical removal of the bodies and synovectomy.

5 Case reports have been presented.

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# THE TECHNIQUE OF GASTRIC RESECTION FOR PEPTIC ULCER

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**I**N recent years, much controversy has centered about the surgical treatment of peptic ulcer. Dragstedt and his co-workers have advocated vagotomy as the operation of choice but the consensus appears to be that subtotal gastrectomy offers the best chance of cure with a minimum of undesirable after effects (6). In our own experience this has certainly been the case. In a series of 1,000 resections by one of the authors (GGM) in the past 12 years we have been struck by the smooth postoperative course, the low mortality, and the excellent end-results. This series is being analyzed at present and will be the subject of a further communication.

The operative technique of gastric resection has changed over the years as new difficulties have been met and solved. In its present form it represents a routine which is easily adapted to the conditions encountered in any individual case. The purpose of this paper is to describe the operation in detail pointing out the common difficulties and the means of obviating them.

## PREOPERATIVE PREPARATION

The state of nutrition is the major preoperative problem in ulcer patients. These individuals have often been on inadequate diets and this deficiency may be aggravated by bleeding or pyloric obstruction. Routine plasma protein and hemoglobin determinations are carried out and operation is postponed until all deficiencies have been corrected.

If pyloric obstruction is a prominent feature and the stomach is atonic and dilated, it is necessary to keep it empty by constant suction for 48 hours before operation. This method permits the gastric wall to regain its tone and decreases edema. In cases of non-obstruction a Levine tube is passed the morn-

ing of operation and suction is applied during the procedure. The tube is left in place 12 to 24 hours postoperatively. This step is not essential but we feel that it is beneficial in the prevention of distention and in the removal of blood and secretions from the gastric stump. The tube is not allowed to cross the anastomosis because of the possibility of pressure necrosis.

Blood transfusion is used in cases in which the hemoglobin is below normal or in which there has been recent bleeding.

## OPERATIVE TECHNIQUE

High spinal anesthesia with nupercaine 1:1,500 has proved to be ideal. The operation can usually be completed in less than 2 hours and there is adequate relaxation for closure. Heavy preoperative sedation is used and in occasional cases a slow pentothal drip is given to supplement the spinal anesthesia.

The abdomen is opened through a midline epigastric incision extending from the xiphoid to the umbilicus. Excellent exposure is thus obtained for all stages of the operation and the need for strong retraction is minimized. In addition, since this incision goes through the fibrous linea alba it is relatively avascular and permits a strong closure. The incidence of postoperative wound complications has been very low with this approach.

Abdominal exploration is done and when the diagnosis has been confirmed the subtotal resection is carried out in the following steps:

1. (Fig. 1) The transverse colon is lifted up and a vertical incision is made in the mesocolon 1 inch to the left of the ligament of Treitz; care is used to avoid the middle colic artery. The right and left edges of this slit are marked with silk sutures.

The jejunum is then marked with another suture at a point 6 inches from the duodeno-jejunal junction and the colon and small bowel are returned into the abdomen. This step is

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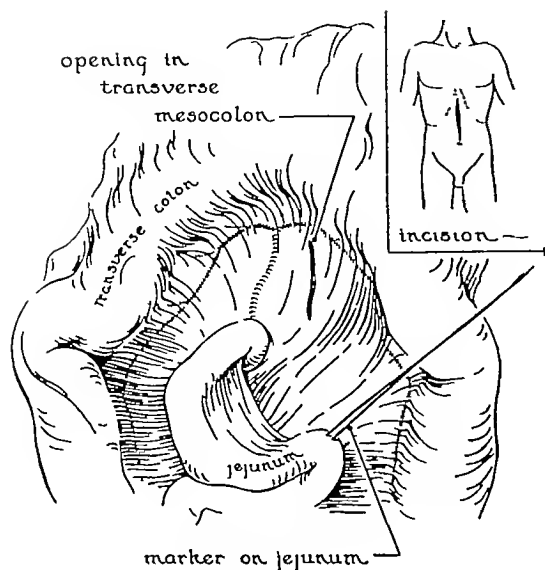


Fig 1

carried out first to avoid the undue handling of the bowel at a later stage after the stomach has been cut across and the peritoneal cavity has been exposed to potential soiling

2 (Fig 2) The greater curvature of the stomach is freed by the clamping and division of the individual vessels and their ligation with fine silk. The marginal vessel is left intact on the omental side, to avoid compromising the circulation of the great omentum. This mobilization is carried out from the pylorus to the bare area just distal to the vasa brevia

3 (Fig 3) The operator's finger can then be passed around the stomach through the avascular part of the lesser omentum  $\frac{1}{2}$  inch above the pylorus, and a tape passed through this opening is then used for traction

The right gastric artery is isolated below the tape, divided between clamps, and ligated

4 (Fig 4) The duodenum is freed from the surrounding structures by sharp scissor dissection. If the ulcer can be removed easily this is done and the duodenum is divided below the lesion. In such cases the McClure modification of the Furness clamp is used and the duodenal stump is inverted with a continuous Lembert stitch of No 000 chromic catgut. This suture is reinforced with a layer of interrupted fine silk sutures and the stump is

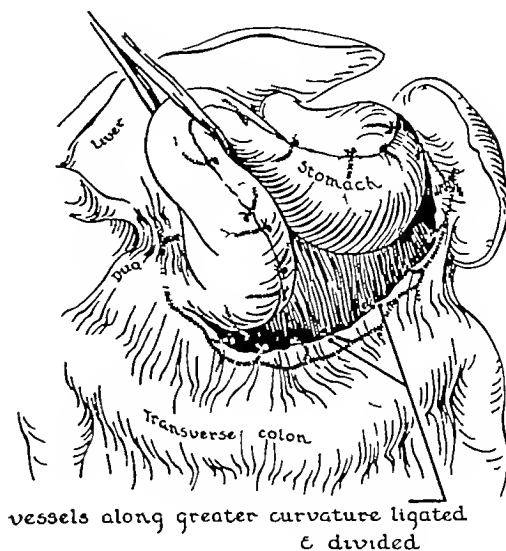


Fig 2

then buried into the capsule of the pancreas and covered with omentum held in place with fine silk sutures. In cases with a large, caloused, adherent, penetrating ulcer a different technique is used. In the past, great difficulty was encountered in the freeing of these ulcers from the pancreas and other organs. There is serious danger of injuring important structures in performing this dissection and it is difficult to free sufficient duodenum to obtain a satisfactory closure. In an attempt to solve

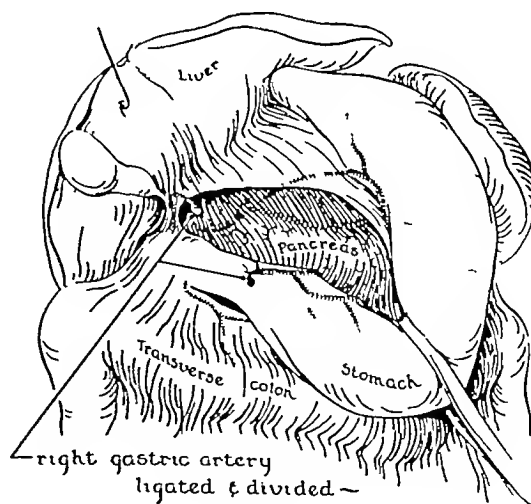


Fig 3





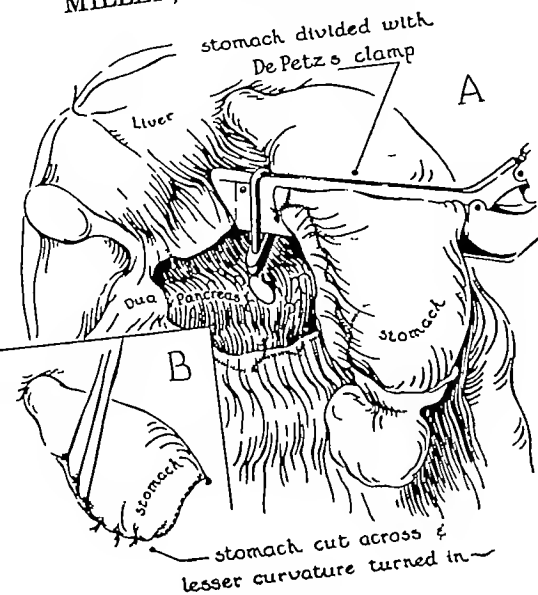


Fig 7

entire lesser curvature, excising about 75 per cent of the stomach as a routine measure. The lesser curvature half of the cut edge is then turned in with 2 layers of interrupted fine cotton,  $1\frac{1}{2}$  inches is left for the anastomosis.

7 (Fig 7) The left edge of the opening in the mesocolon is sutured to the posterior wall of the stomach and the jejunum is brought up through the opening and a retrocolic no-loop antiperistaltic anastomosis is carried out. The seromuscular layer is sutured with interrupted fine cotton and the mucosal layer is sutured with continuous No 000 chromic catgut, a lock stitch being used posteriorly and a baseball stitch anteriorly. The jejunum is fixed along the lesser curvature with 2 purse string sutures to form a Hofmeister valve. This step prevents reflux of gastric contents along the afferent loop and protects the so-called "dangerous angle" of the anastomosis.

8 (Fig 8) The right edge of the mesocolic opening is then sutured to the anterior wall of the stomach.

9 The abdomen is closed with interrupted medium steel wire sutures in peritoneum, fascia, and skin.

## POSTOPERATIVE CARE

Continuous gastric suction is maintained for 24 hours, and water is allowed by mouth

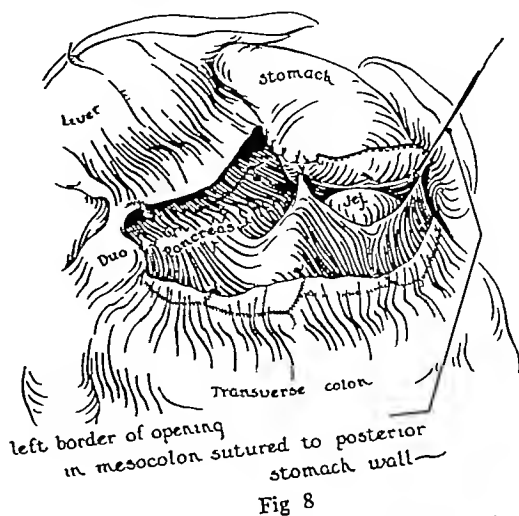


Fig 8

to wash any old blood from the stomach. On the first postoperative day the tube is removed and the patient is allowed up. The following feeding routine has been used with complete satisfaction.

### First day

One ounce of water hourly

### Second day

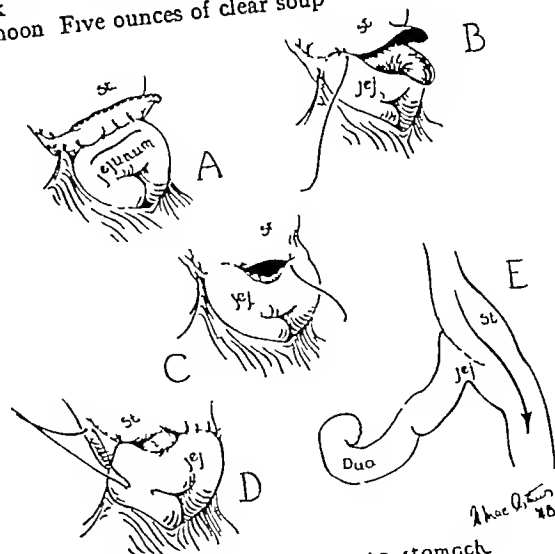
One ounce of water and 1 ounce of milk hourly

### Third day

8 00 a.m. Five ounces of tea

10 00 a.m. Three ounces of water and 2 ounces of milk

12 noon Five ounces of clear soup



anastomosis of jejunum to stomach

Fig 9

2 00 p m Three ounces of water and 2 ounces of milk

4 00 p m Five ounces of albumen water

6 00 p m Five ounces of tea

8 00 p m Three ounces of water and 2 ounces of milk

#### *Fourth day*

8 00 a m Tea, bread and butter

10 00 a m Orange juice

12 noon Clear soup and custard

2 00 p m Orange juice

4 00 p m Soft boiled egg, bread and butter, and tea

6 00 p m Bread and butter, jelly, and tea

8 00 p m Orange juice

#### *Fifth day*

Soft diet with extra feedings at 10 00 a m, 2 00 p m, and 8 00 p m Fluids as tolerated

*Sixth day* Same as fifth day

#### *Seventh day*

Bland ulcer diet with extra feedings at 10 00 a m, 2 00 p m, and 8 00 p m

This routine is supplemented by intravenous infusions for 48 hours, 3,000 cubic centimeters are given daily consisting of 1,000 cubic centimeters of 5 per cent glucose saline, 1,000 cubic centimeters of parenamine, and 1,000 cubic centimeters of 10 per cent glucose in water Vitamins B and C in soluble form are given with this routine The sutures are removed on the 8th day and the patient leaves

the hospital on the 10th day on a convalescent ulcer diet This diet is usually maintained for 2 or 3 months, at the end of which time all restrictions are removed

#### SUMMARY

1 A technique of gastric resection for peptic ulcer is described The essential features are as follows (a) midline epigastric incision, (b) removal of 75 per cent of the stomach, (c) removal of the pylorus in all cases, (d) a simplified method of duodenal closure in large callous ulcers, (e) a retrocolic, no loop, antiperistaltic anastomosis, according to the Hofmeister-Finsterer technique, is made

2 The preoperative and postoperative care of ulcer patients is outlined

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# PREDISPOSING ACTION OF ANESTHETIC AGENTS ON THE VASCULAR RESPONSES IN HEMORRHAGIC SHOCK

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RECENT work on experimental shock (5) has clearly established the existence of a variety of initiating and sustaining mechanisms which lead to peripheral circulatory collapse. Among the mechanisms reported to participate in the syndrome are a reduced blood volume via extravascular fluid loss (1), compensatory and decompensatory changes in the peripheral blood vessels via humoral principles (11, 13), neurogenic vasoconstrictor influences (4), and endothelial toxins of tissue and bacterial origin (3, 8). These different mechanisms do not consistently appear in the same sequence relative to one another, nor do they participate to the same degree in different subjects or in different types of shock. The precise experimental conditions under which the shock is produced appear to determine which of the several possible factors will predominate and which of them will be excluded. One of the major determinants of the character of the shock syndrome has been shown to be the type of anesthetic agent employed (12). The influence of the anesthetic agent on the course of the syndrome was found to be exerted in a specific, predictable manner. The specific vascular effects of different anesthetic drugs were such as to make it possible to produce a different sequence in the peripheral circulatory reactions under otherwise identical experimental procedures. Certain anesthetics, such as cyclopropane and morphine, accentuated the compensatory vasoconstrictor aspects of the syndrome virtually to the exclusion of other factors. Other agents, such as sodium pentobarbital and pentothal, aggravated the reduced, circulating volume by depressing the compensatory responses of the peripheral blood vessels. Finally, agents such as ether

produced sufficient vascular dilation and endothelial damage to limit severely the compensatory vascular phenomena and to lead to a disruption and stasis of the peripheral circulation early in the syndrome. In the present study, use was made of the predisposing actions of three different anesthetic agents: cyclopropane as an agent favoring a predominantly compensatory response to hemorrhage, ether to demonstrate an extreme decompensatory pattern, and sodium pentobarbital to provide an intermediate pattern. The specific properties of these three anesthetic agents made it possible to study selectively several of the basic mechanisms participating in the syndrome.

Chambers, Zweifach, and associates (13) were able by direct visualization of the small blood vessels to follow the progression of shock following hemorrhage on the basis of characteristic alterations in the functional response of the capillary bed. Two patterns of response were noted: (a) an initial period of compensatory activity in which the peripheral vascular apparatus accommodates its capacity and vasomotor activity to the reduced blood volume, (b) a subsequent decompensatory period in which the capillary bed loses its ability to restrict effectively the circulation in a manner compatible with tissue needs, as a result of which adequate venous return into the general circulation is no longer possible. The decompensatory phase was associated with the development of the so-called "irreversible" stage of shock. Both the compensatory and decompensatory phases were shown to be related to blood-borne principles (vasoexcitor principle, VEM, and vasodepressor principle, VDM). Although these studies made no direct evaluation of the role of the nervous system in the reactions of the peripheral blood vessels to blood loss, it was clear from subsequent experiments on animals subjected to postganglionic sympathectomy that vasoconstriction of

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the larger vessels during the compensatory stage could, in large part, be ascribed to increased neurogenic stimuli. Increased reactivity of the terminal arterioles and precapillaries, on the other hand, was related to a blood-borne vasoconstrictor principle, VEM, of renal origin (6). The decompensatory stage did not appear to be related to a failure of neurogenic vasoconstrictor influences but to an interference with the response of the peripheral blood vessels to these stimuli by the progressive accumulation in the blood stream of a vasodepressor principle, VDM, principally of hepatic origin (6).

The effectiveness and widespread use of blood replacement therapy has tended to over-emphasize the fluid loss aspect of the syndrome and has led to the clinical neglect of other mechanisms which exert a deleterious influence on the blood vessels themselves (7). Further clarification of the mechanisms leading to the decompensatory phase could be of considerable value in counteracting the progressive refractoriness to corrective therapy which develops during this stage of shock. The present report is therefore concerned particularly with the changes in the peripheral blood vessels, observed by direct microscopic study, as they reflect the influence of anesthetic drugs on the decompensatory, hyporeactive phase of the shock syndrome.

#### MATERIAL AND METHOD

Alterations in the peripheral circulation were studied visually in the omentum of a dog by a technique previously described (10). It consists essentially of the exteriorization of the omentum into a rubber sheath with a small portion of the tissue resting in a special moist chamber. The omental tissue was irrigated with a thermostatically controlled, warm solution of Ringer gelatin at pH 7.3 having the colloidal osmotic pressure of a serous exudate. This method of preparation allowed for normal reactivity of the vascular bed for a period in excess of 5 to 6 hours.

The bleeding procedure consisted of an initial blood loss of 2 per cent body weight and subsequent small bleedings (0.5-0.2 per cent) at 15 to 20 minute intervals. These were continued until the flow in the larger omental ar-

teries became static during the actual bleeding procedure. This degree of blood loss usually corresponded to the amounts required to induce fatal shock. Cyclopropane and ether were given with excess oxygen through an endotracheal catheter by a closed to-and-fro rebreathing system providing for carbon dioxide absorption. The first plane of surgical anesthesia was maintained throughout. Sodium pentobarbital was injected intravenously as a single dose of 25 milligrams per kilogram of body weight. The animals received no other medication. Continuous visual records of the circulation were obtained in selected animals by photomicrography. In several instances motion picture records were made. The illustrations included in the present paper represent individual frames from such a continuous film or selected photomicrographs.

A number of criteria were routinely employed for evaluating the functional state of the peripheral vascular bed: (1) degree of vasoconstriction, (2) rate of blood flow, (3) extent of ischemia in capillary bed as estimated by the number of active capillaries, (4) reactivity of arterioles and precapillaries to epinephrine applied topically, (5) evidence of capillary stasis or increased permeability, (6) presence in blood of vasoactive substances as demonstrated by the rat mesoappendix assay (10). In the accompanying photographs it is possible to demonstrate only the vasoconstrictor changes, the development of either capillary ischemia or hyperemia, and the presence or absence of capillary stasis.

#### EXPERIMENTAL RESULTS

The data are presented under three categories according to the nature of the vascular response following hemorrhage. In each category are presented selected protocols in the form of photographs indicating the sequence of hemodynamic changes in the capillary circulation characteristic of this group of animals.

*1. Compensatory type of vascular response*  
Of a series of 30 dogs subjected to hemorrhagic shock during cyclopropane anesthesia, 26 animals went into fatal circulatory collapse while showing a purely compensatory sequence of vascular changes throughout the syndrome. Table I presents the pertinent data on Dog

No 12 which is typical for this category. Accompanying this is Figure 1 which illustrates the vascular changes as observed through the microscope. In order to indicate the terminology of the different vascular components a schematized tracing of the capillary bed is included in Figure 1,a as a point of reference for the ensuing photographs.

The small arteries and arterioles (50 to 60 micra) undergo a progressive vasoconstriction with the successive bleedings. The vasoconstriction becomes clearly evident at 3 per cent blood loss in Figure 1,d and is pronounced in the latter stages (40 per cent) (Fig 1,e). Often at exitus (Fig 1,f) the arteries and arterioles are almost completely constricted and empty of blood.

The precapillary sphincters show an increase in vasomotion which results in a periodic reduction in blood flow through the capillary bed. The augmented vasomotion is pronounced after 3 to 4 per cent blood loss (Fig 1,d) the precapillaries remaining in a constricted state for a greater proportion of the cycle. The compensatory type of vascular response with marked narrowing of the precapillary vessels is clearly seen in Figure 1,e and is still present in Figure 1,f, taken just prior to circulatory collapse.

Initially there is an active blood flow through most of the capillary vessels (Fig 1, b). With successive bleedings the active circulation is progressively restricted to fewer capillaries (Fig 1,d and e). When maximal blood loss has been attained, little or no active circulation is present in the majority of the capillary vessels (Fig 1,e). At exitus (Fig 1, f) the capillary network is highly ischemic, the endothelial walls being visible only at the venous end where they join the collecting venules.

Only slight changes in caliber occur in the collecting venules, which have a sparse distribution of muscle in their walls. The darker appearance of the venules in the photographs as shock progresses is due to the slowed circulation and close packing of the red blood cells (Fig 1,d and e). At exitus (Fig 1,f) the venules are the only capillary vessels with blood.

Thus when profound shock develops in dogs bled during cyclopropane administration, the

TABLE I —HEMORRHAGE DURING CYCLOPROPANE ANESTHESIA  
Dog No 12

Photo-micro-graphs Fig 1	Blood loss (% body wt.)	B P (mm Hg)	Blood flow in capillary bed	Vasomotion
b	Control	160	Good	Normal
c	2	110	Good	Augmented
d	3	104	Mod slowed, unrestricted	Augmented
e	4	84	Slowed restricted	Augmented
f	5.3 (maximum)	52	Ischemic	Augmented

arteries are partially narrowed, the arterioles are maximally constricted almost to the point of obliteration of the vessel lumen, the precapillary sphincters are closed, the capillaries are empty except for occasional blood cells, and only the venules contain stagnant blood.

2 *Intermediate type of vascular response* To illustrate this type of vascular behavior following hemorrhage, a protocol is given for Dog No 3 which was subjected to hemorrhage during sodium pentobarbital anesthesia. In this animal, 46 per cent of body weight was bled to produce fatal circulatory collapse (see Table II). The sequence of vascular changes is illustrated in Figure 2.

With a blood loss of only 2 to 3 per cent of body weight, a narrowing of the larger arteries and arterioles occurs (Fig 2 d). When sufficient blood has been withdrawn to lower the blood pressure below 45 millimeters of mercury, both the larger arteries and veins undergo more pronounced vasoconstriction (Fig 2,

TABLE II —HEMORRHAGE DURING PENTOBARBITAL ANESTHESIA  
Dog No 3

Photo-micro-graphs Fig 2	Blood loss (% body wt.)	B P (mm Hg)	Blood flow in capillary bed	Vasomotion
b	Control	110	Good	Normal
c	2	86	Good, slight restriction	Augmented
d	3	70	Mod slowed, restricted	Present
e	4	50	Slowed unrestricted	Impaired
f	4.6	34	Sluggish, unrestricted	Absent

TABLE III —HEMORRHAGE DURING ETHER ANESTHESIA

Dog No 64

Photo-micro-graphs Fig 3	Blood loss (% body wt.)	B P (mm Hg)	Blood flow in capillary bed	Vasomotion
b	Control	150	Good	Present
c	2	102	Mod slowed, some restriction	Impaired
d	3	76	Slowed unrestricted	Slight
e	4	56	Sluggish unrestricted	Absent
f	4.1	42	Stagnant, unrestricted	Absent

e) At exitus (Fig 2,f) the arteries are constricted, but not as completely as in those animals bled during cyclopropane anesthesia.

An increase in activity of the precapillary sphincters occurred after blood loss of 3 per cent when the blood pressure was between 60 to 70 millimeters of mercury. The increased vasomotion markedly reduces the capillary circulation during the initial stages (Fig 2,d and e). However, the increased vasomotor activity does not persist, as can be seen in Figure 2,f. The capillary bed remains only partially ischemic (Fig 2,e) and actually has begun to open up with the approach of circulatory collapse (Fig 2,f).

The collecting venules at first show only a pronounced slowing of flow through them, with some evidence of clumping of red cells (Fig 2,d). No significant venular vasoconstriction is evident. As the shock deepens, the outflow from the collecting venules into the larger veins is almost completely curtailed (Fig 2,e). As a result, blood accumulates in the venules which then become somewhat engorged (Fig 2,f). At exitus there is no forward propulsion of blood in these vessels.

Thus, fatal circulatory collapse in dogs bled during pentobarbital anesthesia occurs with the arteries and veins narrowed, the terminal arterioles only partially constricted, many of the precapillary sphincters relaxed so that blood is present in the capillary vessels, and the venules congested and often distended.

3 *Decompensatory type of vascular response*  
This type of vascular behavior was frequently seen in dogs subjected to hemorrhage during

ether anesthesia (15 dogs). Figure 3 contains a series of photographs taken of Dog No 64 and illustrates the extreme decompensatory changes which occur in the peripheral blood vessels in this group of animals. Fatal circulatory collapse was induced in Dog No 64 by a blood loss of 4.1 per cent of body weight (see Table III). The peripheral blood flow was already slowed when only 3.5 per cent of body weight of blood had been removed (Fig 3,d). At this stage the larger arteries were only moderately constricted (Fig 3,d). In the terminal stages, the arterioles are not at all constricted and show no forward propulsion of blood, the cells being clumped with intervening areas of clear plasma (Fig 3,f). The large veins showed little or no change in caliber throughout.

The precapillary sphincters showed evidence of an increased vasomotion when as little as 2 per cent of blood had been withdrawn (Fig 3, c). As can be seen in Fig 3,d and e the capillary bed does not become appreciably ischemic. Although less blood is circulating through the capillary vessels, none of the capillaries in the field are actually closed off (Fig 3, c, d, e). As a result, the blood flow in the collecting venules becomes sluggish when the blood pressure has fallen only to 60 to 70 millimeters of mercury. This is in contrast to the active venular circulation at a comparable stage of hemorrhagic hypotension in unanesthetized dogs, or dogs receiving cyclopropane anesthesia.

The collecting venules become engorged with blood and stasis develops about 30 to 40 minutes before circulatory collapse occurs (Fig 3,e). Many of the capillary channels are filled with blood which is closely packed (Fig 3,f). This type of stasis is usually associated with a loss of fluid into the tissues and is probably indicative of an increased capillary permeability.

The vascular picture in fatal hemorrhagic shock in dogs during ether anesthesia therefore occurs with moderate vasoconstriction of the larger blood vessels, a relaxation of the arterioles, an opening up of the precapillary sphincters, a trapping of blood in the capillary vessels and a pronounced engorgement of the venules with considerable extravasation in

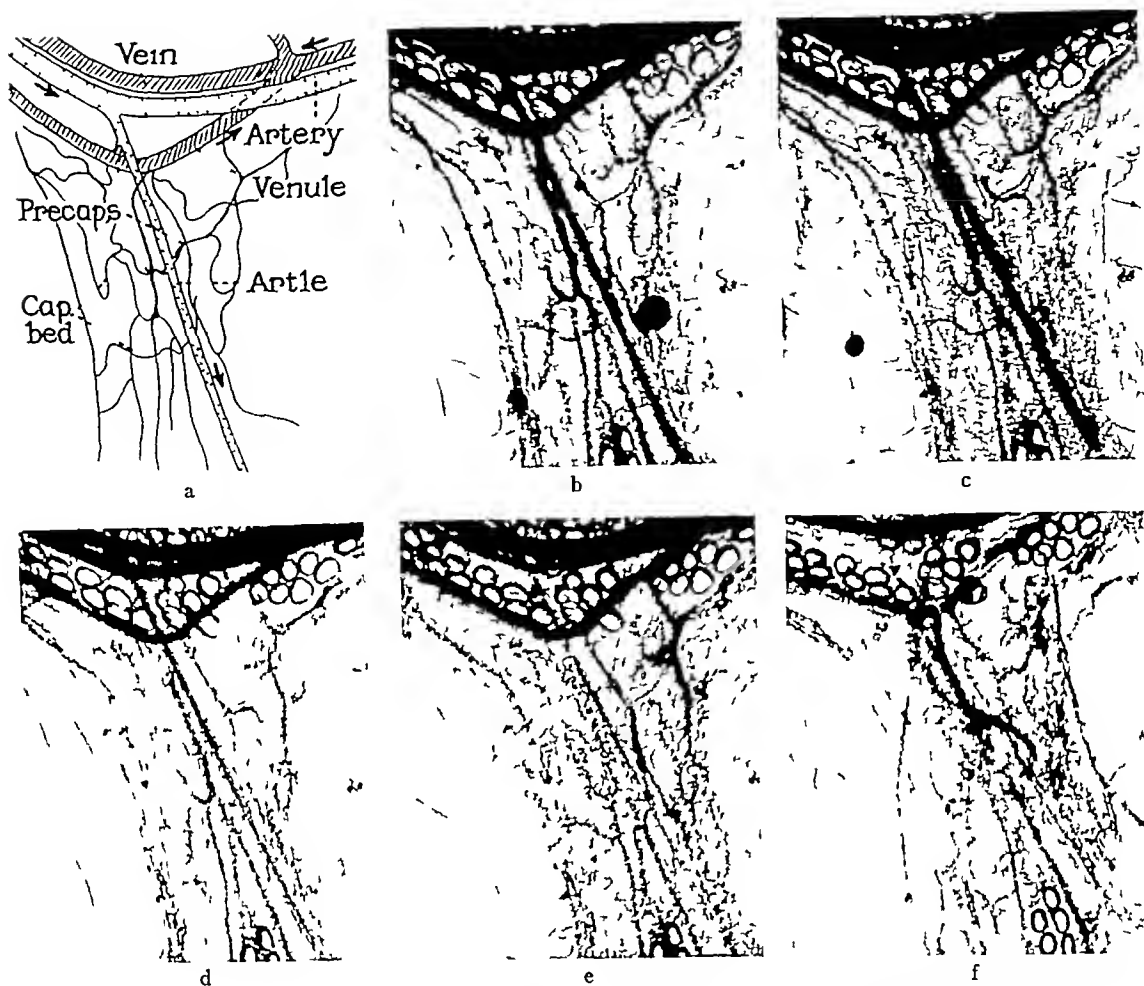


Fig 1 Hemorrhage during cyclopropane anesthesia compensatory type of vascular response a, In order to indicate the terminology of vascular components, a schematized tracing of capillary bed is given arteriole, *Arteriole*, pre-

capillary sphincter, *Precaps*, capillary bed, *Cap. bed*, collecting venule, *Venule* b to f, Successive stages illustrating vascular changes during progression of shock syndrome in the omentum of dog  $\times 50$

many of these vessels. This group of animals not only showed the most pronounced degree of vascular change but was also refractory to blood replacement therapy.

**Blood-borne principles** Our previous experiments (11) have indicated that the vascular changes observed in the omentum during shock are closely paralleled by the appearance in the blood stream of two vasotropic principles whose vascular effects were comparable to those observed in the shocked animal at the time the blood samples were withdrawn for bioassay. In the initial, compensatory stage there appears a vasoexcitor principle, VEM,

which in the test rat potentiated the response of the terminal arterioles to epinephrine. In the latter stages of shock when decompensatory phenomena preponderate, a vasodepressor principle, VDM, appears in the blood which makes the terminal arterioles of the test rat refractory to the vasoconstrictor effects of epinephrine. In dogs subjected to hemorrhage with cyclopropane large amounts of the vasoexcitor principle appear in the blood and persist throughout the syndrome. In dogs bled with sodium pentobarbital anesthesia showing an intermediate type of vascular response, vasoexcitor material, VEM, appears in the



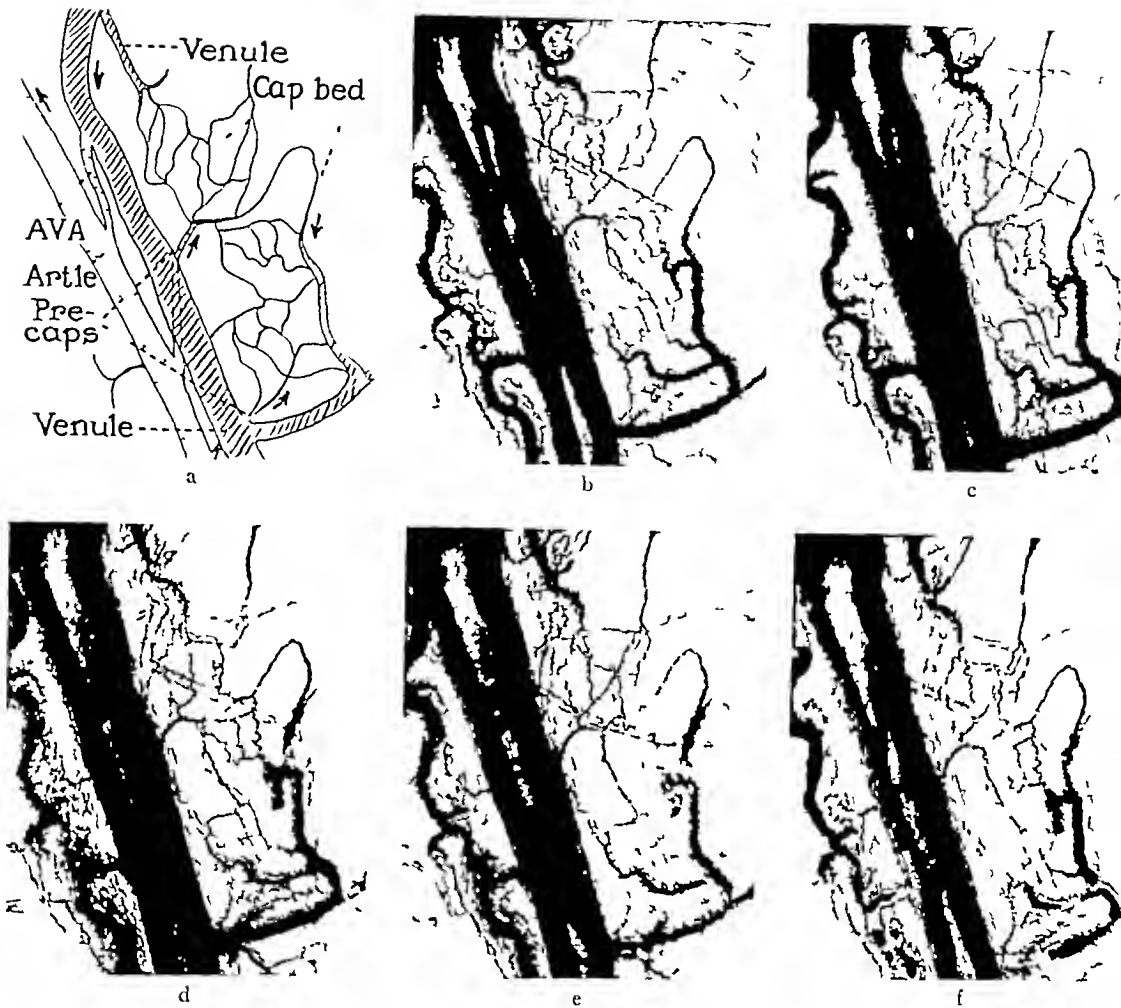


Fig 2 Hemorrhage during pentobarbital anesthesia, intermediate type of vascular response a, Abbreviations

same as in Figure 1 Note 4 1 4 (arteriovenous anastomosis) between arteriole and venule  $\times 50$

blood stream early in the syndrome and is subsequently replaced by the vasodepressor principle which then persists until the animal goes into fatal circulatory collapse. In ether treated dogs showing a decompensatory type of vascular response, VEM appears in the blood stream only transiently and is soon replaced by the vasodepressor principle which is present at exitus in excessive amounts.

**Anesthesia administered during shock** The deleterious influence of anesthetic agents on the response of the peripheral vascular system to shock is evident from experiments in which anesthetic drugs are administered after shock has developed (2). This was most pronounced

in dogs bled during ether or pentobarbital anesthesia and to a lesser degree in dogs bled after morphine administration.

The subsequent intravenous injection of pentobarbital (2 to 3 mgm /kgm) during the period of drastic hypotension (40 to 50 mm Hg) which developed 4 to 5 hours after the initial induction of pentobarbital anesthesia was extremely hazardous, in 7 out of 10 animals, it resulted in a further marked deterioration of the capillary circulation. Frequently the terminal arterioles and precapillaries became dilated within a few minutes after injection. Reactivity of blood vessels to epinephrine also began to decline precipitously.

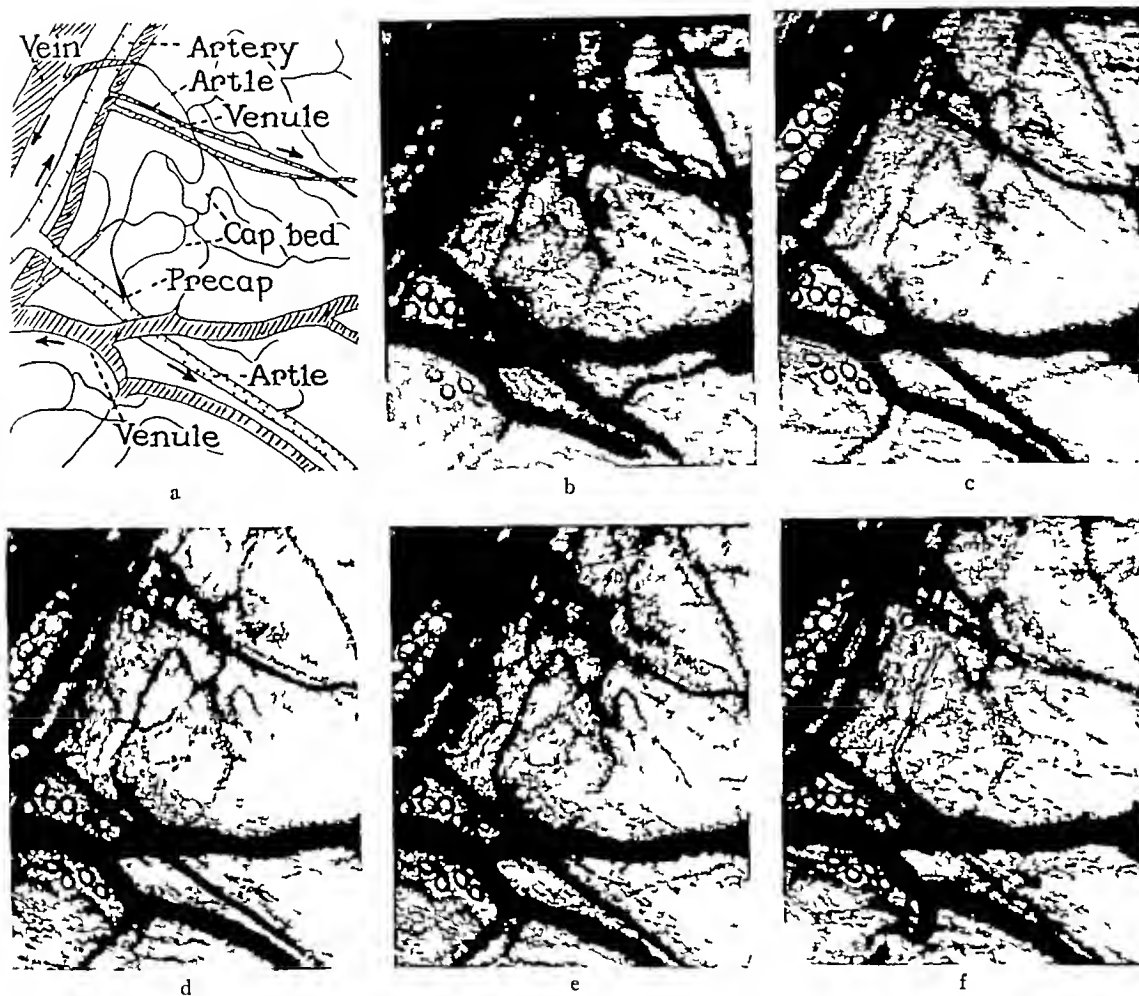


Fig 3 Hemorrhage during ether anesthesia, decompensatory type of vascular response b to f, Illustrate the

extreme decompensatory changes in peripheral blood vessels  $\times 50$

In dogs maintained with ether anesthesia it was invariably necessary during the progression of shock to discontinue the administration of ether and use only oxygen in the closed endotracheal anesthesia system. The addition of minimal amounts of ether to the oxygen mixture during profound shock resulted in the rapid dilatation of the small arterioles and a pronounced slowing of capillary flow. The venous circulation became almost stagnant.

In morphine treated dogs, the subsequent intravenous injection of morphine (1 to 5 mgm/kgm) during the period of drastic hypotension, produced in 2 out of 4 dogs a gradual slowing of capillary flow and a slow depression

of blood pressure which could be alleviated only by transfusion. These amounts of morphine were relatively innocuous when given to unbled dogs. The administration of morphine was also found to be deleterious when it was given to shocked dogs after the original blood volume had been restored with whole blood and the blood pressure had returned to approximately normal levels. In 1 dog, No 58, which had been anesthetized with sodium pentobarbital and had been in extreme hypotension for over  $4\frac{1}{2}$  hours, the infusion of blood restored the blood pressure to 95 to 110 millimeters of mercury. Forty-five minutes after the infusion, the administration of 1

milligram per kilogram of morphine to this dog depressed the peripheral circulation within 5 minutes and almost immediately lowered the blood pressure to 50 millimeters of mercury. Deleterious effects of anesthetics administered during the shock syndrome were less severe in unanesthetized dogs, or in dogs given cyclopropane. However, even in these animals, extreme care had to be observed when anesthetics were administered once shock had developed.

#### DISCUSSION

The feature which distinguishes the shock syndrome is a considerable reduction in peripheral circulation. In most instances the circulatory insufficiency cannot be attributed to any single factor exclusively. With hemorrhage it is possible to produce a predictable syndrome in which the initiating factor is experimentally defined. The response of the peripheral vascular system to hemorrhage represents an attempt to accommodate the vascular bed to the reduced blood volume without curtailing the blood flow beyond the minimal requirements of the tissue. This is accomplished by a partial vasoconstriction of the larger arteries and veins, by an increased vasomotion of the terminal arterioles, and by an increased reactivity of the small blood vessels to humoral agents. Following a single massive, fatal blood loss the resulting vasoconstriction of the larger blood vessels is carried to an extreme. The effect is to curtail excessively the circulation in the tissues to an extent that appreciable quantities of blood are trapped on the capillaries and collecting venules. This might be termed an overcompensation productive of an unfavorable situation. With a graded type of bleeding, in which fatal amounts of blood are withdrawn over a period of 30 to 90 minutes, there is sufficient time for a compensatory hyperreactivity of the capillary bed to develop and thereby to assist in emptying the capillary bed. This compensatory ischemia was most pronounced in unanesthetized dogs subjected to hemorrhage.

An evaluation of the circulatory data from the viewpoint of anesthesia has demonstrated striking differences not only between the reactions of dogs subjected to hemorrhagic hypo-

tension with and without anesthesia, but between dogs bled while under the influence of different anesthetic agents. The predisposing action of anesthetics was readily apparent on the basis of the vascular changes observed through the microscope in the omentum of the dog.

In general, three categories of vascular response were observed with hemorrhage as the initiating factor. The first is the purely compensatory type obtained in unanesthetized animals and most closely approximated in the anesthetized group by those animals bled during cyclopropane administration. Under such conditions the capillary bed as an organic unit shows no essential dysfunction. When it occurs, circulatory collapse is essentially a mechanical failure of blood to be returned from the tissues as the result of excessive vasoconstriction of the larger blood vessels.

The second or intermediate type of vascular response was obtained with animals subjected to graded hemorrhage in which the hypotension is maintained for an extended period usually 3 to 4 hours with blood pressures below 40 to 50 millimeters of mercury. In these animals, although vasoconstriction of the larger blood vessels is relatively unimpaired, there progressively develops a physiologic derangement of the peripheral circulation. Capillary ischemia is no longer complete and a trapping of blood is evident on the venous side of the bed especially in the collecting venules. This type of response is seen most frequently in animals bled during sodium pentobarbital or morphine (2) anesthesia. The circulatory collapse is not solely a mechanical one since biochemical changes occur in the tissues and result in the appearance in the blood of decompensatory vasotropic principles.

The third or more toxic type of vascular change was obtained when ether was used as the anesthetic agent. In these animals not only were the compensatory responses of the capillary vessels severely curtailed but the vasoconstriction of the larger arteries and veins was not as pronounced as in animals anesthetized with other agents. In addition, this was the only anesthetic agent in which many animals showed signs of increased capillary permeability, with considerable capillary

stasis, extravasation, and visible evidence of hemoconcentration in the collecting venules

It is interesting to note that the three types of vascular response to hemorrhage are correlated with the prognosis for the effectiveness of therapy in each group (9). Animals showing no functional derangement of the peripheral blood vessels readily recover after fluid replacement therapy. The second or intermediate type of vascular response is associated with a progressive refractiveness to blood replacement therapy. The third type of vascular response is associated with an extremely poor response to similar therapy. It is also noteworthy that there is a comparable correlation in these three types of vascular response with regard to the ability to tolerate blood loss.

Under normal conditions there exists a precisely controlled relationship between the volume of circulating blood and the capacity of the vascular bed in which it is contained. Two fundamentally different mechanisms can disrupt this normal hemodynamic equilibrium. Peripheral circulatory collapse may be induced either by decreasing the volume of blood through hemorrhage or by increasing the capacity of the vascular bed through peripheral insufficiency. Both of these factors contribute to some extent to all types of shock. Under ordinary circumstances, it is difficult to predict the extent to which each of these two mechanisms participate. The observation that following uncomplicated hemorrhage, different anesthetic drugs, of themselves serve to emphasize the pattern of the vascular disturb-

ance by shifting it to one or the other extreme, would seem to offer further evidence that both mechanisms operate to some degree in all types of shock.

#### SUMMARY AND CONCLUSIONS

This report deals with the specific effects of anesthetic agents on the response of the peripheral blood vessels to blood loss. The data indicate that irrespective of the initiating factor, the compensatory responses of the peripheral blood vessels can be altered in a predictable manner, according to the anesthetic agent employed. The multifacet character of the shock syndrome is re-emphasized.

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# CYTOLOGICAL DIAGNOSIS OF CANCER IN TRANSUDATES AND EXUDATES

## A Comparison of the Papanicolaou Method and the Paraffin Block Technique

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ATTEMPTS at diagnosing cancer from study of smears of ascitic fluid date back to the middle of the last century, at which time dried smears were examined under the microscope for the first time with the express purpose of demonstrating the presence of cancer cells. These early efforts, however, were not very successful for the reason that cellular structures in a dried preparation are distorted and because there were not then adequate cellular criteria on which to base a diagnosis. The earliest significant advance came in 1895 with the publication by Bahrenberg of a description of the method of centrifugating fluid, of fixing the sediment and embedding it in paraffin, subsequently of cutting and staining the specimens in routine manner. Unfortunately, this article was buried in a rather obscure medical journal, with the result that major credit for the development and publicizing of the paraffin method has been ascribed to Mandelbaum, who began such work in New York in 1900 and published a large series of cases of metastatic cancer so diagnosed in 1917. This report stimulated, throughout the country, immediate interest in and enthusiasm for the technique, and the method was taken up in many different centers.

In 1928, in an excellent report, Zemansky thoroughly reviewed all the investigative work that had been done previously in this field and reported as well a large series of cases collected by himself. He concluded that the examination of pleural and peritoneal fluids for tumor cells was a valuable routine laboratory procedure, that a positive report should carry a high degree of accuracy, al-

though a negative report should be interpreted as any other negative laboratory report as not ruling out the presence of cancer. He felt that, with proper technical care, about 50 per cent of the cases of cancer with effusion could be diagnosed by this method alone. In approximately one-third of the positive cases he was able to state accurately the type of tumor involved and that the finding of carcinoma was twice as likely as sarcoma in an equal number of cases compared. He noted, then, that atypical mesothelial cells of long standing, as for example in ascitic fluid with associated cirrhosis of the liver, provide a source of error to the most experienced examiner, which fact has been well borne out by later series. He rejected examination with the paraffin technique of sputum, gastric contents, and urine as being of little value—a fact of interest in the light of the recent great strides made with the new Papanicolaou method along those very lines. Zemansky established as criteria for the diagnosis of malignancy the finding of fragments of tissue with definite arrangement of cells to form acini or papillae, or multiple groups of large deep-staining cells. He emphasized as being of importance in the establishment of a final diagnosis, extreme irregularity of cell outline, eccentricity of the nucleus, macronucleosis, the presence of multinucleated cells, and typical or atypical mitotic figures. Most of these criteria have apparently well stood the test of time.

Subsequent investigators have continued to repeat the work done earlier with quite comparable results. Foot brought out particularly the importance of the nucleolar-nuclear ratio as discovered by other investigators, which is often significantly increased in cancer cells. If above 0.30 in his series, he felt that a

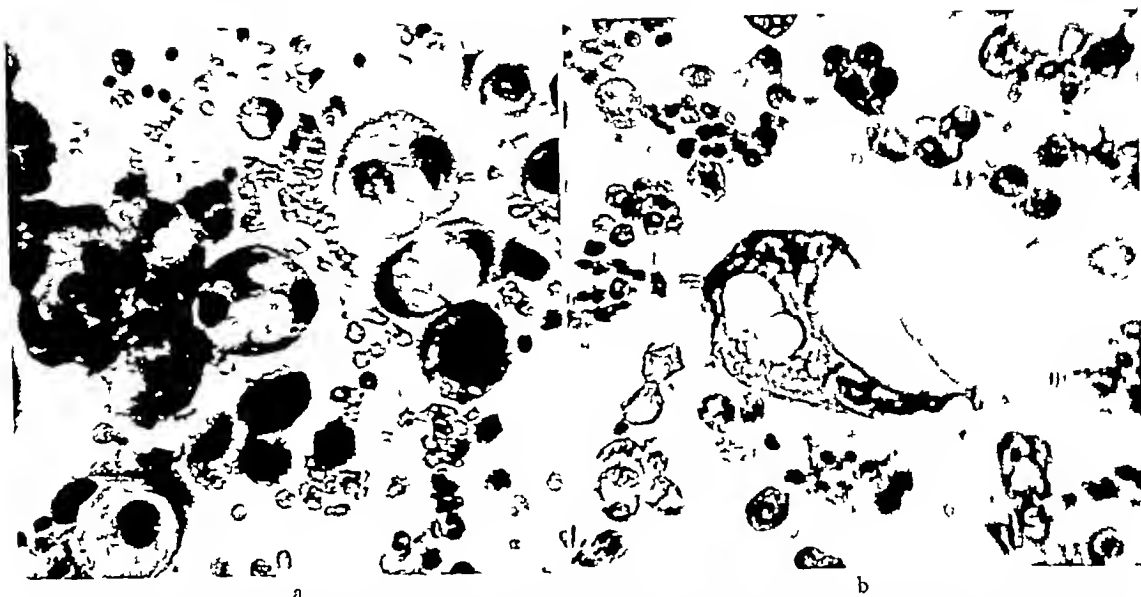


Fig 1 Metastatic papillary cystadenocarcinoma of ovary in ascitic fluid a, Smear b, Paraffin section Note that glandular formation is more prominent in the section, but individual cellular characteristics are better demonstrated by one smear  $\times 190$

positive diagnosis could be made on that fact alone. He also reiterated the fact that mesothelial cells may cloud the issue considerably. Schlesinger in his article stated that definite positive diagnosis of cancer could be made on paraffin section only on the finding of groups of polygonal cells with polarity, distinct cell walls, and acinar or pseudoacinar formation. He reported that such recognizable microscopic bits of tissue are found in about 60 per cent of malignant effusions. Honigman followed Schlesinger's criteria but added a few cases in his series where cells were found in cords or solid groups with sufficient variation of size, shape, and chromatin content of the nucleus to diagnose malignancy.

With the publication of the monograph on the diagnosis of cancer from the vaginal smear by Papanicolaou and Traut (8) in 1943, vast new horizons opened up in the field of cytology, and in the past few years every conceivable body fluid, almost, has been investigated for malignancy by the application of his technique for collecting various fluids and staining. In 1946 Papanicolaou reviewed his methods (7) and gave a general evaluation of results in all aspects of this work, describing at that time his method of collecting effusions for study.

He recommended that the fluid be mixed with 95 per cent alcohol, half and half, as soon as collected, then centrifuged at moderate speed for 30 minutes. The supernatant fluid is poured off, the sediment smeared on slides, fixed in ether-alcohol, and stained in the same fashion as smears from other sources. The development of the Papanicolaou technique of fixing and staining represents the most important milestone in this work. The immediate fixation of the smear in ether alcohol preserves the sharp cell outline and normal size and permits of more satisfactory staining. By prolonging the time of nuclear staining in hematoxylin and using special cytoplasmic stains in high alcoholic solutions, he secured both sharper nuclear staining and a lighter and more transparent cytoplasmic staining without loss of differential staining of basophilic and acidophilic cells. Nuclear characteristics can thus be defined more accurately and individual cells in thick or bloody smears can be much better differentiated. He noted that searching for malignant cells in a very thin smear is not too desirable because of the relative infrequency of the malignant cell among normal cells in early carcinoma. The widespread use of this technique has further eluci-

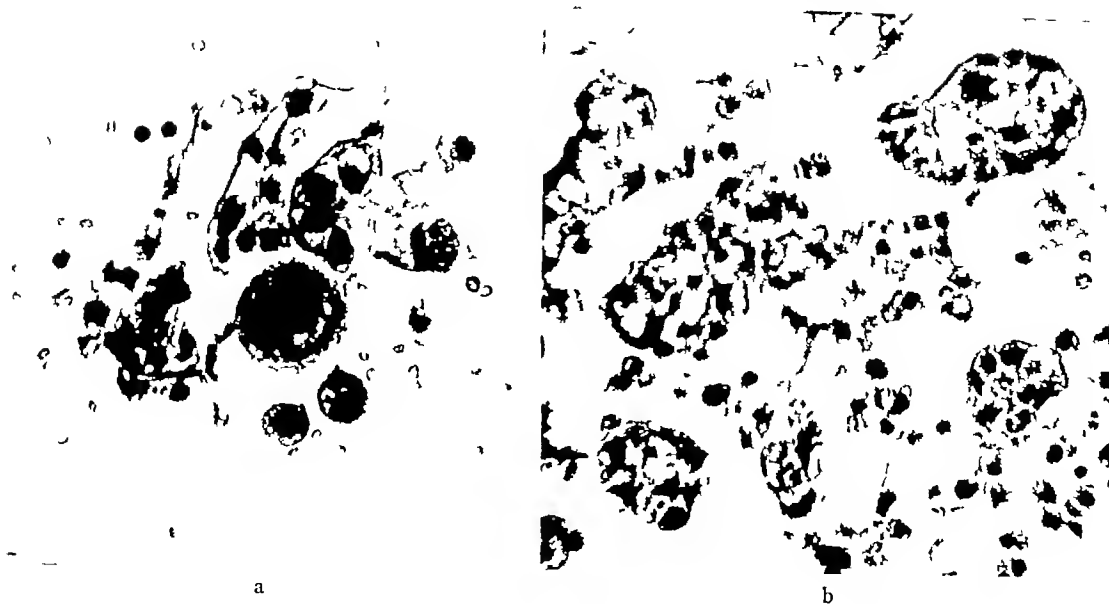


Fig 2 Metastatic carcinoma at ovary in ascitic fluid a, Smear b, Paraffin section In this, as in other figures, one larger size of cells in smears is evident  $\times 190$

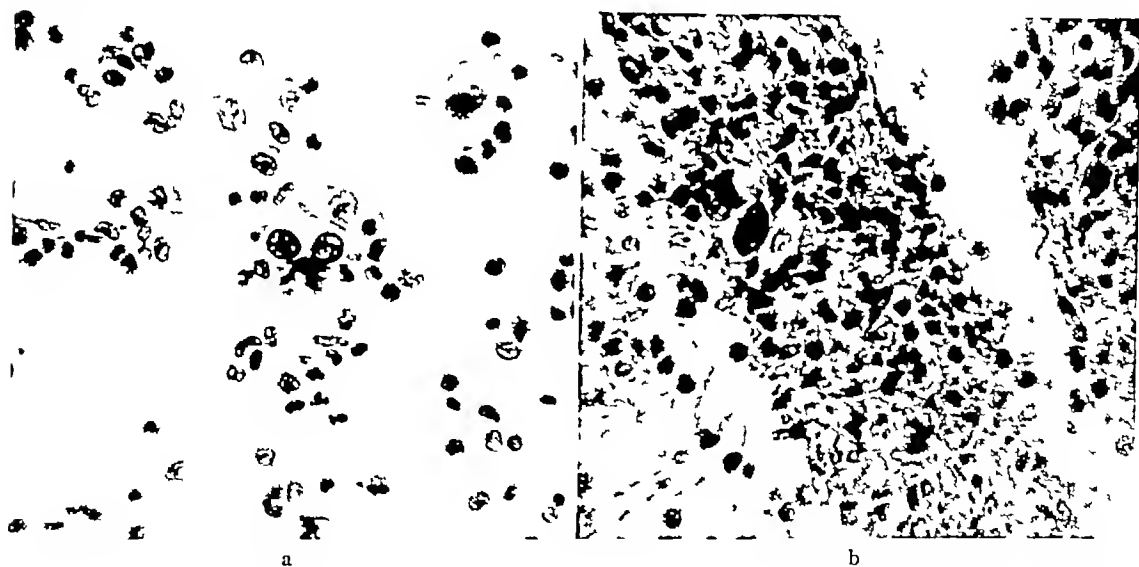


Fig 3 Metastatic adenocarcinoma of sigmoid in pleural fluid a, Smear b, Paraffin section Note the nuclear detail in a  $\times 190$

N B Photomicrographs of the paraffin sections were selected by the pathologist

dated the cellular criteria of malignancy, so that a positive diagnosis of cancer can be made on study of individual cells with an assurance that was not at all possible before

Hunter and Richardson in 1947 reported a modification of the Papanicolaou technique

which combined both the paraffin block and the Papanicolaou stain Specifically, in the case of transudates and exudates, they advised precipitating the protein from fluid with picric acid, filtration, embedding in paraffin, sectioning, and staining with the new stain The

major advantages that they noted were concentration of cells on the slide, location of all cells in the same focal plane, and the fact that groups of cells were not torn apart with loss of relationship. They recognized the advantage of the stain in securing nuclear detail as well as the fact that its use is free of any technical difficulty.

During our work in vaginal cytology we recently became interested in the study of ascitic and pleural fluids particularly for malignant cells and began to collect cases of effusions which were suspected of being malignant. It should be remarked here that all effusions collected were not routinely examined for cells, but only those in which a suspicion of cancer existed were sent for study. Modifications of technique used in preparing these fluids for examination were as follows: (1) collection of effusion and immediate centrifuging without half and half mixture with alcohol, (2) direct smear of any coagulum in the fluid, (3) refrigeration alone, if immediate examination is not feasible, (4) addition of acetic acid to bloody fluid. These changes were developed when it was noted, first, that the addition of alcohol to effusion when collected invariably produced a thick, flocculent precipitate which could be packed down by centrifuging with difficulty, and often not eminently satisfactorily. Considering the fact that malignant cells are lighter than normal cells, we did make smears from the top surface of the centrifuged material as well as from the lower areas. It was discovered, however, that results were much more satisfactory when no alcohol or other precipitating agent was added to the fluid at all. It has become routine here to collect the specimen and centrifuge immediately. The small sediment that is usually found at the bottom of the tube is smeared on slides. While still wet, the slides are immersed in ether-alcohol, fixed and stained in the usual manner outlined by Papanicolaou. If no sediment appears after centrifuging, most of the fluid is carefully poured off and the small amount in the bottom of the tube is smeared directly. If any coagulum is noted in the fluid before centrifuging, good results are obtained by making a direct smear of that, in addition to following through with the usual routine.

In all cases, comparisons were made between specimens of fluid centrifugated directly and those mixed with alcohol at time of collection. Invariably, the smears made from the alcoholic protein precipitate were less satisfactory than those centrifugated directly, in fact, most often no cells were seen on the former while definite malignant cells were found on the latter. A further advantage of the direct centrifugation is that the smears fix very readily to the slide making unnecessary the use of an albumin base before smearing, while, as is known, the sediment from specimens treated with alcohol will wash off slides too easily during the staining unless smeared on a slide prepared with a layer of albumin. In our cases where no sediment appeared after centrifuging, and this applies to sputum, gastric juice, or any other fluid, and when we found it necessary to smear the fluid directly, it was noted that letting the edges of the smear dry, as advised, before immersing in ether-alcohol, was advantageous in fixation. If a fluid specimen cannot be centrifuged immediately cells can be preserved adequately for a short time by keeping the specimen at refrigerator temperatures. We have examined fluid as much as 4 days after collection and found adequate cellular material, providing it was refrigerated. One other aid in the collection and examination of fluid for cytological study is to add acetic acid to grossly bloody or even blood tinged specimens to lysis the red cells. It is perhaps best to add only enough acid to dissolve partially the red blood cells, in that the presence of a moderate number of those cells as a background is advantageous in reading the slides.

Since this study was initiated fairly recently we have been unable, as yet, to gather a very large series of cases, therefore, in so far as clinical material is concerned, this must be in the nature of a preliminary report. However, even with the relatively small number of cases so far studied, results have been quite conclusive and compare favorably with previously reported percentages by the paraffin block method. Every specimen of fluid that has been examined by the Papanicolaou method has also had simultaneous paraffin blocking, sectioning, and staining with hema-



CHART I

Case	Diagnosis	Fluid	Papanicolaou smear	Paraffin block
J M	Adenocarcinoma of sigmoid (operation)	Pleural	Positive	First negative then positive
M W	Metastatic adenocarcinoma	Pleural	Positive	Positive
M C	Adenocarcinoma of ovary	Ascitic	Positive	First negative then positive
L N	Adenocarcinoma of ovary (operation)	Ascitic	Positive	Positive
M K	Metastatic adenocarcinoma	Ascitic	Positive	Positive
R B	Adenocarcinoma of stomach (operation)	Ascitic	Positive	Positive
L S	Adenocarcinoma of ovary	Ascitic	Positive	Positive
M H	Adenocarcinoma of colon (operation)	Ascitic	Positive	Positive
M U	Adenocarcinoma of ovary (operation)	Ascitic	Positive	Positive
J M	Retroperitoneal sarcoma (operation)	Pleural	Negative	Negative
P G	Undetermined	Pleural	First pos then neg	Negative
G R	Tuberculosis	Pleural	Negative	Negative
H J	Adenocarcinoma of stomach (operation)	Ascitic	Negative	Negative
J C	Tuberculosis (?)	Pleural	Negative	Negative
S G	Lymphosarcoma (biopsy)	Ascitic	Negative	Negative
M P	Cirrhosis of liver	Ascitic	Negative	Negative
C G	Cirrhosis of liver (biopsy)	Ascitic	Negative	Negative

toxylin and eosin by the pathologist in routine method used in this hospital, thus affording valid comparison of the results of the two different methods both technically and diagnostically. A total of 17 cases of suspected malignant effusions have been received thus far, of these, 5 were pleural and 11 abdominal. Nine positive diagnoses were made, all adenocarcinoma, while 8 negative slides were reported. Although independently arrived at, results have checked in both series, Papanicolaou and paraffin, exactly. However, it should be reported that 2 of the paraffin block sections originally reported negative later were changed to positive on further examination of the smear. On the other hand, one of the Papanicolaou smears reported first as positive later, on consultation, was changed to negative, the cells seen being finally diagnosed as abnormal histiocytes.

Considering the 9 positive cases first (Chart 1) 5 have been confirmed definitely by operation, at which time biopsy or surgical specimen returned the positive diagnosis. The other 4 cases, while not having been operated upon or subjected to postmortem examination, all had very positive clinical evidence of malignancy. A breakdown of the 8 negative cases reveals the following clinical or pathological diagnoses. There were 3 cases of pleural effusion on the basis of tuberculosis or of undetermined etiology. One lymphosarcoma diagnosed by lymph node and liver biopsy failed to show malignant cells in the ascitic fluid, though lymphocytes of relatively normal appearance were present. One case of retroperitoneal sarcoma diagnosed at exploratory laparotomy failed to show cancer cells in ascitic fluid examined from several subsequent paracenteses. One adenocarcinoma of the stomach was negative on fluid examination, and finally 2 cases of cirrhosis of the liver showed negative smears and paraffin sections. It is interesting to note that the mesothelial cells mentioned by earlier observers were seen in the Papanicolaou smears of one of the latter cases and were not as obvious in the paraffin section.

In comparing slides of the two series (see photographs) it has been found that either method adequately demonstrates malignant cells, with individual case variation. Some of the paraffin slides are superior in demonstration of tissue groups, though their counterpart smeared slides show a large number of unquestionably malignant cells. Often groups of cells in acinar or papillary formation do appear on the smeared slides by the technique outlined above, as well as on the paraffin sections. In one or two cases where the sediment was less abundant, more malignant cells were actually seen on the smears than in the paraffin section. In diagnosing carcinoma from paraffin block, our pathologist has limited himself to accepted criteria of groups of malignant cells in acinar or papillary formation. We have found in our own series that the careful application of the cellular criteria of malignancy is satisfactory for making the diagnosis on individual cells, though the presence of characteristic groups is to be desired. Those

criteria used have been hyperchromatism, with clumping of granules in irregular aggregations or dispersion to the periphery, definite enlargement of the nucleolus or the presence of multiple nucleoli, thickening of the nuclear membrane, relatively large nuclearcytoplasmic ratio, and alternation in the shape of nuclei with fragmentation producing multinucleated cells (6). A change in the amount and shape of the cytoplasm has also been considered. The statement of Papanicolaou that "anisocytosis associated with anisonucleosis constitutes an important diagnostic point because it rarely occurs in nonmalignant conditions" has been borne out. It has been a combination of many of the above criteria rather than the presence, however marked, of any individual standard that has guided the diagnosis of malignancy in the single cell. Particular stumbling blocks have been histiocytes and mesothelial cells, and these must be always considered in all smears. Although the great majority of fluids were examined with no more information than the name of the patient, ward, and origin of the fluid, it is felt that an adequate case history should accompany all specimens, not to influence the examiner unduly but to aid in interpretation of doubtful smears.

We feel that both methods of fluid examination have certain advantages as presented in the following:

#### Papanicolaou method

1. Better nuclear staining. Nuclear structure is much better defined enabling one to make a diagnosis more readily where acinar formation does not appear.

2. Less cellular shrinkage. Smears prepared by the Papanicolaou method show cells significantly larger than the cells in the paraffin slide. This is probably due both to the fact that cells in the paraffin section are somewhat shrunken by fixation and that sectioning tends to cut a majority of cells in a plane which does not go through one maximum diameter of the cell. It is often possible to pick up malignant cells with simple low power screening in the former, without the aid of acinar formation.

4. Possibility of greater percentage of positive diagnoses. Although this series is very small and has not as yet found a positive

case which was not eventually diagnosed by the paraffin method as well, it is believed that where minimal exfoliation into malignant effusion has occurred, a smear is more apt to demonstrate malignancy. Furthermore, there are 2 cases in this series where sediment was insufficient for paraffin blocking, and smearing and staining were done by the pathologist with hematoxylin and eosin. This smear was less satisfactory than the Papanicolaou slide.

#### Paraffin block

1. More frequent appearance of acinar or papillae. In positive cases the paraffin section is more likely to show typical malignant gland formation than the smear method.

2. Concentrated cellular material. On the paraffin section cells are concentrated in a small area, making examination of the slides somewhat more rapid.

3. Cells in same focal plane. On sectioning, all cells lie in one plane, while a poorly made smear may necessitate frequent change of focal plane in examination.

4. Technique well established. The paraffin method has been in use in most hospitals for many years and there are trained technicians, as well as pathologists, well versed in the method.

In general, both methods of examination of transudates and exudates have been found to compare very closely. Each has certain advantages and disadvantages, though the end result remains the same. Because of the widespread use of paraffin blocking, it is believed that this method will remain the standard one for fluid examination, especially in view of the present lack of many properly qualified cytologists. However, it is also felt that the more widespread use of the Papanicolaou smear technique may result in a higher percentage of positive diagnoses, and represents a definite advance. Perhaps the ideal condition would be the maintenance of both methods of examination on all effusions, both as a double check and to increase the incidence of diagnosis. If a situation exists in which the paraffin method is not available, then it is our belief that the alternative method is equally adequate for purposes of diagnosis at least.

### SUMMARY

1 A brief review of the history of the diagnosis of cancer in transudates and exudates has been presented

2 A small series of cases has been reported comparing Papanicolaou's method of examination of smears and the older established paraffin blocking and sectioning

3 In examining smears of fluid, the following modifications of method were used with more satisfactory results (a) collection of effusion and immediate centrifuging without half and half mixture with alcohol, (b) direct smear of any coagulum in the fluid, (c) refrigeration alone, if immediate examination is not feasible, (d) addition of acetic acid to bloody fluid

4 Of 17 cases reported, 9 gave positive diagnoses while 8 were negative, or 53 per cent uncorrected positive cases. Of the negative fluids reported, 3 cases had proved malignancy, while 2 cases were definite cirrhosis of the liver (liver biopsy). Three pleural effusions have not had etiology definitely estab-

lished. For a total of 12 proved cases of malignancy then, 9 had malignant effusion demonstrated by microscopic examination of fluid, or 75 per cent

5 The relative advantages and disadvantages of both methods have been listed with the conclusion that either method is valid, that a combination of both or wider use of the Papanicolaou technique may increase the percentage of positive diagnoses of malignancy in effusion

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OCTOBER, 1949

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### THE BONE BANK

A DEPARTMENT of spare parts seems destined eventually to be part and parcel of every modern hospital, just as such a department is today an integral part of every modern garage. In most instances, human tissues seem to be best preserved for future use by refrigeration, and bone is no exception. There is some evidence to support the belief that it may not be necessary to preserve the organic elements of bone in a viable state.

Syngene-sioplasmic, homogenous and heterogenous bone transplants in various forms have been employed successfully but sporadically for a number of years. Only recently Reynolds and Oliver, in an exhibit at the meeting of the American Academy of Orthopedic Surgeons, demonstrated the use of homogenous bone transplants preserved in a weak aqueous solution of merthiolate in a manner similar to that used for a number of years to preserve transplants of cartilage.

Walsh<sup>1</sup> pointed out that it was the opinion of Dr. A. E. Osterberg that bone treated with a 1:1,000 aqueous solution of merthiolate would maintain sterility but that the antiseptic agent also would affect adversely the protein matrix of the bone. Likewise, homogenous bone preserved in alcohol and other antiseptic solutions or fresh or dried bone sterilized by boiling or autoclaving has been used. Bone thus preserved or sterilized can serve only as a supply of inorganic calcium and phosphorus and as a trellis or framework for the process of "creeping substitution" as described by Phemister.<sup>2</sup> The protein matrix would be adversely affected by such treatment, with the possible result that a foreign body reaction would be induced in the host.

Walsh, in summarizing his thesis concerning the preservation of bone, made the following statements:

"In preserving tissues for transplantation at a later date, three principles must be observed:

"1 The cells of the tissues should be kept viable

"2 If viability is not possible or necessary, the tissue must be preserved from degenerative changes

"3 The tissue must be maintained in the same aseptic state as it was when placed in the preserving containers

"From a study of the literature it would appear that all these principles can best be fulfilled by preservation at a temperature below -20°C. Above this degenerative changes

<sup>1</sup> Walsh, A. C. I. The use of homogenous and heterogenous bone in bone grafting. II. A method of preserving homogenous bone for use in bone grafting. Thesis, Graduate School, University of Minnesota, 1947, 79 pp.

<sup>2</sup> Phemister, D. B. *Ann. Surg.*, 1935, 102: 261-285.

occur and sterility cannot be assured. Temperatures below  $-25^{\circ}\text{C}$  appear to be of no practical value."

All the experimental evidence thus far points to the fact that probably none of the bone cells of refrigerated bone transplants remain viable after being transplanted into the host. However, most observers feel that even in the case of fresh autogenous bone transplants, only a few, at most, of the peripheral cells remain viable. Certainly, the chief value of any bone transplant other than the support and fixation which it might offer seems to be in the framework and mineral salts which are supplied.

Osteogenesis proceeds to the same end, whether autogenous or frozen homogenous transplants are used, provided there is a "take" of the transplant. It is the opinion of Bush<sup>1</sup> and others who have done investigation along this line that this end is reached sooner in the case of autogenous transplants than in the case of homogenous transplants. In other words, if we may be permitted a practical simile, in going from Chicago to New York the former proceeds by a direct route and the latter by Washington, D C. For this reason, I doubt that the autogenous bone graft will ever be completely replaced by the homogenous transplant. We do not have evidence as yet in a large series of comparable cases that the percentage of "takes" of frozen homogenous transplants is as high as that of fresh autogenous bone, and I doubt that such will be the case. Therefore, at this stage frozen bone should not be used routinely, and certainly each case in which it is proposed to use it must be carefully evaluated. Possibly it will be demonstrated that frozen homogenous bone will have its greatest efficacy when it is mixed with fresh autogenous transplants.

The source of bone for the bone bank is almost limitless, provided the bone to be stored is removed under aseptic conditions. Upon removal of the graft from the donor, the bone is placed in a sterile container with a seal cap, and this container is placed in a second sterile container or wrapped in sterile surgical linen. It is then immediately placed in a deep-freeze unit which maintains a constant temperature of  $-20^{\circ}\text{C}$  to  $-25^{\circ}\text{C}$ . The bone is then left in the freezer until a few minutes before the time when it is to be used.

Walsh, in experimental work, has shown that under such conditions bone apparently will remain sterile and viable for an indefinite period, although we hesitate at the present to use bone if it is more than three months old. At present, most of the bone bank supply which is used by my associates and me is obtained by freezing segments of ribs removed during the course of combined thoracolumbar sympathectomy, and other thoracic operations. Formerly, these segments of ribs were discarded. Traumatic amputations and fresh cadavers conceivably could furnish unlimited supplies of suitable bone for the bank, provided permission could be obtained from the patient or the relatives for its use.

It has been shown by Ghormley<sup>2</sup> and others that the blood group of the donor does not have to be compatible with that of the recipient as far as the use of homogenous bone transplants is concerned. The history of the donor must be free of any record of syphilis, and serologic tests must rule out this disease, for it has been shown that the *Treponema pallidum* may survive at a very low temperature. Likewise, the donor should not have had jaundice. Nor do we feel it advisable to use bone from any

<sup>1</sup> Bush, L. F. J. Bone Surg. 1947, 29: 620-628

<sup>2</sup> Ghormley, R. K. Ann. Surg., 1942, 115: 427-434

donor in whom there may be question as to the presence of an infectious or a malignant neoplastic illness. The aforementioned factors together with the age, sex, nationality, occupation, past and present illnesses of the donor and recipient, should be set down and filed for future reference.

By the use of homogenous bone grafts the patient is spared the shock, increased morbidity, and cost of a second operative procedure. We have found the bank of especial use in the surgical treatment of children, where the supply of autogenous bone is scant and for filling in large cystic lesions and giant cell tumors and for the reinforcement of autogenous grafts. It is possible that a combination of autogenous and homogenous transplants will prove more efficient than the use of the latter alone, although experimental work along this line has not yet been performed.

At this stage of our knowledge it is felt by most surgeons using bone transplants that the autogenous graft is the one of choice in most instances, provided the operative risk and postoperative morbidity will not be seriously affected by the removal of such a graft at the time of definitive surgical treatment, and provided a sufficient supply of autogenous bone can be obtained. In those instances already mentioned in which the factors in question do not apply, the surgeon would be justified in using frozen homogenous transplants or a combination of autogenous and homogenous transplants. Not until large, comparable series of the use of the two types of transplants have been critically compared will the average surgeon be justified in the routine use of homogenous grafts, whether they are preserved by refrigeration, by aqueous solution of merthiolate, or by other antiseptic means.

PAUL R. LIPSCOMB

## CONGENITAL DEFORMITIES OF THE FEET

CONGENITAL deformities of the feet are produced by the same factors which produce deformities in other parts of the body. Mall divided them into primary and secondary deformities. Primary deformities result from some inherent defect of the fertilized ovum. Murphy said that primary congenital malformations arise solely from influences which affect the germ cells prior to fertilization.

In secondary congenital deformities, it is assumed that the fetus is at first normally formed, but that later deformity is produced by the action of some extraneous cause. Piette suggested that deformities and monsters may be due to fertilization of a dying ovum or a dying spermatozoon. Hobbs showed that injury to gonads of animals by roentgen rays will cause inheritable deformities. Workany and Schraffenberger produced congenital malformations in the offspring of female rats by exposing them to roentgen rays. Beveridge H. Moore found that children of parents with neurofibromatosis were more apt to develop deformities. Gregg in 1941 and later Swan and others have reported ops rubella during the first three months of pregnancy the child is apt to have congenital cataract, heart disease, deafmutism, microcephaly and glomerular sclerosis.

Warkany and Nelson and others report deformities in rats when the mother is placed on a deficient diet. These can all be prevented by adding two per cent pig liver to the diet. They found that of all vitamin B derivatives, riboflavin was the only one which would prevent deformities. This was effective if given only between the 12th and 14th days when the limb buds of the rat were developing.

Bohm showed in 1929 by serial sections of early human embryos that as the limb bud develops, the foot is in a clubfoot position and that congenital clubfoot is due to an arrest of development. As further development occurs in most cases, the foot turns into the normal position. We assume that there is some unknown stimulus which causes the foot to progress to a normal foot. If the lack of riboflavin in rats allows deformities to occur, might not the lack of riboflavin or some unknown stimulus in human beings allow the foot to remain in the clubfoot position?

Nine congenital deformities may occur in the feet. Some of these are so evident they offer no problem in diagnosis. *Congenital absence of parts* may vary from the absence of a part of a toe to the absence of the entire foot. *Congenital hypertrophy* may involve one or more toes or the entire extremity. In *polydactylism*, the physician may perform an inadequate operation by simply removing the extra toe, thus leaving the enlarged part of the metatarsal or the extra metatarsal. A roentgenogram should be made and a complete operation done. Syndactylism in most cases is no handicap. When the ends of the toes are held together by a small adhesion this should be divided.

The deformities following *spina bifida* and *arthrogryposis multiplex congenita* often differ considerably from those of typical clubfeet or flat feet, but the treatment is essentially the same. The club foot following *spina bifida* is usually more easily corrected than the average congenital clubfoot. The deformities associated with arthrogryposis are much more difficult to correct and are more prone to recur. *Congenital calcaneovalgus* may be only a mild flat foot or may be a reverse clubfoot and very rigid and difficult to correct.

The most common congenital deformity of the foot is *congenital clubfoot*, or talipes

equinovarus. One out of every eleven children brought to the Scottish Rite Hospital has clubfeet, 1 of 5 has some congenital deformity.

The earlier congenital deformities are corrected, the easier they are to correct and the better the chance for the correction to be retained. This is especially true for clubfeet. The correction should be accomplished by a method which will do no harm to the foot. Years ago attempts were made to correct the deformity in one operation by crushing the foot in a special machine or by wrenches. This procedure improved the appearance of the foot, but left it stiff and rigid. When the deformity recurred, further corrections were still more difficult.

Later it was found that clubfoot deformity could be corrected gradually by a series of casts and wedgings. This took much more time but gave a flexible foot and one very closely resembling a normal foot in appearance and in function. The plaster method, however, is a laborious method, and requires a very exacting plaster technique, the foot must be untwisted in a very definite manner. The beginner has difficulty in applying casts to struggling babies, and difficulty in keeping the casts on. Sores often occur under the casts and still more frequently he fails to correct the deformity. If he carries his correction too far, a flatfoot may result, and if not carried far enough, the clubfoot will recur. Clubfeet tend to relapse to the position at birth.

Because of the difficulties accompanying the plaster treatment, many modifications of metal splints have been made. The position of the foot cannot be as accurately controlled by splints. The feet are often turned over too far into a flatfoot position. For this reason there may be fewer recurrences after treatment with splints. The test of any method is not how few recurrences a method gives, but how near to normal the foot is after treatment.

The second most frequent congenital deformity of the foot is *congenital metatarsus varus*, which is a third of a clubfoot. Twenty-five years ago this was not recognized as a separate and distinct entity but was thought to be a mild form of clubfoot. A clubfoot presents three deformities: forefoot adduction, inversion of the foot and equinus deformity. Metatarsus varus or metatarsus adductus presents chiefly forefoot adduction. There is an inversion of the forefoot. The heel is sometimes in valgus, sometimes in varus, but not always in varus as in a clubfoot. These feet never show any equinus deformity, but can always be brought in full dorsiflexion. This one sign separates them from clubfeet.

In times past when the newborn was examined, and it was found that the feet were not clubbed, it was assumed that they were normal. This is no longer true. In metatarsus varus the deformity may be so mild at first, it is overlooked on a casual examination. The muscles are out of balance just as they are in a foot following poliomyelitis. No deformity is present immediately after the attack of poliomyelitis and we do not look for a deformity to make the diagnosis. In metatarsus varus the slight deformity present at birth is made worse by muscle imbalance. The anterior tibial constantly pulls the foot in and up in a clubfoot position. As time goes on this deformity becomes more noticeable. There is a structural change in the foot that is easily discernible. A prominence is seen and felt on the lateral border of the foot near the base of the fourth and fifth metatarsals and the cuboid. The arch is higher than normal. When the posterior part of the foot is held in the hand, the forefoot cannot be abducted to the midline. A much wider variation in the severity of the deformity is present in metatarsal varus feet than in congenital clubfeet.

The treatment of metatarsus varus feet con-

sists of stretching the forefeet in abduction in the very mild cases and the wearing of "swungout" shoes. Most of the patients will need a series of casts and wedgings just as is used for clubfeet. The feet should not be strapped in abduction with adhesive as this will increase the valgus deformity of the heel. Metal splints should not be used for the same reason. In using casts, care should be taken not to overcorrect these feet into a flatfoot position. It is less embarrassing to the surgeon to correct a recurrence produced by nature than it is to correct a flatfoot he has produced.

Congenital metatarsus varus is very definitely on the increase. From 1925 to 1940, the writer saw less than a dozen such cases. During the last eight years the number has increased to nearly three hundred. Most of these have been seen in the last three years.

There must be some reason for this recent increase in metatarsus varus cases. As stated above, riboflavin can prevent deformities in rats. We do not know that human beings and rats behave alike in this respect, neither do we know that the diet of the mother is deficient in vitamin B. This we do know for the last few years: obstetricians have been giving mothers multiple vitamins as soon as they come under observation. To prevent foot deformity these should be given during the fifth and sixth weeks when the limb buds are forming. Most mothers do not begin taking vitamins until the second or third month. Vitamins then do not prevent the deformity but furnish the stimulant for the foot which was predestined to be a clubfoot to develop into a more nearly normal foot, so at birth the child has only a "third of a clubfoot." May not the taking of multiple vitamins account for the increase in the number of metatarsus varus deformities, and the time at which they are begun account for the wide variation in the degree of this deformity?

J H KITE



# THE SURGEON'S LIBRARY

## REVIEWS OF NEW BOOKS

THE biography of Oliver Wendell Holmes by Eleanor Tilton<sup>1</sup> is a well written and factual narrative which describes the life and environment of Holmes in an entertaining manner. The book is definitely not a medical biography and the medical life and contributions of Holmes receive less emphasis than his poems, epigrams, speeches, and novels. He is depicted as one of the most versatile men of American medicine, being a physician, poet, author, and philosopher of note. The description of his education in the basic sciences and medicine more than 100 years ago should be of especial interest to physicians today. His critical opinions of many of the medical giants of France under whom he studied, such as Louis, Marjolin, Roux, Velpeau, Ricord, and Lisfranc are noteworthy. Other medical topics of interest include the introduction of anesthesia and his investigation of the contagion of puerperal sepsis. Throughout his life, his diminutive size and frailness were more than compensated for by his many intellectual gifts and developments. His reactionary nature to his early home life and education are reflected later in his severe study of medical science, his development of a skeptical attitude toward established modes of treatment, his admiration for sincerity and truth, and his realization of the accumulative value of personal experiences in clinical medicine.

W A ALTEMEIER

THE book, *The Parathyroid Glands and Metabolic Bone Disease, Selected Studies*,<sup>2</sup> by Fuller Albright and Edward C Reifenstein, Jr, is an important and invaluable contribution to a complex subject.

Dr Fuller Albright is justly regarded as the outstanding authority in this country on clinical metabolic investigations in general and the study of the interrelationships linking calcium metabolism, the parathyroid glands, and bone in particular. This status is a natural outgrowth of the remarkable and unique series of shrewd clinical observations, careful and painstaking metabolic balance studies, and brilliant and open minded theorizing which Dr Albright, Dr Reifenstein, and other colleagues have contributed during the past 2 decades. The present extraordinary volume comprises an integrated and

detailed summary of some of these contributions, in some cases altered and brought up to date. No attempt is made to present any systematic or comprehensive monograph on the subjects discussed.

The subjects covered include chapters on the normal and pathologic physiology of the parathyroid glands, clinical hyperparathyroidism and hypoparathyroidism, vitamin D and dihydrotachysterol, osteoporosis, osteomalacia, polyostotic fibrous dysplasia, and Paget's disease. Included among the subjects covered in some detail under these headings are senile and postmenopausal osteoporosis, the osseous lesions of Cushing's syndrome and Grave's disease, Milkman's syndrome, and the various renal osteodystrophies (renal rickets, Fanconi's syndrome, and "tubular insufficiency without glomerular insufficiency").

A remarkable quantity of original observation has been compressed into this book. However, the authors are not at all content merely to present data; they try, wherever possible, to develop a hypothesis on which to hang the observations. In Albright's hands, a hypothesis becomes a research tool in itself, to be welded with skill so long as it remains useful. It is quite evident from the comment that the authors, perhaps better than the reader, appreciate the shortcomings and limitations of the theories presented. In a characteristically candid "prophylactic criticism" which they include in the preface, the authors state "The hypotheses—it almost follows—are subject to change without notice."

If for no other reason than that it is a convenient source book for the large quantity of experimental data which are reported in detail, the book would be invaluable to serious students of the field. However, the authors' extensive clinical experience with the conditions mentioned will make it, in addition, an authoritative and indispensable text for internists interested in metabolic and endocrine disturbances, as well as for urologists, orthopedists, and general surgeons.

The volume is superbly written in a clear and informal style, and the subject matter is arranged in a sensible and well organized manner. The numerous illustrations are of good quality. A complete bibliography and excellent subject index are included. In addition, the text is carefully annotated with numerous cross references which should expedite its use as a reference work. An appendix provides details of methods of analysis and study, including methods for calculating and plotting metabolic balances. The book is well printed and bound, and contains com-

<sup>1</sup>AMABLE AUTOCRAT. A BIOGRAPHY OF DR. OLIVER WENDELL HOLMES. By Eleanor M Tilton. New York: Henry Schuman 1947.

<sup>2</sup>THE PARATHYROID GLANDS AND METABOLIC BONE DISEASE, SELECTED STUDIES. By Fuller Albright, A.B. M.D. and Edward C. Reifenstein, Jr. A.B. M.D. F.A.C.P. Baltimore: The Williams & Wilkins Co. 1948.

paratively few typographic errors. It is hard for this reviewer to see how either authors or publishers could have done a better job. F. R. KEATING, JR.

THE small volume entitled *Clinical Endocrinology for Practitioners and Students*,<sup>1</sup> is a well organized primer which deals with the anatomy, physiology, and clinical characteristics of the endocrine glands. Its simplicity and correctness are particularly com-

mendable in view of the myriad sources among clinicians, biochemists, physiologists, and all round enthusiasts from which material for such a text would be derived. Its qualifications for the practitioner and the medical student are excellent since each chapter contains not only the fundamental concepts pertaining to each gland but specific directions concerning the treatment of dysfunctions. It is only to be regretted that the bibliography, necessarily brief, includes references to secondary investigators and journals and fails to stress many key papers of permanent historical interest. The impression thus conveyed is that the book was compiled more from reviews than from the original sources.

EDITH B. FARNSWORTH

<sup>1</sup>CLINICAL ENDOCRINOLOGY FOR PRACTITIONERS AND STUDENTS. By Lawrence Martin, M.D. (Camb.), F.R.C.P. (Lond.) and Martin Hynes, M.D. (Camb.) M.R.C.P. (Lond.) Foreword by Sir Lionel Whitby, M.D. F.R.C.P., D.P.H. Philadelphia and Toronto: The Blakiston Co., 1949.

## BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

DIE ELEKTROCHIRURGISCHE BEHANDLUNG DER TUBERKULOSE. By Heinrich Bruegger. Stuttgart: Georg Thieme Verlag, 1949.

EXPERIMENTELLE UNTERSUCHUNGEN UEBER ROENTGENEFFEKTE UND CHEMISCHE EFFEKTE AUF DIE PFLANZLICHE MITOSE. By Dr. Med. Kurt Hohl. Stuttgart: Georg Thieme Verlag, 1949.

GEMEINSAME ERKRANKUNGEN AUS DER INNEREN MEDIZIN UND CHIRURGIE. By Walther Kanert and Kurt August Koelsch. Stuttgart: Georg Thieme Verlag, 1949.

DAS LANGE BECKEN, GEBURTSHILFLICHE STUDIE UEBER DAS ASSIMILATIONSBECKEN. By Prof. Dr. Heinz Kirchhoff. Stuttgart: Georg Thieme Verlag, 1949.

DIE PATHOLOGIE DES HARNLEITERS IM ROENTGENBILD. By Dr. Anton Thelen. Stuttgart: Georg Thieme Verlag, 1949.

DAS ADENOCARCINOM DES COLLUM UTERI. HISTOLOGISCHE, KLINISCHE UND THERAPEUTISCHE ERGEBNISSE. By Drs. Hans Limburg and Klaus Thomsen. Stuttgart: Georg Thieme Verlag, 1949.

TREATMENT IN PROCTOLOGY. By Robert Turell, B.S., M.D. Baltimore: The Williams & Wilkins Co., 1949.

DIE ERKRANKUNGEN DER ENDOKRINEN DRUESSEN. By Prof. Dr. Adolf Oswald. Bern: Hans Huber, 1949.

A DUBLIN SCHOOL OF MEDICINE AND SURGERY, AN ACCOUNT OF THE SCHOOLS OF SURGERY, ROYAL COLLEGE OF SURGEONS, DUBLIN 1789-1948. By J. D. H. Widdess, M.A. (Dublin), L.R.C.P. & S.I. Foreword by William Doolin, F.R.C.S.I. Baltimore: The Williams & Wilkins Co., 1949.

SYNOPSIS OF HERNIA. By Alfred H. Iason, M.D. New York: Grune & Stratton, 1949.

A TEXTBOOK OF NEUROPATHOLOGY, WITH CLINICAL, ANATOMICAL AND TECHNICAL SUPPLEMENTS. By Ben W. Lichtenstein, B.S., M.S., M.D. Philadelphia, London: W. B. Saunders Co., 1949.

BLAKISTON'S NEW GOULD MEDICAL DICTIONARY. Edited by Harold Wellington Jones, M.D., Normand L.

Hoerr, M.D., and Arthur Osol, Ph.D. 1st ed. Philadelphia and Toronto: The Blakiston Co., 1949.

DE BOUW EN ONTWIKKELING VAN HET MEDIASTINALE BINDWEEFSEL. By William Abraham Bax. Leiden: Eduard Ijdo N.V., 1949.

BLOOD TRANSFUSION. By H. F. Brewer, Richard Ellis, R. I. N. Greaves, Geoffrey Keynes, F. W. Mills, R. Bodley Scott, Anthony Till, and Lionel Whitby. Edited by Geoffrey Keynes. Baltimore: The Williams & Wilkins Co., 1949.

DIE KREUZSCHMERZEN DER FRAU. By Prof. Dr. Heinrich Martius. Stuttgart: Georg Thieme Verlag, 1947.

SUPPLEMENT TO CHILD HEALTH SERVICES AND PEDIATRIC EDUCATION, REPORT OF THE AMERICAN ACADEMY OF PEDIATRICS. New York: The Commonwealth Fund, 1949.

AUTOBIOGRAPHY OF DR. ROBERT MEYER (1864-1947), A SHORT ABSTRACT OF A LONG LIFE. With a Memoir of Dr. Meyer by Emil Novak, M.D. New York: Henry Schuman, 1949.

ESSENTIALS OF GYNECOLOGY. By Leo Brady, M.D., F.A.C.S., Ethna Louise Kurtz, R.N., and Eileen McLaughlin, B.S., R.N. 2d ed. New York: The Macmillan Co., 1949.

SURGICAL MANAGEMENT OF VASCULAR DISEASES. By Gerald H. Pratt, M.D., F.A.C.S. Philadelphia: Lea & Febiger, 1949.

THE AMERICAN ILLUSTRATED MEDICAL DICTIONARY, A COMPLETE DICTIONARY OF THE TERMS USED IN MEDICINE, SURGERY, DENTISTRY, PHARMACY, CHEMISTRY, NURSING, VETERINARY SCIENCE, BIOLOGY, MEDICAL BIOGRAPHY, ETC., WITH PRONUNCIATION, DERIVATION, AND DEFINITION. By W. A. Newman Dorland, A.M., M.D., F.A.C.S. With the collaboration of E. C. L. Miller, M.D. 21st ed. Philadelphia and London: W. B. Saunders Co., 1948.

PHENOL AND ITS DERIVATIVES. THE RELATION BETWEEN THEIR CHEMICAL CONSTITUTION AND THEIR EFFECT ON THE ORGANISM. By W. F. von Oettingen. Washington: U.S. Government Printing Office, 1949.

GROUP MEDICINE AND HEALTH INSURANCE IN ACTION. By Robert E. Rothenberg, A.B., M.D., Karl Pickard, A.B., M.D., and Joel E. Rothenberg, A.B., J.D. Introduction by George Baehr, M.D. New York: Crown Publishers, 1949.

# CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

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DALLAS B. PHLMISTER, Chicago, *President*  
FREDERICK A. COLLIER, Ann Arbor, *President Elect*

## PRELIMINARY PROGRAM FOR THE 35th CLINICAL CONGRESS—THE STEVENS, CHICAGO

OCTOBER 17 TO 21, 1949

CHICAGO, which during the week of October 17 to 21, 1949, will entertain the Clinical Congress of the American College of Surgeons for the ninth time has played a significant part in the development of the organization and has many attractions to offer the visiting surgeons and hospital representatives. It was host city to the first Clinical Congress of Surgeons of North America in 1910, three years later, it was the setting for the First Convocation of the American College of Surgeons, which met in conjunction with the Clinical Congress in that year of its founding, 1913, and annually thereafter until 1917 when the Clinical Congress was merged with the College. Centrally located, and with excellent medical center prospects, it was selected as the headquarters of the College, and in 1919 surgeons of the city and their friends presented it with the magnificent building which it occupies at 40 East Erie Street, to which was added in 1926 the John B. Murphy Memorial Auditorium which is now connected to it on the East.

The medical center prospects of Chicago as they appeared early in the century have been realized beyond the expectations of the most visionary of the prophets, and the atmosphere is one of much greater things to come. The city even now actually has three great medical centers—on the south side, centering around the University of Chicago, on the west side, centering around the University of Illinois professional schools and hospitals, Cook County Hospital, Presbyterian Hospital, Chicago Medical College, and other institutions, and on the near north side, centering around Northwestern University, Wesley Memorial Hospital, and Passavant Memorial Hospital, with Mercy Hospital about to build

nearby, which will bring in the Loyola University influence. No other city in the world has five accredited medical schools.

Chicago has 68 hospitals which are approved by the American College of Surgeons, 23 of which are also approved for graduate training in surgery and the surgical specialties.

Chicago is the headquarters city for many medical and related organizations besides the College, such as the American Medical Association, the American Hospital Association, the American College of Hospital Administrators, and the American Dental Association.

The medical and hospital resources of the city will be heavily drawn upon to make the thirty-fifth Clinical Congress, and the Sixth Inter-American Congress of Surgery which will meet with it and continue for two days longer, educational events of the highest character. In addition, the speakers and discussion leaders will include outstanding authorities from overseas and from Latin-America, as well as from the United States and Canada.

Advance registration figures indicate that the thirty-fifth Clinical Congress may be the largest of all the Congresses to date.

### SIXTH INTER-AMERICAN CONGRESS OF SURGERY

The Sixth Inter-American Congress of Surgery will meet as a part of the Clinical Congress on Monday through Friday, will have its Inaugural Session on Friday morning and will continue with scientific, business and social sessions on Saturday and Sunday, October 22 and 23. An outline of the program appears in a succeeding article.

Many delegates and other surgeons from Latin American countries are registering, along with

## AMERICAN COLLEGE OF SURGEONS

their colleagues from the United States and Canada, in anticipation of a seven-day surgical program of extremely great interest.

Every Fellow of the American College of Surgeons is a member of the Association of Inter-American Congresses of Surgery by virtue of the fact that the College is a signatory member of that organization. Its scientific and social sessions on Saturday and Sunday are therefore open to all Fellows. The members of the other signatory societies of the Association are likewise entitled to attend the Clinical Congress clinics and scientific meetings, since it is the practice for the host country to make a joint event of its own annual surgical Congress and that of the Inter-American group.

### COLOR TELEVISION

Telecasts in color of operations taking place at St. Luke's Hospital will be shown in the Normandy Lounge of The Stevens every afternoon, Monday through Thursday, and every morning except Monday. Dr. Foster L. McMillan of the hospital staff is television chairman. Dr. Kendall A. Elsom of Philadelphia, Assistant Professor of Clinical Medicine, Medical School of the University of Pennsylvania, who directed the television program at the American Medical Association convention in Atlantic City in June, will be the co-ordinator.

This demonstration is made possible by Smith, Kline & French Laboratories of Philadelphia. It was at their request that Columbia Broadcasting System, Inc., undertook to specially design and manufacture color television equipment, the first of its kind to date, is owned by the Laboratories and is being demonstrated by them throughout the country as a contribution to medical teaching. The showing at the Clinical Congress will be only the third demonstration of color television in surgery, the first having been at Atlantic City in June and the second at the meeting of the Colorado State Medical Society in September.

The American College of Surgeons was the first organization to use television in the scientific program of a large meeting. In September, 1947, during the thirty-third Clinical Congress, a series of operations was televised from The New York Hospital to a conference room at the Waldorf-Astoria. Television was employed for the second time at a Clinical Congress in October, 1948, when operations were televised from the Los Angeles County Hospital to the Philharmonic Auditorium and to a room at the Los Angeles Biltmore Hotel. Both of these demonstrations were in black and white. The New York showing

was made possible by a grant from the Johnson & Johnson Research Foundation and the Los Angeles showing was sponsored by the *Los Angeles Times*. The tentative color television program appears in a succeeding section.

### ADDITIONAL TELEVISION

Under a grant from Ciba Pharmaceutical Products, Inc., Lewis Memorial Maternity Hospital is scheduling a program of obstetrical procedures under saddle block anesthesia, and other obstetrical and gynecological operations, which will be televised, in black and white, within the hospital. The Radio Corporation of America is handling the installation. About twelve screens will be used, some of which will be large, and an estimated total audience of 500 can be accommodated. The clinics are scheduled from 9:00 to 11:30 each morning and from 1:00 to 3:30 each afternoon. The preliminary program appears under the hospital name with the other hospital clinics on succeeding pages.

### CLINICS

Operative and non-operative clinics will be held on Tuesday through Friday mornings, and on Monday through Friday afternoons, in 23 hospitals, all of which are approved by the American College of Surgeons for graduate training in surgery. Twenty-two of these are within city limits, and one, Evanston Memorial Hospital, in Evanston. A preliminary outline of the clinical program appears in a succeeding section. The program will be finally revised and amplified immediately preceding and during the Congress, and published in a *Clinical Bulletin* which will be distributed each day at the headquarters hotel, The Stevens. Tickets for the clinics will be placed on open distribution at the Clinic Ticket Desk in the Exposition Hall without advance requisition. Tickets for Monday clinics may be obtained on Sunday afternoon, October 16, from 3:00 to 6:00 p.m. Tickets for Tuesday through Friday clinics will be available beginning at 8:00 a.m. on the day before the clinic is scheduled.

### PRESIDENTIAL MEETING

The Presidential Meeting will be held on Monday evening, October 17. The complete program appears on another page. At this meeting the officers-elect, consisting of Dr. Frederick A. Coller, of Ann Arbor, president, Dr. Donald G. Tollefson, of Los Angeles, first vice-president, and Dr. Robert M. Moore, of Galveston, second vice-president, will be installed. The outgoing president, Dr. Dallas B. Phemister, of Chicago, will

preside and will deliver the Presidential Address. His subject will be, "An Evaluation of Full-time and Group Practice for the Clinical Faculty of a Medical School."

Sir James Learmonth, of Edinburgh, will deliver the fourth Martin Memorial Lecture. His subject will be "Collateral Circulation, Natural and Artificial."

#### CONVOCATION

The formal initiation ceremonies for the new Fellows will be a colorful feature of the annual Convocation which will be held on the final evening, Friday, October 21. Honorary Fellowships will also be conferred on this occasion. Lord Webb-Johnson, of London, president of the Royal College of Surgeons of England, will deliver the Fellowship Address. His subject will be "Science in Surgery—Stop, and Look, and Listen."

It is interesting to note that the dedicatory address at the first Convocation of the American College of Surgeons, held in the Gold Room of the Congress Hotel in Chicago on the evening of November 13, 1913, was presented by Sir Rickman Godlee, then President of the Royal College of Surgeons of England, which sent greetings through him in the form of an illuminated parchment.

#### GENERAL SURGERY

In general surgery, the program at the headquarters hotel will embrace three evening symposia and six afternoon panel discussions.

The subjects for the symposia on Tuesday, Wednesday, and Thursday evenings, respectively, will be "Acute Surgical Emergencies in Gynecology and Obstetrics", "Blood Coagulation and the Use of Anticoagulants", and "Malignant Disease." At the Wednesday evening session there will also be presented the Fracture Oration by Dr Otto J. Hermann, of Boston, on the subject "Fracture Hazards."

The following subjects have been chosen for the afternoon panel discussions in general surgery, the first one of which will be held from 1:30 to 3:00 and the second from 3:30 to 5:00 o'clock on Monday, Tuesday, and Wednesday: "Surgical Lesions of the Breast", "Fractures of the Skull", "Massive Upper Abdominal Hemorrhage", "New Surgical Technics in Drug Treated Infections", "The Management of Acute Emergencies Occurring during Operations", and "Preoperative and Postoperative Care and Anesthesia for Infants."

Detailed programs are published on succeeding pages.

#### SURGICAL SPECIALTIES

Panel discussions on the surgical specialties will be held on Friday afternoon from 1:30 to 4:45

o'clock. The panels will be held concurrently in the following fields: orthopedic surgery, plastic surgery, urology, thoracic surgery, neurological surgery, and obstetrics and gynecology. Programs are shown on succeeding pages.

#### OPHTHALMOLOGY AND OTOLARYNGOLOGY

Separate programs are planned for Ophthalmologists and Otolaryngologists on Tuesday, Wednesday and Thursday of the Congress week. Since the annual meetings of the Academy of Ophthalmology and the Academy of Otolaryngology will be held in Chicago during the week immediately preceding the Clinical Congress, the Congress programs for these two specialties are being modified to suit this unusual sequence.

During the forenoon and afternoon the programs for these two specialties will consist of operative clinics and demonstration clinics which will be held in several Chicago hospitals and in medical motion picture programs for these two specialties at the Clinical Congress headquarters in the Stevens Hotel.

Evening sessions at the Congress headquarters in the Stevens Hotel, according to preliminary plans, will be as follows:

#### Tuesday 8:00 p.m.

Recent Developments in the Field of Allergy as Related to Otolaryngology. GOSTA DOHLMAN, M.D., Professor of Otolaryngology, Lund University, Lund, Sweden.

#### Thursday 8:00 p.m.

The Dependence of Surgery on Physiology as Exemplified in the Treatment of Glaucoma. SIR STEWART DUKE ELDER, K.C.V.O., F.R.C.S. (Eng.), Director of Research, the Institute of Ophthalmology, University of London, London, England.

#### SYMPOSIA ON AMPUTEES AND ON TRAUMA

A symposium on "The Care and Education of Amputees" will be held on Tuesday morning from 10:00 a.m. until noon.

On Tuesday afternoon from 2:00 until 5:00 o'clock, a symposium on trauma will be held at which Dr. Robert H. Kennedy of New York, chairman of the Committee on Trauma, will preside.

The programs for these two symposia appear on succeeding pages.

#### SYMPOSIUM ON CANCER

A symposium on cancer will be held on Wednesday afternoon from 2:00 until 5:00 o'clock, with Dr. Grantley W. Taylor, of Boston, chairman of the Cancer Committee, presiding. The program appears on a succeeding page.

# FORUM ON FUNDAMENTAL SURGICAL PROBLEMS

The Forum on Fundamental Surgical Problems, one of the most popular features of Clinical Congresses during the past few years, will be held on Monday through Thursday afternoons, and Tuesday through Friday mornings. Two concurrent sessions will be held on Wednesday morning only. Brief reports of original clinical and experimental observations relating to the broad aspects of surgery and the surgical specialties will be presented under the general direction of Dr. Owen H. Wangensteen, chairman of the committee. Forum on Fundamental Surgical Problems. An outline of the main topics follows:

Monday, 2:00—5:00 p.m.—Gall Bladder and Pancreas, Urology, Orthopedics, Plastic Surgery  
 Tuesday, 9:00—12:00 a.m.—Surgery of the Heart  
 Tuesday, 2:00—5:00 p.m.—Vascular Surgery and Surgery of Hypertension  
 Wednesday, 9:00—12:00 a.m.—Neurosurgery  
 Wednesday, 9:00—12:00 a.m.—Thyroid, Lungs, Esophagus, Anesthesia  
 Wednesday, 2:00—5:00 p.m.—Stomach and Intestines  
 Thursday, 9:00—12:00 a.m.—Wounds and Wound Healing, Burns, Infections, Shock  
 Friday, 9:00—12:00 a.m.—Blood and Body Fluids, Portacaval Anastomosis, Cancer

The Thursday afternoon session, from 1:00 to 3:30, will be conducted as a seminar, with Dr. I. S. Ravdin as moderator, on the subject "Nutritional Problems including a Consideration of the Use of Fluids and Electrolytes." Programs appear on succeeding pages.

## SYMPOSIUM ON GRADUATE TRAINING IN SURGERY AND THE SURGICAL SPECIALTIES

The Symposium on Graduate Training in Surgery will be held Thursday 10:00 a.m. to 12:30 p.m. with Dr. Frederick A. Collier, Chairman of the Graduate Training Committee presiding. The program will be devoted to subjects of timely interest to all who are engaged in graduate training in surgery.

## HOSPITAL CONFERENCES

The twenty-eighth Hospital Standardization Conference will be held during the Clinical Congress. Its opening meeting will constitute the first formal session of the Clinical Congress and will be for both surgeons and hospital representatives. Dr. Dallas B. Phemister, president of the College, will preside.

Hospital administrators, trustees, members of medical staffs, nurses, technicians, dietitians, and heads of the various hospital departments and their personnel, are invited to participate in the discussions at the hospital conferences which will be directed by leading authorities in the hospital field in the United States and Canada. The program will include formal sessions, panel discussions, round table conferences, symposia, and forums. An outline of the program appears on succeeding pages.

## ASSEMBLY OF INITIATES

The 1949 initiates will attend an assembly on Friday afternoon from 1:30 to 2:15 o'clock. Dr. Frederick A. Collier, newly installed president of the College, will preside. Dr. Arthur W. Allen, vice chairman of the Board of Regents, and Dr. Bowman C. Crowell, Dr. Malcolm T. MacEachern, and Dr. H. Prather Saunders, associate directors, will briefly outline the program of the College.

## OTHER OFFICIAL MEETINGS

A special meeting of the Board of Governors will be held on Sunday afternoon, October 16. The annual meeting of the Governors and Fellows of the College will be held on Thursday afternoon at 3:30 o'clock. Reports on activities of the American College of Surgeons, of great interest to all of its Fellows, will be presented by officers, chairmen, and administrative staff members following the election of officers.

Important committee meetings will be held on Wednesday as follows: State and Provincial Executive Committees, State and Provincial Credentials Committees, and Committees on Applicants and Judiciary Committees, 10:00 a.m. to 12:00 Noon, the Committee on Trauma and Regional Committees (formerly the Committee on Fractures and Other Traumas), 3:30 to 5:30 p.m., and the annual dinner and meeting of the Cancer Committee, 6:30 p.m.

Thursday committee meetings will include the annual dinner meeting of the Committee on Trauma at 6:30.

## COMMITTEE ON ARRANGEMENTS AND EXECUTIVE COMMITTEE

The Chicago Committee on Arrangements and the Executive Committee for the Clinical Congress are actively at work on arrangements for the program. The membership of these committees follows:

### Committee on Arrangements

Warren H. Cole, M.D., F.A.C.S., chairman  
 Lester R. Dragstedt, M.D., F.A.C.S., vice chairman

Michael L. Mason, M D, F A C S, secretary  
 Dallas B. Phemister, M D, F A C S, president and regent  
 of the College  
 William E. Adams, M D, F A C S  
 James J. Callahan, M D, F A C S  
 Fremont A. Chandler, M D, F A C S  
 Edward A. Christofferson, M D, F A C S  
 Vernon C. David, M D, F A C S  
 Loyal Davis, M D, F A C S  
 M. Edward Davis, M D, F A C S  
 Paul W. Greeley, M D, F A C S  
 Paul H. Holinger, M D, F A C S  
 Sumner L. Koch, M D, F A C S  
 Herman L. Kretschmer, M D, F A C S  
 Walter G. Maddock, M D, F A C S  
 Foster L. McMillan, M D, F A C S  
 Karl A. Meyer, M D, F A C S  
 Harry A. Oberhelman, M D, F A C S  
 Willis J. Potts, M D, F A C S  
 Charles B. Puestow, M D, F A C S  
 Herbert E. Schmitz, M D, F A C S  
 Derrick T. Vail, M D, F A C S

#### *Executive Committee*

Warren H. Cole, M D, chairman  
 Lester R. Dragstedt, M D, vice chairman  
 Michael L. Mason, M D, secretary  
 Dallas B. Phemister, M D, president and regent of the  
 College  
 James J. Callahan, M D  
 Loyal Davis, M D  
 Walter G. Maddock, M D

#### PARTICIPATING HOSPITALS AND HOSPITAL CLINICS COMMITTEE

Augustana Hospital OSCAR E. NADEAU, M D, F A C S  
 Children's Memorial Hospital PAUL F. FOX, M D,  
 F A C S  
 Cook County Hospital KARL A. MEYER, M D, F A C S,  
 and MANUEL E. LICHTENSTEIN, M D, F A C S  
 Evanston Memorial Hospital J. EDWARD KEARNS, JR.,  
 M D, F A C S  
 Illinois Eye and Ear Infirmary MAURICE D. PEARLMAN,  
 M D  
 Lewis Memorial Maternity Hospital HERBERT E. SCHMITZ,  
 M D, F A C S  
 Mercy Hospital-Loyola University Clinics JOHN B. O'-  
 DONOGHUE, M D, F A C S  
 Michael Reese Hospital MORRIS L. PARKER, M D,  
 F A C S  
 Mount Sinai Hospital DAVID A. WILLIS, M D, F A C S  
 Passavant Memorial Hospital WALTER W. CARROLL,  
 M D, F A C S  
 Presbyterian Hospital FRANCIS H. STRAUS, M D,  
 F A C S  
 Provident Hospital ULYSSES GRANT DAILEY, M D,  
 F A C S  
 Research and Educational Hospitals, University of Illinois  
 JOHN T. REYNOLDS, M D, F A C S  
 St. Elizabeth's Hospital MARTIN GIRARD LUKEN, M D,  
 F A C S  
 St. Joseph Hospital LEONARD KRATZ, M D, F A C S  
 St. Luke's Hospital FOSTER L. McMILLAN, M D,  
 F A C S Assistant JOHN T. REYNOLDS, M D, F A C S  
 St. Mary of Nazareth Hospital ANTHONY S. SAMPOLINSKI,  
 M D, F A C S  
 University of Chicago Clinics  
 Albert Merritt Billings Hospital J. GARROTT ALLEN,  
 M D, F A C S

Bobs Roberts Memorial Hospital for Children J. GAR-  
 ROTT ALLEN, M D, F A C S  
 Chicago Living in Hospital and Dispensary WILLIAM  
 DIECKMANN, M D  
 Home for Destitute Crippled Children J. GARROTT  
 ALLEN, M D, F A C S  
 Wesley Memorial Hospital EARL O. LATIMER, M D,  
 F A C S  
 Hines Veterans Administration Hospital CHARLES B.  
 PUESTOW, M D, F A C S Assistant JAMES H. CROSS,  
 M D, F A C S

#### SPECIAL COMMITTEE ON TELEVISION

Foster L. McMillan, M D, F A C S, St. Luke's Hospital,  
 Chairman  
 Burton C. Kilbourne, M D  
 Charles E. Shannon, M D, F A C S

#### GENERAL AND PROGRAM COMMITTEES

The Clinical Congress general committee which  
 operates under the Administrative Board of the  
 College, consists of Dr. Malcolm T. MacEachern,  
 chairman, Miss Eleanor K. Grimm, secretary,  
 Doctors Bowman C. Crowell, Charles F. Branch,  
 George H. Miller and H. Prather Saunders, and  
 Mr. Edward G. Sandrok, Mr. James S. Shannon,  
 and Miss Laura G. Jackson

The Clinical Congress Committee on Program  
 consists of Dr. Frederick A. Collier, chairman, and  
 Doctors Henry W. Cave, Evarts A. Graham, and  
 Alton Ochsner

The Advisory Committee on Programs consists  
 of Dr. George H. Miller, chairman, and Doctors  
 Warren H. Cole, Sumner L. Koch, Michael L.  
 Mason, Charles B. Puestow, Bowman C. Crowell,  
 H. Prather Saunders, Charles F. Branch, and  
 Malcolm T. MacEachern

#### MEDICAL MOTION PICTURES

The showing of medical motion pictures each  
 day will again be a popular feature of the Clinical  
 Congress. The latest available films on surgery  
 and related subjects will be presented. Special  
 showings will be arranged of medical motion pic-  
 tures in the fields of ophthalmology and otorhino-  
 laryngology. Both sound and silent films will be  
 shown, all of which will have been approved by  
 the Committee on Motion Pictures

Some of the newer medical motion pictures  
 which have been or are being produced under  
 Directing Committees of the College, will be pre-  
 sented during the Clinical Congress. Among these  
 will be the film entitled "Injuries of the Peripheral  
 Nerves" directed by Dr. Loyal Davis, under a  
 grant from the Johnson & Johnson Research  
 Foundation. A premiere showing of this particu-  
 lar film will take place as the concluding feature  
 of the Monday morning General Assembly in the  
 Grand Ballroom of The Stevens



## AMERICAN COLLEGE OF SURGEONS

### TECHNICAL AND SCIENTIFIC EXHIBITION

The Technical and Educational Exhibits will be held in the Exhibition Hall on the lower level of the Stevens. There will be represented leading manufacturers of surgical instruments, of x-ray apparatus, of sterilizers, of operating room lights, of ligatures, of dressings, of hospital apparatus, and supplies of all kinds, and of pharmaceuticals, and publishers of medical books. There will also be presented exhibits depicting the work of the College.

### ENTERTAINMENT FOR LADIES AND GUESTS

Wives, daughters, and other guests of surgeons attending the Clinical Congress and the Sixth Inter-American Congress of Surgery will have a well planned program of entertainment to help to make their visit to Chicago enjoyable. Mrs. Dallas B. Phemister is chairman of the entertainment committee. Assisting her are Mesdames William E. Adams, James J. Callahan, Walter W. Carroll, Warren H. Cole, Loyal Davis, M. Edward Davis, Lester R. Dragstedt, Walter G. Maddock, and Michael L. Mason.

On Monday, October 17, the first day, there will be registration all day in the lower lobby of The Stevens. There will be opportunities to meet the hostesses, to get acquainted, and to make plans to attend the events scheduled. State Street stores and shops are open until 8:30 on Monday evenings. A limited number of radio broadcast tickets will also be available on this first day.

On Tuesday at 11:00 o'clock the group will leave The Stevens for a 2-hour tour of the North Shore, concluding with luncheon at the Exmoor Country Club in Highland Park. Enroute they will see the smart Michigan Avenue specialty shops, Lincoln Park, world-famed Lake Shore Drive, Belmont Yacht Harbor, Edgewater Beach Hotel, Mundelein College, Loyola University, Northwestern University, Evanston, and other beautiful suburbs. Advance reservations are absolutely necessary for this trip.

Fortunately, St. Luke's Fashion Show occurs during Clinical Congress week. Taking advantage of this, the committee has arranged for the group to attend this event on Wednesday afternoon at 2:00 o'clock at Medinah Temple on the near North Side. This is Chicago's outstanding fashion show of the year. Bonwit-Teller, whose new five-story store on North Michigan Avenue opened in late August, will provide the stage setting for this extensive display by Chicago's leading jewelers, department stores, couturiers, etc.

Thursday afternoon at 3:00 o'clock the group will gather at the Art Institute for a tour of Mrs. James Ward Thorne's miniature rooms. Mrs.

Thorne will appear in person to tell how she produced these world famous rooms. Tea will follow.

On Friday afternoon at 2:00 o'clock the group will leave The Stevens for a tour of the South Shore. Among the highlights of this tour will be the Field Museum, the Shedd Aquarium, Adler Planetarium, Art Institute, Buckingham Fountain, Chicago's old Gold Coast of 40 years ago, Soldier Field, Jackson Park, Museum of Science and Industry, Midway Plaisance, the University of Chicago, Washington Park, and the Fountain of Time by Lorado Taft.

Guests may attend any or all of these events. Reservations should be made immediately. The costs are as follows: Tuesday tour and luncheon, \$5.50; Wednesday Fashion Show, \$2.40; Thursday Art Institute tour and tea, \$1.50; Friday tour, \$2.25.

### ADVANCE REGISTRATION

Surgeons who wish to attend the Congress should register in advance. Advance registration will greatly expedite the procedure of registering. No registration fee will be charged. Fellows whose dues are paid to December 31, 1948. For endorsed Junior and Senior Candidates, the fee will be \$5.00. Non-Fellows who after individual consideration are permitted to register, will pay a fee of \$10.00. No registration fee will be required of initiates of the class of 1949.

### HOTEL RESERVATIONS

It is desirable to make hotel reservations as early as possible. In making these, communications should be addressed to the Convention Housing Bureau, 105 West Madison Street, Chicago, stating that you will be attending the Clinical Congress of the American College of Surgeons. All hotel reservations, both for surgeons and hospital representatives, are to clear through this Bureau. No correspondence should be sent directly to the hotels. A form for reservations was enclosed in the letter recently sent to Fellows. Choice of hotels may be designated.

The principal participating hotels are		Single	Double
Chicago Hotels		\$3.50	\$5.00
Atlantic		5.00	8.00
Bismarck		3.50	6.00
Brevort		3.75	5.50
Chicagoan		4.50	7.50
Drake		3.50	5.50
Eastgate		4.00	6.00
Hamilton		3.00	4.00
Harrison		5.00	8.00
Knickerbocker		4.00	6.00
Maryland		3.00	4.00
Midland		4.00	6.00
Palmer House		3.85	5.00
Sheraton		4.50	6.00
Stevens			



## PROGRAM IN BRIEF

### CLINICAL CONGRESS OF THE AMERICAN COLLEGE OF SURGEONS AND SIXTH INTER-AMERICAN CONGRESS OF SURGERY

#### *Sunday, October 16*

3 00- 6 00 Meeting, Governors

#### *Monday, October 17*

8 00-12 00 Clinics, local hospitals  
10 00-12 30 General Assembly  
1 00- 5 00 Clinics and Demonstrations at local hospitals  
1 30- 4 00 Medical Motion Pictures  
1 30- 3 00 Panel Discussion  
2 00- 4 30 Television, Operations  
2 00- 5 00 Forum, Fundamental Surgical Problems  
2 00- 5 00 Hospital Conference  
3 30- 5 00 Panel Discussion  
8 15-10 30 Presidential Meeting

#### *Tuesday, October 18*

8 00-12 00 Clinics and Demonstrations at local hospitals  
9 00-12 00 Forum, Fundamental Surgical Problems  
9 30-12 30 Surgical Film Exhibition, General Surgery  
10 00-12 00 Symposium on Amputees  
10 00-12 30 Hospital Conference  
10 00-12 30 Television, Operations  
1 00- 5 00 Clinics and Demonstrations at local hospitals  
1 30- 3 00 Panel Discussion  
2 00- 5 00 Forum, Fundamental Surgical Problems  
2 00- 4 00 Television, Operations  
2 00- 4 30 Surgical Film Exhibition (EENT)  
2 00- 5 00 Hospital Conference  
2 00- 5 00 Symposium on Trauma  
3 30- 5 00 Panel Discussion  
7 00- 8 00 Surgical Film Exhibition (EENT)  
8 00-10 00 Scientific Session, General Surgery  
8 00-10 00 Scientific Session, Otorhinolaryngology  
8 00-10 00 Hospital Conference

#### *Wednesday, October 19*

8 00- 9 30 Hospital Breakfast Conference  
8 00-12 00 Clinics and Demonstrations at local hospitals  
9 00-12 00 Forum on Fundamental Surgical Problems (2 sections)  
10 00-12 00 State and Provincial Executive, Credentials and Judiciary Committees  
9 30-12 30 Surgical Film Exhibition  
10 00-12 30 Hospital Conference  
10 00-12 30 Television  
1 00- 5 00 Clinics and Demonstrations at local hospitals  
1 30- 3 00 Panel Discussion  
2 00- 5 00 Forum on Fundamental Surgical Problems  
2 00- 4 00 Surgical Film Exhibition  
2 00- 4 00 Television—Operations  
2 00- 5 00 Symposium on Cancer  
2 00- 5 00 Hospital Conference  
3 30- 5 00 Panel Discussion  
3 30- 5 30 Meeting of National and Regional Fracture Committees  
7 00- 8 00 Surgical Film Exhibition, (EENT)

8 00-10 00 Scientific Session, General Surgery  
8 00-10 00 Hospital Conference

#### *Thursday, October 20*

8 00- 1 30 Hospital Conference, Breakfast  
8 00-12 00 Clinics and Demonstrations at local hospitals  
9 00-12 00 Forum on Fundamental Surgical Problems  
9 00-12 30 Surgical Film Exhibition, General Surgery  
10 00-12 30 Hospital Conference  
10 00-12 30 Television, Operations  
1 00- 5 00 Clinics and Demonstrations at local hospitals  
1 30- 3 30 Forum on Fundamental Surgical Problems  
1 30- 3 30 Surgical Film Exhibition  
1 00- 3 30 Seminar  
2 00- 4 00 Television  
2 00- 5 00 Hospital Conference  
3 30- 3 45 Adjourned Meeting, Governors  
3 45- 5 30 Annual Meeting of Fellows  
7 00- 8 00 Surgical Film Exhibition (EENT)  
8 00-10 00 Scientific Session, General Surgery  
8 00-10 00 Ophthalmology  
8 00-10 00 Hospital Conference

#### *Friday, October 21*

8 00-12 00 Clinics and Demonstrations at local hospitals  
8 00-12 00 Tours of hospitals—hospital group  
9 00-12 00 Forum on Fundamental Surgical Problems  
9 30-12 30 Surgical Film Exhibition, General Surgery  
10 00-12 00 Television, Operations  
10 00-12 30 Inaugural Session, Inter American Congress of Surgery  
12 30- 2 30 Luncheon for Delegates, Inter American Congress of Surgery  
1 00- 2 30 Assembly of Initiates  
1 00- 4 00 Tours of hospitals—hospital group  
1 00- 5 00 Clinics and Demonstrations at local hospitals  
1 30- 4 45 Panel Discussion for each of the Following  
Obstetrics and Gynecology  
Plastic Surgery  
Neurological Surgery  
Thoracic Surgery  
Urology  
Orthopedic Surgery  
8 15-10 30 Convocation

#### *Saturday, October 22*

10 00-12 30 Scientific Session, Sixth Inter American Congress of Surgery  
2 00- 5 00 Scientific Session, Inter American Congress of Surgery  
7 00-11 00 Official Banquet—Inter-American Congress of Surgery

#### *Sunday, October 23*

10 00-12 30 Business Session, Inter-American Congress of Surgery  
2 00- 4 00 Scientific Session, Inter American Congress of Surgery

## GENERAL ASSEMBLY

### JOINT SESSION—SURGEONS AND HOSPITAL REPRESENTATIVES

*Monday, 10 00 a m —12 30 p m —Grand Ballroom, The Stevens*

DALLAS B. PHEMISTER, M D , F A C S , Chicago, President, American College of Surgeons, Presiding  
The Ever Present Challenge—Good Care of the Patient ARTHUR W. ALLEN, M D , F A C S , Boston, Vice  
Chairman, Board of Regents, American College of Surgeons  
The Health of the Nation—Our Greatest Asset HARRISON RAY ANDERSON, D D , Chicago, Pastor, Fourth  
Presbyterian Church  
The Voluntary Hospital—The Foundation of the Present Hospital System REV. JOHN W. BARRETT,  
Chicago, director of Catholic Hospitals, Archdiocese of Chicago, president, Catholic Hospital Asso-  
ciation  
Trends in Legislation Affecting Hospitals GEORGE BUGBEE, Chicago, executive director, American Hos-  
pital Association  
Means for Diagnostic Facilities in Community Hospitals for Service to All PAUL B. MAGNUSON, M D ,  
F A C S , Washington, D C , Chief Medical Officer, Veterans Administration, Secretary, American  
College of Surgeons  
Premiere Showing Injuries of the Peripheral Nerves Film Directed by LOYAL DAVIS, M S , Ph D , M D ,  
F A C S , Chicago, Professor of Surgery and Chairman of Division of Surgery, Northwestern University  
Medical School  
(Production made possible through a grant from the Johnson & Johnson Research Foundation )

### PRESIDENTIAL MEETING

*Monday, 8 15-10 30 p m —Grand Ballroom, The Stevens*

DALLAS B. PHEMISTER, M D , F A C S , Chicago, President, American College of Surgeons, Presiding  
Processional—Officers, Regents, and Distinguished Guests  
Invocation  
Address of Welcome  
WARREN H. COLE, M D , F A C S , Chicago, Chairman, Committee on Arrangements  
Introduction of Distinguished Guests  
ARTHUR W. ALLEN, M D , F A C S , Boston, Vice Chairman, Board of Regents  
Address of Retiring President An Evaluation of Full-Time and Group Practice for the Clinical Faculty of a  
Medical School  
DALLAS B. PHEMISTER, M D  
Inauguration of Officers  
Presented by HOWARD A. PATTERSON, M D , F A C S , New York, Retiring First Vice President  
First Vice President DONALD G. TOLLEFSON, M D , F A C S , Los Angeles  
Second Vice President ROBERT M. MOORE, M D , F A C S , Galveston  
President FREDERICK A. COLLER, M D , F A C S , Ann Arbor  
The Fourth Martin Memorial Lecture Collateral Circulation, Natural and Artificial SIR JAMES  
LEARMONTH, K C V O , C B E , F R C S (Ed ), Edinburgh, Scotland  
Recessional

### EVENING SCIENTIFIC SESSIONS

#### GENERAL SURGERY and GYNECOLOGY and OBSTETRICS

*Tuesday, 8 00-10 30 p m —Grand Ballroom—The Stevens*

*Symposium on Acute Surgical Emergencies in Gynecology and Obstetrics*

General Introduction NEWELL W. PHILPOTT, M D , F A C S , Montreal  
Tubal Pregnancy, Its Diagnosis and Treatment LEWIS C. SCHEFFEY, M D , F A C S , Philadelphia  
Pelvic Peritonitis Occurring in the Obstetrical or Gynecological Patient FRANK GLENN, M D , F A C S ,  
New York  
Emergency Cesarean Section WILLIAM E. STUDDIFORD, M D , F A C S , New York.

*Wednesday, 8 00-10 30 p m , Grand Ballroom, The Stevens*

Fracture Oration Fracture Hazards OTTO J. HERMANN, M D , F A C S , Boston

*Symposium on Blood Coagulation and the Use of Anticoagulants*

- The Significance of Different Methods for Prothrombin Estimation and Their Relative Values JOHN H OLWIN, M D, F A C S, Chicago  
 Studies on Antithrombin and Etiologic Factors in Phlebothrombosis JOHN H KAY, M D, New Orleans  
 A Further Report on Dicumarol Prophylaxis Against Venous Thrombosis in Women GEORGE VAN S SMITH, M D, F A C S, Brookline, Massachusetts

*Thursday, 8 00-10 30 p m, Grand Ballroom, The Stevens*

*Symposium on Malignant Disease*

- Chemotherapy in Malignant Neoplastic Disease CARL V MOORE, M D, St Louis  
 Hormone Therapy of Cancer CHARLES B HUGGINS, M D, Chicago  
 What We Have Learned from Isotopes Concerning Depletion and Repair in Surgical Patients FRANCIS D MOORE, M D, F A C S, Boston  
 The Use of Radioactive Iodine in Studying the Pathologic Physiology of Thyroid Cancer RULON W RAWSON, M D, New York

## CONVOCATION

*Friday, 8 15-10 30 p m —Grand Ballroom, The Stevens*

- FREDERICK A COLLER, M D, F A C S, Ann Arbor, President, American College of Surgeons, Presiding  
 Processional—Initiates, Officers, Regents, and Distinguished Guests  
 Invocation  
 Presentation of Initiates for Fellowship ARTHUR W ALLEN, M D, F A C S, Boston, Vice Chairman,  
 Board of Regents  
 Fellowship Pledge The Initiates  
 Conferring of Fellowships by the President  
 FREDERICK A COLLER, M D  
 Conferring of Honorary Fellowships  
 The President  
 Fellowship Address Science in Surgery—Stop, and Look, and Listen  
 LORD WEBB-JOHNSON, K C V O, C B E, D S O, T D, F R C S (Eng), F A C S (Hon), London,  
 England, President, Royal College of Surgeons of England  
 Recessional

## PANEL DISCUSSIONS

## GENERAL SURGERY

*Monday, 1 30-3 00 p m*

*Surgical Lesions of the Breast*

- Moderator GEORGE G FINNEY, M D, F A C S, Baltimore  
 Collaborators J MONTGOMERY DEEVER, M D, F A C S, Philadelphia, STUART W HARRINGTON,  
 M D, F A C S, Rochester, Minnesota, W PERRIN NICOLSON, M D, Atlanta, HUGH H TROUT,  
 M D, F A C S, Roanoke

*Monday, 3 30-5 00 p m*

*Fractures of the Skull*

- Moderator ELDRIDGE H CAMPBELL, M D, F A C S, Albany  
 Collaborators FRANK H. MAYFIELD, M D, F A C S, Cincinnati, DONALD MUNRO, M D, F A C S  
 Boston, HARRY B WILKINS, M D, F A C S, Oklahoma City

*Tuesday, 1 30-3 00 p m*

*Massive Upper Abdominal Hemorrhage*

- Moderator JOHN H MULHOLLAND, M D, F A C S, New York  
 Collaborators ROBERT ELMAN, M D, F A C S, St Louis, CHARLES G JOHNSTON, M D, F A C S,  
 Detroit, JOHN D STEWART, M D, F A C S, Buffalo

*Tuesday, 3 30-5 00 p m*

*New Surgical Techniques in Drug Treated Infections*

- Moderator CHAMP LYONS, M D, New Orleans  
 Collaborators HARVEY S ALLEN, M D, F A C S, Chicago, FRANK B BERRY, M D, F A C S, New  
 York, GEORGE K. CARPENTER, M D, F A C S, Nashville

# AMERICAN COLLEGE OF SURGEONS

Wednesday, 1 30-3 00 p m

*The Management of Acute Emergencies Occurring During Operations*  
 Moderator I MIMS GAGE, M D, F A C S, New Orleans  
 Collaborators BENTLEY P COLCOCK, M D, F A C S, Boston, DANIEL C ELKIN, M D, F A C S,  
 Atlanta, NORMAN E FREEMAN, M D, F A C S, San Francisco, CARL A MOYER, M D, F A C S,  
 Dallas

Wednesday, 3 30-5 00 p m

*Preoperative and Postoperative Care and Anesthesia for Infants*  
 Moderator THOMAS H LANMAN, M D, F A C S, Boston  
 Collaborators C EVERETT KOOP, M D, Philadelphia, WILLIS J POTTS, M D, F A C S, Chicago,  
 ROBERT M SMITH, M D, Boston

## SURGICAL SPECIALTIES, Friday, 1 30-4 45 p m

### ORTHOPEDIC SURGERY

Moderator GUY A CALDWELL, M D, F A C S, New Orleans  
*Management of Established Non-Union of the Long Bones*  
 Collaborators HUGH SMITH, M D, F A C S, Memphis, FRANK E STINCHFIELD, M D, F A C S,  
 New York, ALEJANDRO VELASCO ZIMBRON, M D, Mexico City  
*Indications and Technic for Arthrodeses of the Joints of the Foot and Ankle in Post-Traumatic Conditions*  
 Collaborators HAROLD B BOYD, M D, F A C S, Memphis, JAMES A DICKSON, M D, F A C S,  
 Cleveland, C LESLIE MITCHELL, M D, F A C S, Detroit

### PLASTIC SURGERY

Moderator JEROME P WEBSTER, M D, F A C S, New York  
*Plastic Surgery and the Treatment of Malignant Skin Disease*  
 Collaborators JAMES BARRETT BROWN, M D, F A C S, St Louis, W BRANDON MACOMBER, M D,  
 F A C S, Albany, CLAIRE L STRAITH, M D, F A C S, Detroit  
*The Use of Skin Homografts*  
 Collaborators JAMES F CONNELL, M D, Fort Sam Houston, WILLIAM P LONGMIRE, JR, M D,  
 Los Angeles, BLAIR O ROGERS, M D, Minneapolis

### UROLOGY

Moderator GEORGE F CAHILL, M D, F A C S, New York  
*Hydronephrosis Due to Upper Ureter Obstruction*  
 Collaborators GRAYSON L CARROLL, M D, F A C S, St Louis, FRED E B FOLEY, M D, St Paul,  
 PARKE G SMITH, M D, F A C S, Cincinnati  
*Ureteral Intestinal Transplantation*  
 Collaborators CHARLES C HIGGINS, M D, F A C S, Cleveland, VICTOR F MARSHALL, M D,  
 F A C S, New York, JAMES T PRIESTLY, M D, F A C S, Rochester, Minnesota

### THORACIC SURGERY

Moderator BRIAN B BLADES, M D, F A C S, Washington  
*Surgery of the Heart and Great Vessels*  
 Collaborators ALFRED BLALOCK, M D, F A C S, Baltimore, ROBERT E GROSS, M D, F A C S,  
 Boston, EDWARD B D NEUHAUSER, M D, Boston  
*Intrathoracic Tumors*  
 Collaborators THOMAS H BURFORD, M D, F A C S, St Louis, JOHN H GIBBON, JR, M D, F A C S,  
 Philadelphia, EDWARD M KENT, M D, Pittsburgh

### NEUROLOGICAL SURGERY

Moderator ALFRED W ADSON, M D, F A C S, Rochester, Minnesota  
*Chemical and Physical Diagnostic Aids in the Localization of Brain Tumors*  
 Collaborators GEORGE MOORE, M D, Minneapolis, ERIC OLDBERG, M D, F A C S, Chicago,  
 BERTRAM SELVERSTONE, M D, Boston, HENDRICK J SVIEN, M D, Rochester, WILLIAM H  
 SWEET, M D, Boston  
*Diagnosis and the Localization of Intraspinal Tumors*  
 Collaborators PAUL C BUCY, M D, F A C S, Chicago, T C ERICKSON, M D, Madison, HAROLD C  
 VORIS, M D, F A C S, Chicago

## OBSTETRICS AND GYNECOLOGY

- Moderator FRANKLIN L PAYNE, M D , F A C S , Philadelphia  
*Carcinoma of the Uterine Cervix—Modern Concepts in Diagnosis and Treatment*  
 Collaborators ROBERT GORDON DOUGLAS, M D , New York, HERBERT F TRAUT, M D , F A C S ,  
 San Francisco, PAUL A YOUNGE, M D , Brookline  
*Cesarean Section—Should the Latitude of Its Indications be Broadened?*  
 Collaborators D ANTHONY D'ESOP, M D , New York, CARL P HUBER, M D , Indianapolis, H  
 HUDNALL WARE, JR , M D , F A C S , Richmond

## SYMPOSIUM ON AMPUTEES

*Tuesday, 10 00 a m —12 00 noon*

ROBERT H KENNEDY, M D , F A C S , New York, Chairman, Committee on Trauma, Presiding  
 The Care and Education of Amputees

## SYMPOSIUM ON TRAUMA

*Tuesday, 2 00–5 00 p m*

- ROBERT H. KENNEDY, M D , F A C S , New York, Chairman, Committee on Trauma, Presiding  
 The Plastic Approach to the Surgery of Trauma TRUMAN G BLOCKER, JR , M D , F A C S , Galveston,  
 Professor of Plastic and Maxillo-facial Surgery, University of Texas School of Medicine  
 Plastic Surgical Repair of Radiation Injuries JAMES BARRETT BROWN, M D , F A C S , St Louis, Associate  
 Professor of Clinical Surgery, Washington University School of Medicine  
 Blood and Blood Substitutes in Trauma JONATHAN E RHODES, M D , F A C S , Philadelphia, Associate  
 Professor of Surgery, University of Pennsylvania School of Medicine and Assistant Director of the  
 Harrison Department of Surgical Research  
 A Prolonged End Result Study of 235 Intracapsular Fractures of the Femoral Neck MATHER CLEVELAND,  
 M D , F A C S , New York, Attending Orthopedic Surgeon and Director of Orthopedic Out-Patient  
 Department, St Luke's Hospital  
 Observations on Results of Shoulder Cuff Repair HARRISON L McLAUGHLIN, M D , F A C S , New York,  
 Professor of Clinical Orthopedic Surgery, College of Physicians and Surgeons, Columbia University  
 An Analysis of the Management and Complications of Multiple (3 or more) Rib Fractures DUNCAN A  
 CAMERON, M D , Detroit, Assistant Professor of Surgery, Wayne University School of Medicine  
 Use of Intramedullary Fixation in Fractures HAROLD A SOFELD, M D , F A C S , Chicago, Assistant  
 Professor of Bone and Joint Surgery, Northwestern University Medical School  
 Fractures of the Tarsal and Metatarsal Bones FRANCIS M MCKEEVER, M D , F A C S , Los Angeles, Associ-  
 ate Clinical Professor of Surgery (Orthopedic), University of Southern California School of Medicine

## SYMPOSIUM ON CANCER

*Wednesday, 2 00–5 00 p m*

- GRANTLEY W TAYLOR, M D , F A C S , Boston, Chairman, Cancer Committee, American College of  
 Surgeons, Presiding  
 Melanoeptithelomas HAMILTON MONTGOMERY, M D , Rochester, Minnesota, Associate Professor of Der-  
 matology and Syphilology, Mayo Foundation, University of Minnesota  
 Benign Bone Tumors MURRAY M COPELAND, M D , F A C S , Washington, D C , Professor of Oncology,  
 Georgetown University School of Medicine  
 Branchiogenic Cancer HAYES MARTIN, M D , F A C S , New York, Professor of Clinical Surgery, Cornell  
 University Medical College, Attending Surgeon, Memorial Hospital for the Treatment of Cancer and  
 Allied Diseases  
 What Is a Precancerous Lesion? FRED W STEWART, M D , New York, Professor of Pathology, Cornell  
 University Medical College, Pathologist, Memorial Hospital for the Treatment of Cancer and Allied  
 Diseases  
 Cancer of the Kidney HERMAN L KRETSCHMER, M D , F A C S , Chicago, Professor of Urology, University  
 of Illinois College of Medicine, Chief, Department of Urology, Presbyterian Hospital  
 Sarcomas of the Soft Parts ARTHUR PURDY STOUT, M D , New York, Professor of Surgical Pathology,  
 Columbia University College of Physicians and Surgeons

# AMERICAN COLLEGE OF SURGEONS

## ANNUAL MEETING—BOARD OF GOVERNORS

*Sunday, 3 00-6 00 p m —Murphy Memorial Auditorium*  
 HOWARD A PATTERSON, M D, F A C S, New York, First Vice President, American College of Surgeons,  
 Presiding

Organization of Local Chapters of the College  
 Means of Improving Conditions in the Practice of Surgery in Areas where Problems Exist, Including Dis-  
 cussion of the Principles of Financial Relations in the Professional Care of the Patient  
 Sectional Meetings Discussion of Their Present Value, Means through which They May Be Improved, and  
 the Desirability of Arranging an Increased Number of Meetings Each Year  
 Evaluation of Present Activities of the College  
 Suggestions Concerning the College in General  
 General Discussion

## ADJOURNED MEETINGS

### BOARD OF GOVERNORS OF THE COLLEGE

*Wednesday, Luncheon, 12 00 p m -2 00 p m —Boulevard Room, The Stevens*  
 FREDERICK A COLLER, M D, F A C S, Ann Arbor, President, American College of Surgeons, Presiding  
 Unfinished Business

*Thursday, 3 30-3 45 p m —Grand Ballroom, The Stevens*  
 Report of Committee on Nominations to the Board of Governors  
 Election of Regents of the College

## ANNUAL MEETING, FELLOWS OF THE COLLEGE

*Thursday, 3 45-5 30 p m —Grand Ballroom, The Stevens*  
 FREDERICK A COLLER, M D, F A C S, Ann Arbor, President, American College of Surgeons, Presiding  
 Report of Committee on Nominations to the Fellows  
 Election of Officers and Governors of the College

Report of the Treasurer WARREN H COLE, M D, F A C S, Chicago, Treasurer, EDWARD G SANDROK,  
 Comptroller  
 Cancer Committee GRANTLEY W TAYLOR, M D, F A C S, Boston, Chairman  
 Committee on Trauma ROBERT H KENNEDY, M D, F A C S, New York, Chairman  
 Committee on Graduate Training in Surgery FREDERICK A COLLER, M D, F A C S, Ann Arbor, Chairman  
 Committee on Medical Motion Pictures CHARLES B PUESTOW, M D, F A C S, Chicago, Chairman

Hospital Department  
 Hospital Standardization MALCOLM T MACEachern, M D, Associate Director  
 Graduate Training in Surgery PAUL S FERGUSON, M D, Assistant Director, Hospital Activities,  
 GEORGE H MILLER, M D, Director of Educational Activities

Sectional Meetings MALCOLM T MACEachern, M D, Associate Director, H PRATHER SAUNDERS, M D,  
 F A C S, Associate Director  
 Credentials Department

a, Credentials Committee, b, Committees on Applicants, c, Committee on History Reviews H  
 PRATHER SAUNDERS, M D, F A C S  
 Presentation of Certificates of Appreciation to Long-time Members of the Committee on History Reviews  
 The President

Clinical Research  
 Medical Service in Industry BOWMAN C CROWELL, M D, Associate Director, CHARLES F BRANCH,  
 M D, Assistant Director, G R HESS, M D, Assistant  
 Publications ELEANOR K. GRIMM, Administrative Executive Library and Department of Literary Re-  
 search L MARGUERITE PRIME, Director of Library and Department of Literary Research  
 Public Relations LAURA G JACKSON, Director of Public Relations  
 The American College of Surgeons Fellowship Obligations and Opportunities ARTHUR W ALLEN,  
 M D, F A C S, Boston, Vice Chairman, Board of Regents

## SURGICAL SEMINAR

*Nutritional Problems Including a Consideration of the Use of Fluids and Electrolytes*

*1 00 p m , Thursday—Grand Ballroom, The Stevens*

- I S RAYDIN, M D , F A C S , Philadelphia, John Rhea Barton Professor of Surgery, University of Pennsylvania Medical School, Presiding
- The Measurement of the Total Exchangeable Potassium by Isotope Dilution in Man LESLIE CORSA, JR., M D , RICHARD W STEENBERG, M D , JOHN M OLNEY, JR., M D and FRANCIS D MOORE, M D , F A C S , Boston, Massachusetts Peter Bent Brigham Hospital and Harvard Medical School
- Studies in Experimental Alkalosis ROBERT E L BERRY, M D , F A C S , VIVIAN IOB, PH D , DANIEL C THOMPSON, M D , RALPH D MAHON, M D and SAMUEL J GREER, M D , Ann Arbor, Michigan University of Michigan Medical School
- Renal Function in Relation to Operations WALTER G MADDOCK, M D , F A C S , Chicago, Ill North western University Medical School
- Water and Electrolyte Exchange in the Postoperative Patient JAMES WALKER, JR., M D and BROOKE ROBERTS, M D , Philadelphia, Pennsylvania University of Pennsylvania School of Medicine
- The Individual Essential Amino Acids in Plasma and Urine Following Surgery and in Malnutrition TILDEN C EVERSON, M D , M S , Chicago, Illinois University of Illinois College of Medicine
- The Significance of Simultaneous Caloric Intake on the Utilization of Parenteral Protein EDWIN H ELLISON, M D , ROBERT M ZOLLINGER, M D , F A C S and ROBERT S MCCLEARY, M A , M D , F A C S , Columbus, Ohio Ohio State University College of Medicine
- The Effect of Nutritional Defects in the Response to Infection PAUL CANNON, M D , Chicago, Illinois University of Chicago School of Medicine
- The Importance of Nutrition in Surgical Patients RICHARD L VARCO, M D , Minneapolis, Minnesota University of Minnesota Medical School

## FORUM ON FUNDAMENTAL SURGICAL PROBLEMS

*Monday 2 00 p m —5 00 p m , Tuesday, Wednesday, Thursday, 9 00 a m —12 00 m & 2 00 p m —5 00 p m and Friday, 9 00 a m —12 00 m*

*Gall Bladder and Pancreas, Urology, Orthopedics, Plastic Surgery*

*2 00 p m Monday—8th Street Theatre*

- WARREN H COLE, M D , F A C S , Chicago, Professor of Surgery and Head, Department of Surgery, University of Illinois College of Medicine, Presiding
- Cholecysto-Choledochal Fistula An Unusual Form of Internal Biliary Fistula ALBERT BEHREND, M D , F A C S and MILTON L CULLEN, M D , Philadelphia, Pennsylvania University of Pennsylvania School of Medicine
- Fluorescein An Adjunct in Surgery of the Gallbladder and Biliary Passages GERALD J MENEKER, M D and MORRIS L PARKER, M D , F A C S , Chicago, Illinois Michael Reese Hospital
- Healing in the Common Bile Duct An Experimental Study THOMAS C DOUGLASS, M D , F A C S , BENJAMIN F LOUNSBURY, M D , NICHOLAS WETZEL, M D and WILLIAM W CUTTER, M D , Chicago, Illinois Northwestern University School of Medicine
- Liver Protein Regeneration in the Presence of Biliary Obstruction COLIN G FERGUSON, M D , CHARLES S ROGERS, M D and HARRY M VARS, PH D , Philadelphia, Pennsylvania University of Pennsylvania School of Medicine
- Studies on External Pancreatic Secretion with Chronic Pancreatic Fistula with Emphasis on the Effects of Vagotomy E F ROUTLEY, M D , F G MANN, M D , M S , D Sc , J L BOLLMAN, M S , B S , M D , J H GRINDLAY, M D , M S (SURG), F A C S , and E V FLOCK, M S , PH D , Rochester, Minnesota Mayo Foundation
- Report on Splanchnicectomy for Fibrocystic Disease of Pancreas WILLIAM AYERS, M D , DANIEL STOWENS, M D and ALTON OCHSNER, M D , F A C S , New Orleans, Louisiana Tulane University of Louisiana School of Medicine
- Studies on Phospholipid Metabolism in Normal and Depancreatized Dogs Using Radioactive Phosphorus WILEY F BARKER, M D and ERIC ROGERS, M D , Boston, Massachusetts Harvard Medical School and Peter Bent Brigham Hospital
- Prevention and Dissolution of Experimental Urinary Calculi by Diuresis WILLIAM J GROVE, M D and C W VERMEULEN, M D , Chicago, Illinois University of Illinois College of Medicine
- A Method for the Study of Urinary Calcium and Urinary Phosphorus in the Normal and Diseased Kidney R H FLOCKS, M D , F A C S , JOHN TUDOR, M D and MARGARET JOHNSON, B S , Iowa City, Iowa State University of Iowa College of Medicine

# AMERICAN COLLEGE OF SURGEONS

The Endocrine Basis for Slipping of the Upper Femoral Epiphysis An Experimental Study W ROBERT HARRIS, M D , Toronto, Ontario University of Toronto Faculty of Medicine  
Experimental Evaluation of Homogenous Bone Grafts FRED C REYNOLDS, M D , F A C S and DAVID R OLIVER, St Louis, Missouri Washington University School of Medicine  
The Production of Epithelial Lined Tubes from Buried Strips of Intact Skin WILLIAM J BUTLER, M D , F A C S and WAYNE WHITAKER, Ph D , Ann Arbor, Michigan University of Michigan Medical School  
Nicotinic Acid and Epinephrine Test for Determining the Source of Blood Supply of Delayed Skin Flaps GEORGE OLANDER, M D , Chicago, Illinois University of Illinois College of Medicine and Hines Veterans Hospital

## *Surgery of the Heart*

9 00 a m , Tuesday—Grand Ballroom, The Stevens

ROBERT E GROSS, M D , F A C S , Boston, Assistant Professor of Surgery, Harvard Medical School, Presiding  
The Vagus Nerve in Cardiac Arrest HERBERT E SLOAN, M D , Ann Arbor, Michigan University of Michigan Medical School  
Determination of Electrical Currents Which Will Produce Fibrillation and Defibrillation in Dogs KENNETH MOOSLIN, M D , STUART MCKAY, Ph D and SANFORD E LEEDS, M D , F A C S , San Francisco, California Mount Zion Hospital  
The Production of Progressive Coronary Artery Narrowing in Dogs WILLIAM T FITTS, JR , M D , WARNER F SHELTON, M D and JOHN J SAYON, M D , Philadelphia, Pennsylvania University of Pennsylvania College of Medicine  
Observations on the Growth of Aortic Anastomoses in Puppies ELLIOTT S HERWITT, M D , F A C S and SIGMUND A BRAHMS, M D , New York, New York The Mt Sinai Hospital  
A Technique for the Complete Excision of a Portion of the Ventricle of the Heart BRUCE G MACMILLAN, M D , B N CARTER, M D , Ph D , F A C S , Cincinnati, Ohio University of Cincinnati College of Medicine  
Excision of Cardiac Infarcts MILTON C MALONEY, M D and W EMORY BURNETT, M D , F A C S , Philadelphia, Pennsylvania Temple University College of Medicine  
Commissurotomy for Mitral Stenosis R P GLOVER, M D , C P BAILEY, M D , M Sc , F A C S , and T J E O'NEILL, M D , Philadelphia, Pennsylvania The Hahnemann Medical College and Hospital of Philadelphia  
Experimental Production and Closure of Cardiac Interventricular Septum Defects MAURICE GALANTE, M D , ROBERT JOHANSEN, M D , RICHARD E GARDNER, M D , H BRODIE STEPHENS, M D and H J MCCORKLE, M D , F A C S , San Francisco, California University of California Medical School  
Experimental Production of Interventricular Septal Defects in Dogs and Certain Physiologic Effects GEORGE D J GRIFFIN, JR M D , and HIRAM E ESSEX, M D , Rochester, Minnesota Mayo Foundation  
An Experimental Method for Producing Lesions at Selected Sites in the Mitral Valve in Dogs DUANE L MERRILL, M D , Baltimore, Maryland Johns Hopkins University School of Medicine  
Plastic Valvular Prostheses CHARLES A HUFNAGEL, M D , Boston, Massachusetts Peter Bent Brigham Hospital and Harvard Medical School  
Observations of the Action of a Pump Designed to Shunt the Venous Blood Past the Right Heart Directly into the Pulmonary Artery WILLIAM H SEWELL, JR and WILLIAM W L GLENN, M D , New Haven, Connecticut Yale University School of Medicine  
Pump Oxygenator to Support the Systemic Circulation During the Surgical Approach to the Heart CLARENCE DENNIS, M D , KARL E KARLSON and DAVID SANDERSON, Minneapolis, Minnesota University of Minnesota Medical School

## *Vascular Surgery and Surgery of Hypertension*

2 00 p m , Tuesday—North Ballroom, The Stevens

LOYAL DAVIS, M D , F A C S , Chicago, Illinois, Professor of Surgery and Chairman of Division of Surgery, Northwestern University Medical School, Presiding  
Observations of Lower Leg Venous Pressures in the Human Standing and Walking PAUL T DECAMP, M D , N DONALD FEIBLEMAN, M D and CHARLES J RAY, M D , New Orleans, Louisiana Tulane University of Louisiana School of Medicine  
Renal Function in Coarctation of the Aorta HAROLD G BARKER, M D and JOHN K CLARK, Philadelphia, Pennsylvania University of Pennsylvania School of Medicine  
Repetitive Studies of Intra-Arterial Pressures After Resection of Coarctation of the Aorta in Man BOWEN E TAYLOR, M D , C T CLAGETT, M D , M S (SURG ), F A C S , H B BURCHELL M D , Ph D , and E H WOOD, M D , M S , Ph D , Rochester, Minnesota Mayo Foundation  
Regional Heparinization in Vascular Surgery NORMAN E FREEMAN, M D , F A C S , San Francisco, California Franklin Hospital



- Absorbable Sutures in the Surgery of Major Blood Vessels SIDNEY SMITH, M D , FRANK R JOHNSON, M D and WILLIAM L RIKER, M D , Chicago, Illinois Northwestern University Medical School
- Use of Arteriovenous Shunts for Revascularization of the Ischemic Limbs PRESCOTT JORDAN, M D and CHARLES G JOHNSTON, M D , F A C S , Detroit, Michigan, Wayne University College of Medicine
- Preservation of Arterial Grafts in Solutions Containing Antibiotics Experimental Observations HAROLD RHEINLANDER, M D and ROBERT E GROSS, M D , F A C S , Boston, Massachusetts Harvard Medical School and The Children's Hospital
- Arterial Homografts HOWARD T ROBERTSON, M D , MARVIN JOHNSON, M D , HENRY SWAN, M D , F A C S , Denver, Colorado University of Colorado Medical Center
- The Fate of the Arterial Graft in Small Arteries HARRY H MILLER, M D , ALLAN D GALLOW, M D and C STUART WELCH, M D , M S , Ph.D , F A C S , Boston, Massachusetts, Tufts Medical College and New England Center Hospital
- Reconstruction of the Superior Mesenteric Vascular Axis in Dogs ARNOLD J KREMEN, M D and LOREN NELSON, M D , Minneapolis, Minnesota University of Minnesota Medical School
- Radioactive Isotope Index of Circulation in the Selection of Patients for Sympathectomy W INDECK, M D , M T FRIEDEL, M D , M S (SURG ), F A C S and F SCHAFFNER, Chicago, Illinois Hektoen Institute for Medical Research of Cook County Hospital, Stritch School of Medicine of Loyola University and The Peripheral Vascular Clinic of Mercy Hospital
- Reflex Peripheral Vasoconstriction Its Use in the Study of Patients Before and After Limb Sympathectomy CHARLES W ROBERTSON, M D , DOUGLAS A FARMER, M D and REGINALD H. SMITHWICK, M D , F A C S , Boston, Massachusetts Boston University School of Medicine
- The Use of Nor-Epinephrine as a Pressor Drug with Special Reference to Thoraco-Lumbar Sympathectomy, R A DETERLING, M D , VIRGINIA APGAR, M D and MARCEL GOLDENBERG, M D , New York, New York Columbia University College of Physicians and Surgeons and Presbyterian Hospital

### Neurosurgery

9 00 a m , Wednesday—8th Street Theatre

- HOWARD C NAFFZIGER, M D , F A C S , San Francisco, Professor of Surgery, University of California Medical School, Presiding
- The Transplantation of Tumors of the Human Central Nervous System into Animal Hosts JOHN MARTIN, M D , M S , Ph D , F A C S , Chicago, Illinois Northwestern University Medical School
- Extradural Hemorrhage—A Report of One Hundred Patients JOHN P GALLAGHER, M D , Washington, D C and E J BR WDER, M D , Brooklyn, New York
- Effect on Intracranial Pressure in Man of Newer Drugs and Hypertonic Solutions LOUIS BACKAY, M D and WILLIAM H SWEET, M D , Boston, Massachusetts Harvard Medical School
- Studies on the Sacral Reflex and in Paraplegia III Clinical Observations on Inhibitory Impulses Within the Sacral Reflex Arc ARNOLD M MEIROWSKY, M D and C DAVID SCHEIBERT, M D , Memphis, Tennessee Kennedy Veterans Administration Hospital
- Myelographic Demonstration of Avulsing Injuries of the Brachial Plexus A Method of Determining the Point of Injury and the Possibility of Repair FRANCIS MURPHEY, M D , Memphis, Tennessee, University of Tennessee College of Medicine, and JOHN W KIRKLIN, M D , Rochester, Minnesota Mayo Foundation
- Studies in Intracranial Pressure of Head Injuries I Basic Physiologic Observations FRANK F ESPEY, M D , HENRY W RYDER, M D , F VATNAR KRISTOFF, M D and JOSEPH P EVANS, M D , Ph D , F A C S , Cincinnati, Ohio University of Cincinnati College of Medicine
- Mesencephalo-Thalamotomy for the Treatment of Intractable Pain HENRY T WYCIS, M D , M S , F A C S and E A SPIEGEL, Philadelphia, Pennsylvania Temple University School of Medicine
- Carotid-Internal Jugular Anastomosis in the Monkey Certain Physiological Observations E S GURDJIAN, M S , Ph D , M D , F A C S and J E WEBSTER, M D , Detroit, Michigan Wayne University College of Medicine
- The Results of the Treatment of Cerebro-Vascular Accidents by Interruption of Cervical Sympathetic Impulses AVERILL STOWELL, M D , F A C S , Tulsa, Oklahoma Springer Clinic
- Topectomy Bifrontal Limited Cortical Ablation for the Treatment of Mental Illness J LAWRENCE POOL, M D , F A C S , New York, New York Columbia University College of Physicians and Surgeons
- The Usefulness of Radio-Active Substances in Studying Certain Aspects of Circulation in the Brain EDWARD B SCHLESINGER, M D and EDITH QUIMBY, M D , New York, New York Neurological Institute, Presbyterian Hospital
- Studies Upon the Altered Physiology of the Brain in Toxemias of Pregnancy MILTON L MCCALL, M D , F A C S and T VERNON FINCH, M D , Philadelphia, Pennsylvania Jefferson Medical College of Philadelphia
- A Method of Chronic Remote Electrical Stimulation of Nerves in Unanesthetized Animals JOHN J FARRELL, M D , Albany, New York Albany Medical College

*Thyroid, Lungs, Esophagus and Anesthesia**9 00 a m , Wednesday—Grand Ballroom, The Stevens*

- OWEN H WANGENSTEEN, M D , F A C S , Minneapolis, Professor of Surgery, University of Minnesota Medical School, Presiding
- The Uptake of Radioactive Iodine in Residual Thyroid Tissue Following Subtotal Thyroidectomy H. J. McCORKLE, M D , F A C S , EARL MILLER, M D , RICHARD GARDNER, M D , ROBERT JOHANSEN, M D (Presenter), MAURICE GALANTE, M D , KENNETH SCOTT, Ph D and MAYO SOLEY, M D , San Francisco, California University of California Medical School
- Experimental Study of the Effect of Occlusion of the Bronchial Arteries F HENRY ELLIS, JR, M D , JOHN H GRINDLAY, M D , M S (SURG), F A C S and JESSE E EDWARDS, M D , Rochester, Minnesota Mayo Foundation
- The Surgical Treatment of Intractable Bronchial Asthma T J E O'NEILL, M D , R P GLOVER, M D , and C P BAILEY, M D , M S , F A C S , Philadelphia, Pennsylvania The Hahnemann Medical College and Hospital of Philadelphia
- Physiological Studies in Children Following Pulmonary Resection RICHARD M PETERS, M D , ALBERT ROOS, M D and HARRISON BLACK, M D , St Louis, Missouri Washington University School of Medicine
- Use of the Mass Spectrometer in a Comparison of the Open and Closed Circuit Methods for Measuring Lung Volume ALLAN HEMINGWAY, M D , A O C NIER, M D , FLETCHER MILLER, M D , RICHARD L VARCO, M D , Minneapolis, Minnesota University of Minnesota Medical School
- The Use of Pre- and Postoperative Pulmonary Function Tests in Thoracic Surgery WILLIAM S BLAKEMORE, M D , Philadelphia, Pennsylvania University of Pennsylvania School of Medicine
- Controlled Respiration in Thoracic Surgery JOSEPH W STAYMAN, JR, M D , JOHN H. GIBBON, JR, M D , F A C S and FRANK F ALLBRITTON, JR, M D , F A C S , Philadelphia, Pennsylvania Jefferson Medical College of Philadelphia
- Effects of Positive Respiratory Pressure Upon the Circulation and Acid Base Balance of Open Chest Dogs A Comparison of Continuous with Phasic Lung Inflation and a Description of an Apparatus for the Application of Positive Pressure During Inspiration ALVIN M CAHAN, M D , HOWARD A FRANK, M D , F A C S and HENRY BANKS, B A , M D , Boston, Massachusetts Beth Israel Hospital
- Problems in Esophageal Anastomosis R W POSTLETHWAIT, M D , W RALPH DEATON, JR, M D (Presenter), H H BRADSHAW, M D , F A C S and R W WILLIAMS, Winston-Salem, North Carolina Bowman Gray School of Medicine of Wake Forest College
- The Extent to Which One May Interfere with the Blood Supply of the Esophagus and Obtain Healing on Anastomosis JOHN R PAINE, M D , JOSEPH T DAMERON, M D and JOSEPH E MACMANUS, M D , F A C S , Buffalo, New York Buffalo General Hospital and University of Buffalo School of Medicine
- The Use of Polyethylene in Reconstruction of Esophageal and Pharyngeal Defects CALVIN T KLOPF, M D , F A C S and HOWARD C PIERPONT, M D , Washington, D C George Washington University School of Medicine
- Renal and Hepatic Function Measured by Clearance and Venous Catheterization Techniques During Anesthesia and Surgery DAVID V HABIF, M D , W D BLAKE and S E BRADLEY, M D , New York, New York Columbia University College of Physicians and Surgeons
- An Analysis of the Effects of Spinal Anesthesia on Human Circulation B D KING, M D , L H PETERSON, A B , F E GREIFENSTEIN, M D and R D DRIPPS, A B , M D , Philadelphia, Pennsylvania University of Pennsylvania School of Medicine

*Stomach and Intestines**2 00 p m , Wednesday—North Ballroom, The Stevens*

- LESTER R DRAGSTEDT, M D , F A C S , Chicago, Professor and Chairman, Department of Surgery, University of Chicago School of Medicine, Presiding
- A Contribution to the Role of the Autonomic Nervous System in Gastric Secretion PAUL W SCHAFER, M D and C FREDERICK KITTLE, M D (Presenter), Kansas City, Kansas University of Kansas Medical Center
- A Study of the Extrinsic Nerve Supply Regulating Gastrointestinal Activity ROBERT M WHITROCK, M D and HENRY L TIECHE, M D , Ann Arbor, Michigan University of Michigan Medical School
- A Quantitative Study of the Effect of Vagotomy on Gastric Secretion in Total Pouch Dogs EDWARD R WOODWARD, M D , PAUL V HARPER, JR and LESTER R DRAGSTEDT, M S , Ph D , M D , F A C S , Chicago, Illinois University of Chicago School of Medicine
- Effect of Sympathetic and Parasympathetic Nerves on the Gastric Secretory Response of Total Pouch Dogs F JOHN LEWIS, M D , Minneapolis, Minnesota University of Minnesota Medical School
- The Effects of Lumbodorsal Splanchnicectomy Alone and Combined with Minimal Gastric Resection on the Gastric Secretory Mechanism JOHN J KNEISEL, M D , CHESTER W HOWE, M D , F A C S , PAUL F WARE, M D and REGINALD H SMITHWICK, M D , F A C S , Boston, Massachusetts Boston University School of Medicine and Massachusetts Memorial Hospitals

- Study of a Few Painful Gastrointestinal Disorders and Treatment by Celiac and Superior Mesenteric Ganglionectomy or by Vagotomy KEITH S GRIMSON, M D , F A C S , FRANK H LONGINO, M D , EUGENE J LINBERG and CHARLES E KERNODLE, M D , Durham, North Carolina Duke University School of Medicine
- Pathologic and Physiologic Effects of the Administration of Finely Ground Sand and Talc STEPHEN CHESSE, M D , DOROTHY CHESSE, M D , GEORGE OLANDER, M D and WILLIAM BANNER, M D , Chicago, Illinois University of Illinois College of Medicine
- The Use of Pancreatin in Reducing the Increased Fecal Nitrogen and Fecal Fat Loss Occurring After Total Gastrectomy TILDEN C EVERSON, M D , M S , MORTON I GROSSMAN, M D , PH D and ANDREW C IVY, M D , PH D , Chicago, Illinois, University of Illinois College of Medicine
- The Pathologic Distribution of Water and Electrolytes and the Loss of Red Cell Mass in Patients Following Perforated Duodenal Ulcer The Significance of the Findings to the Plan of Fluid Therapy JAMES R HOPKIRK, M D and OLIVER COPE, M D , F A C S , Boston, Massachusetts Harvard Medical School
- Identification of the Toxin of the Clostridium Organisms From Experimental Intestinal Obstruction RAYMOND E ANDERSON, M D and CARLOS A TANTURI, M D , Chicago, Illinois Northwestern University Medical School
- The Role of Clostridium Welchii in Strangulation Obstruction ISIDORE COHN, JR , M D and H R HAWTHORNE, M D , F A C S , Philadelphia, Pennsylvania University of Pennsylvania School of Medicine
- Experimental Evidence of Factors Concerned in the Viability and Eventual Recovery of Strangulated Intestine HAROLD LAUFMAN, M D , PH D , F A C S and HAROLD METHOD, M D , Chicago, Illinois Northwestern University Medical School
- The Use of Antibiotics in Experimental Closed Loop Obstruction in Small Bowel E B TOVEE, M D and MURRAY FLOCK, M D , Toronto, Ontario University of Toronto Faculty of Medicine

### *Wounds and Wound Healing, Burns, Infections and Shock*

*9 00 a m , Thursday—Grand Ballroom, The Stevens*

- MICHAEL L MASON, M D , F A C S , Chicago, Associate Professor of Surgery, Northwestern University Medical School, Presiding
- Studies in Experimental Frostbite JOSEPH C FINNERAN, M D and HARRIS B SHUMACKER, JR , M D , Indianapolis, Indiana Indiana University Medical Center
- Tissue Reactions to Waxes Derived From Spool Cotton Their Possible Relation to Suture Granulomata and Suture Extrusion NORMAN ROSENBERG, M D , F A C S , SYLVAN E MOOLTEN, M D , F A C P and LEO VROMAN, New Brunswick, New Jersey St Peter's General Hospital
- Experimental Study of the Rate of Healing of Tendon Grafts HARVEY S ALLEN, M D , F A C S , Chicago, Illinois Northwestern University Medical School
- Urine and Fecal Urobilinogen Excretion in Severe Burns G WATSON JAMES III, M D , O J PURNELL, M D and EVERETT IDRIS EVANS, B S , PH D , M D , F A C S , Richmond, Virginia Medical College of Virginia
- Experimental Study of the Effect of Heparinization and Gravity on Tissue Loss in Thermal Burns J ROBERT PARSONS, JR , M D , E MEREDITH ALDRICH, M D , M S (SURG ), F A C S and EDWIN P LEHMAN, M D , F A C S , Charlottesville, Virginia University of Virginia Department of Medicine
- Chloromycetin In Surgical Infections JEROME GIUSEFFI, M D and W A ALTEMEIER, M D , M S , F A C S , Cincinnati, Ohio University of Cincinnati College of Medicine
- The Appropriate Selection of Antibacterial Agents Evaluation of a Rapid Sensitivity Test CHESTER W HOWE, M D , F A C S and DOROTHEA J REILLY, M A , Boston, Massachusetts Boston University School of Medicine
- Completed Clinical Study of the Use of Hexachlorophene (G-11) in Phisoderm for Disinfection of the Skin BROMLEY S FREEMAN, M D , F A C S and THOMAS K. YOUNG, JR., M D , Temple, Texas McCloskey Veterans Administration Hospital
- A New Separation of Several Sets of Pathologic Mechanisms Which Occur During Different Kinds of Circulatory "Shock " M H KNISELY, L A CRANDAL, JR , S BARKER, E H BLOCH, A LIPSCOMBE, L WARNER, F BROOKS and L R DRAGSTEDT, M S , PH D , M D , F A C S Charleston S C , Medical College of the State of South Carolina, Memphis, Tennessee, University of Tennessee Medical School, and Chicago, Illinois, University of Chicago School of Medicine
- The Role of the Hypothalamus in the Pituitary-Adrenal Cortical Response to Stress DAVID M HUMF M D , Boston, Massachusetts Peter Bent Brigham Hospital and Harvard Medical School
- Effect of Sublethal Hemorrhage and Quantitative Replacement of Whole Blood on Circulating Blood Volume FRANK W SPICER, JR , M D , IRVING RUDMAN, M D , TYGE SONDERGAARD, M D , CARROL SHAVER, M D and JOHN D STEWART, M D , Buffalo, New York University of Buffalo Medical School and Edward J Meyer Memorial Hospital

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Capillary Permeability in Shock PHILIP B PRICE, M D, F A C S, RALPH L TINGEY, M D and FRANK K INUI, M D, Salt Lake City, Utah University of Utah College of Medicine  
 Effect of Intraintestinal Oxygen Insufflation on Portal and Hepatic Venous Oxygen Level in Hemorrhagic Shock THOMAS W GORMAN, M D, Montreal, Quebec McGill University Faculty of Medicine  
 Some Effects of Certain Drugs on the Vessels of the Cerebral Cortex of the Dog Mensuration of Vessel Caliber as Demonstrated Photographically Through an Arcylic Window DONALD B SWEENEY, M D and DOUGLAS W EASTWOOD, M D, Iowa City, Iowa Iowa University College of Medicine

1 00 p m, Thursday—Grand Ballroom, The Stevens

See separate program for Surgical Seminar Nutritional Problems Including a Consideration of the Use of Fluids and Electrolytes

Blood and Body Fluids, Porto-Caval Anastomosis and Cancer  
 9 00 a m, Friday—Grand Ballroom, The Stevens

HARRY A OBERHELMAN, M D, F A C S, Chicago, Professor and Chairman, Department of Surgery, Stritch School of Medicine of Loyola University, Presiding  
 Alterations in Coagulation Mechanism of the Blood in Postoperative Patients RICHARD WARREN, M D, F A C S, MARY A AMDUR, PH D, JOHN BELKO, M S and DONALD V BAKER, M D, Boston, Massachusetts Veterans Administration Hospital, West Roxbury and Harvard Medical School  
 Some Potential Dangers in Hypodermoclysis WATTS R WEBB, M D, and R. A LEMMER, M D, St Louis, Missouri Washington University School of Medicine  
 The Use of Iodinated Plasma Protein in the Study of Blood Volumes WILLIAM D HOLDEN, M D, F A C S, JOHN P STORASSLI, M D, HYMER L FRIEDEL, M D and HARVEY KRIEGER, M D, Cleveland, Ohio Western Reserve University School of Medicine and University Hospitals of Cleveland  
 The Application of Paper Partition Chromatography to the Analysis of Amino Acids in Animal Tissues and Body Fluids HARRIET A DAVIS, B A, Rochester, New York University of Rochester School of Medicine and Dentistry  
 Total Body Water Determination with Deuterium Oxide (Heavy Water) PAUL R SCHLOERB, M D, BENT J FRIIS-HANSEN, M D, ISIDORE S EDELMAN, M D and FRANCIS D MOORE, M D, F A C S, Boston, Massachusetts Peter Bent Brigham Hospital and Harvard Medical School  
 The Spectroscopic Analysis of Body Fluids EDGAR J POTH, M A, M D, PH.D, F A C S and VICTOR W NOWINSKI, PH D, Galveston, Texas University of Texas Medical Branch  
 Hepatic Function Measured by Clearance and Venous Catheterization Techniques Before and After Portocaval Anastomosis in Patients with Hepatic Cirrhosis A I S MACPHERSON, M B, CH B, F R C S E, J L BRANDT, P F ALPHONSO, A H BLAKEMORE, M D and S E BRADLEY, M D, New York, New York Columbia University College of Physicians and Surgeons  
 Amino Acid Tolerance in Experimental Portocaval Anastomosis HAROLD HARPER, PH D, RICHARD E GARDNER, M D (Presenter), ROBERT JOHANSEN, M D, MAURICE GALANTE, M D and H J MCCORKLE, M D, F A C S, San Francisco, California University of California Medical School  
 Experimental Hepatic-Portal Arteriovenous Fistulae J A SCHILLING, M D, F W MCKEE, M D and W WILT, M D, Rochester, New York University of Rochester School of Medicine and Dentistry  
 Visualization of Regional Lymph Nodes by Means of a Vital Staining Dye as an Aid in Radical Gastrectomy JOSEPH WEINBERG, M D, M Sc, F A C S and E M GREANEY, M D, Los Angeles Birmingham Veterans Administration Hospital, Van Nuys, California and University of California Medical School  
 Steroids and Radiation Sensitivity J B GRAHAM, M D and R M GRAHAM, Portland, Oregon University of Oregon Medical School  
 Auxiliary Carcinogens EDWARD L HOWES, M D, M S (MED), D Sc, F A C S, New York, New York Columbia University College of Physicians and Surgeons

# TWENTY-EIGHTH ANNUAL HOSPITAL STANDARDIZATION CONFERENCE—

*Monday, 10 00 a m—12 30 p m*

## GENERAL ASSEMBLY

DALLAS B. PHEMISTER, M D, F A C S, Chicago, president, American College of Surgeons, Presiding  
The Ever Present Challenge—Good Care of the Patient  
ARTHUR W. ALLEN, M D, F A C S, Boston, vice chairman, Board of Regents, American College of Surgeons  
The Health of the Nation—Our Greatest Asset HARRISON RAY ANDERSON, D D, Chicago, Pastor, Fourth Presbyterian Church

The Voluntary Hospital—The Foundation of the Present Hospital System REV JOHN W. BARRETT, Chicago, director of Catholic Hospitals, Archdiocese of Chicago, president, Catholic Hospital Association

Trends in Legislation Affecting Hospitals GEORGE BUGBEE, Chicago, executive director, American Hospital Association

Means for Diagnostic Facilities in Community Hospitals for Service to All PAUL B. MAGNUSON, M D, F A C S, Washington, D C, chief medical officer, Veterans Administration, Secretary, American College of Surgeons

Premiere Showing Injuries of the Peripheral Nerves Film Directed by LOYAL DAVIS, M S, PH D, M D, F A C S, Chicago, Professor of Surgery and Chairman of Division of Surgery, Northwestern University Medical School  
(Production made possible through a grant from the Johnson & Johnson Research Foundation)

*Monday, 2 00—5 00 p m*

Panel Discussion—Standards of Professional Services for the Good Care of the Patient as Rendered by  
The Radiologist, the Pathologist, the Anesthesiologist, the Physical Therapist

*Tuesday, 10 00 a m—12 30 p m*

Standards for the Institutional Care of Psychiatric Patients in Mental Hospitals, General Hospitals, Tuberculous Patients in Sanatoria, General Hospitals

*Tuesday, 2 00—5 00 p m*

The Medical Staff of the Hospital Basic Considerations in Organization, Duties and Responsibilities, Essentials of Adequate Medical Staff Organization, Control of Professional Work, Review and Analysis of Clinical Work

*Tuesday, 7 30—10 00 p m*

Special Collaborative Conference for Doctors, Hospital Trustees and Administrators

Theme Understanding and Cooperation from the standpoint of the Doctor, the Trustee, and the Administrator

*Wednesday, 8 00—9 30 a m*

Breakfast Conference on Public Relations—Joint Session for Press and Radio Representatives and Hospital and Medical Personnel

*Wednesday, 10 00 a m—12 30 p m*

Theme—Hospital Costs and Maintenance of Standards  
Present and Future Trends in Hospital Costs, Financial Responsibility for the Indigent, Blue Cross and Blue Shield Plans as Factors in Relieving the Hospital's Financial Burden

*Wednesday, 2 00—5 00 p m*

*Standards of Professional Services for the Efficient Care of the Patient in the Hospital*

Discussion based upon American College of Surgeons' Standards, and from the standpoints of Medical Staff Organization, Medical Records, Surgical Department, Medical Department, Obstetrical Department, Anesthesia Department

*Wednesday, 8 00—10 00 p m*

Discussion Conference with the Field Staff of the American College of Surgeons on the Activities of the College as they Affect Hospitals

Hospital Standardization and Point Rating, Graduate Training in Surgery, Medical Service in Industry, Library and Department of Literary Research, Medical Motion Pictures, Sectional Meetings, Committee on Trauma, Cancer Committee, Publications, Public Relations

*Thursday, 8 00—9 30 a m*

Breakfast Conference for Graduates and Administrative Residents of University Programs in Hospital Administration, and Course Directors

Experience Exchange My First Year of Administering a Hospital

*Thursday, 10 00 a m—12 30 p m*

Theme—Discussion of Current Problems in Hospitals

General Practice Division, Methods of Improving Medical Records, Dental Service, the Administrator and the Atom, Problems of the Small Hospital

*Thursday, 2 00—5 00 p m*

Forum on Trends in Hospital Administration, New Ideas and Special Hospital Problems

Selected topics from transcripts of graduates in hospital administration and administrative residents

*Thursday, 8 00—10 00 p m*

Open Forum on Nursing

Representatives of American Medical Association, American Hospital Association, American College of Surgeons, American College of Physicians, Catholic Hospital Association, American Protestant Hospital Association, American Nurses' Association, National League of Nursing Education, United States Public Health Service, U S Veterans Administration

*Friday, 10 00 a m—12 00 Noon*

*and 2 00—5 00 p m*

Demonstrations in Selected Chicago Hospitals

Arrangements will be made for hospital representatives to visit Chicago Hospitals for special features in which they are particularly interested

Workshop Conference with Field Staff of the American College of Surgeons on the Point Rating System method of evaluating hospitals

# AMERICAN COLLEGE OF SURGEONS

## COLOR TELEVISION FROM ST LUKE'S HOSPITAL

Normandy Lounge, The Stevens  
Demonstration made available by Smith, Kline & French  
Laboratories, Philadelphia  
Television Chairman FOSTER L. McMILLAN, M.D.,  
F.A.C.S., Chicago  
Television Co-Ordinator KENDALL A. ELSON, M.D., Phila-  
delphia

**Monday**  
1 30-2 30 Neurosurgery Craniotomy ERIC OLDBERG  
2 30-3 30 Ophthalmology Corneal Graft. JAMES W.  
CLARK  
3 30-4 30 General Surgery Hemorrhaphy T. P. HAN-  
SEN and ASSOCIATES

**Tuesday**  
8 30-9 15 Genitourinary Surgery Orchidectomy WIL-  
LIAM BAKER and ASSOCIATES  
9 30-10 15 Genitourinary Surgery Nephrectomy T. P.  
GRAUER and ASSOCIATES  
10 30-11 15 Gynecology Vaginal Hysterectomy E. A.  
EDWARDS and ASSOCIATES  
11 30-12 00 Gynecology Abdominal Hysterectomy E. A.  
EDWARDS and ASSOCIATES  
1 30-2 15 General Surgery Thyroidectomy H. I. MEYER.  
2 15-3 15 Plastic Surgery Skin Grafting Operation  
PAUL GREELEY  
3 30-4 30 General Surgery Appendectomy JOHN PRIB-  
BLE

**Wednesday**  
8 30-9 15 General Surgery Subtotal Gastric Resection  
FOSTER L. McMILLAN and ASSOCIATES

9 15-10 00 General Surgery Cholecystectomy E. LEE  
STROHL and ASSOCIATES  
10 15-11 00 General Surgery McArthur Autoplastic  
Hemorrhaphy W. G. DIFFENBAUGH  
11 15-12 00 General Surgery Common Bile Duct Ex-  
ploration CARL IRENEUS  
1 30-2 00 General Surgery Right Hemicolectomy GUY  
PONTIUS and ASSOCIATES  
2 15-4 30 General Surgery Esophageal Resection JOHN  
REYNOLDS

**Thursday**  
8 30-10 15 Thoracic Surgery Pneumonectomy WILLARD  
VAN HAZEL  
10 30-11 00 General Surgery Lumbodorsal Sympathec-  
tomy GEZA DE TAKATS  
1 30-2 00 Orthopedic Surgery Triple Arthrodesis of  
Ankle CLAUDE N. LAMBERT  
2 15-3 15 Orthopedic Surgery Cartilage Cup Arthro-  
plasty of Hip FREMONT CHANDLER  
3 30-4 30 Orthopedic Surgery Arthrotomy of Knee.  
JOHN NORCROSS

**Friday**  
8 30-9 15 General Surgery Radical Mastectomy CHARLES  
SHANNON and ASSOCIATES  
9 30-10 00 General Surgery Femoral Hemorrhaphy  
JOHN LINDQUIST  
10 15-11 00 General Surgery Hand Reconstruction  
Operation W. F. LYON and BURTON KILBOURNE  
11 15-12 00 General Surgery Leg Amputation with Re-  
irrigation Anesthesia H. E. Mock, Jr.

# PRELIMINARY CLINICAL PROGRAM

## CLINICS IN CHICAGO HOSPITALS

This program will be superseded by the final program of clinics which will be published in the *Clinical Bulletin* which will be distributed each day at the Registration Desk during the Clinical Congress

The participating hospitals and the hospital representatives are listed in a preceding section

### AUGUSTANA HOSPITAL

#### Tuesday

8 00-1 00 *General Surgery* Operative Clinic  
Selected cases NELSON M PERCY, OSCAR E NADEAU

#### Wednesday

8 00-10 00 *General Surgery* Operative Clinic  
Selected cases JOHN W NUZUM, CARL GARSIDE  
10 00-12 00 *Neurosurgery* Operative and Nonoperative Clinic  
Sympathectomy in Treatment of Pain WESLEY A GUSTAFSON  
10 00-12 00 *Gynecology* Operative and Nonoperative Clinic  
Complete Hysterectomy WILLIAM H BROWNE

#### Thursday

8 00-1 00 *General Surgery* Operative Clinic  
Selected cases NELSON M PERCY, OSCAR E NADEAU

### ALBERT MERRITT BILLINGS HOSPITAL

#### Tuesday

8 00-12 00 *General Surgery* Operative Clinics  
Vagotomy LESTER R DRAGSTEDT  
Carcinoma of Stomach WILLIAM E ADAMS  
8 00-12 00 *Neurosurgery* Operative Clinic  
Craniotomy THEODORE RASMUSSEN  
8 00-12 00 *Orthopedic Surgery* Nonoperative Clinic  
Grand Rounds HOWARD C HATCHER  
1 00-4 00 *Ophthalmology* Operative Clinics  
Cataract Extraction External Rectus Recession AR LINGTON C KRALSE

#### Wednesday

8 00-12 00 *General Surgery* Operative Clinics  
Carcinoma of the Large Bowel LESTER R DRAGSTEDT  
Coarctation of Aorta WILLIAM E ADAMS  
8 00-12 00 *Orthopedic Surgery* Operative Clinic  
On lay Bone Graft DALLAS B PHEMISTER  
8 00-12 00 *Genitourinary Surgery* Operative and Nonoperative Clinics  
Nephrectomy Cystectomy CHARLES B HUGGINS  
2 00-5 00 *Otolaryngology* Operative Clinics  
Fenestration JOHN R LINDSAY  
Radical Mastoidectomy HENRY B PERLMAN

#### Thursday

8 00-12 00 *General Surgery* Operative Clinics  
Vagotomy LESTER R DRAGSTEDT  
Carcinoma of Bowel J GARROTT ALLEN  
8 00-12 00 *General Surgery* Operative and Nonoperative Clinics  
Carcinoma of Thyroid DWIGHT E CLARK

8 00-12 00 *Orthopedic Surgery* Operative Clinic  
Local Resection of Tumor of the Bone C HOWARD HATCHER

2 00-5 00 *Otolaryngology* Operative Clinics  
Rhinoplasty HEINRICH G KOBRACK  
Panlaryngectomy HAROLD F SCHUCKNECHT

### CHICAGO LYING IN HOSPITAL

#### Monday

2 00-4 30 *Obstetrics and Gynecology* Nonoperative Clinics  
Cancer HERBERT P FRIEDMAN  
Cardiac Disease MARY LOU LILERT  
Ovarian Function M EDWARD DAVIS  
Cesarean Section WILLIAM J DIECKMANN  
Cancer Test SAMUEL LIPTON  
Vulva H CLOSE HESSELTINE  
Nutrition in Pregnancy DR MEILLER  
Erythroblastosis EDITH L POTTER

#### Tuesday

9 00-12 30 *Obstetrics and Gynecology* Operative Clinics  
Cesarean Section Gynecologic Operations WILLIAM J DIECKMANN  
2 00-4 30 *Obstetrics and Gynecology* Nonoperative Clinics  
Newborn Pediatrics W HEPNER  
Maternal and Fetal Mortality WILLIAM J DIECKMANN  
Infection H CLOSE HESSELTINE  
Menses and Weight Change MRS L RYNKIEWICZ  
Cancer Test. LESTER D ODELL  
Tuberculosis R H EBERT  
Gastrointestinal J B KIRSNER  
Bacteremia E C TURNER  
Premature Mortality EDITH L POTTER

#### Wednesday

9 00-12 30 *Obstetrics and Gynecology* Operative Clinics  
Cesarean Section and Gynecologic Operations H CLOSE HESSELTINE  
2 00-4 30 *Obstetrics and Gynecology* Nonoperative Clinics  
Spinal Anesthesia H PRIDDLE  
Chemistry Aids MR R L POTTINGER  
Newborn Pediatrics H WRIGHT  
Preeclampsia WILLIAM J DIECKMANN  
Delivery Weight Lost C P MCCARTNEY  
Abortion M EDWARD DAVIS  
Placental Removal LESTER D ODELL  
Liver Function R SMITTFER

#### Thursday

9 00-12 30 *Obstetrics and Gynecology* Operative Clinics  
Cesarean Section and Gynecologic Operations M EDWARD DAVIS  
2 00-4 30 *Obstetrics and Gynecology* Nonoperative Clinics  
Endocrine N FUGO  
Newborn Pediatrics D CASSELL  
Vulvar Fluorescence M EDWARD DAVIS  
Diabetes Mellitus H RICKETTS  
Congenital Syphilis EDITH L POTTER  
Infection H CLOSE HESSELTINE  
Enzymes LESTER D ODELL  
Mastitis H PRIDDLE

## CHILDREN'S MEMORIAL HOSPITAL

## Monday

2:00-4:00 *Orthopedic Surgery* Nonoperative Clinic  
General Orthopedic Clinic CHARLES N PEASE

## Tuesday

8:00-10:00 *Orthopedic Surgery* Operative Clinics  
Abdominal Extraperitoneal Section of Obturator Nerve  
Panarthrodesis of Foot. Transplant of Tendons of  
Toe Extensors Into Heads of Metatarsals CHARLES N  
PEASE

## Wednesday

9:00-11:00 *General Surgery* Operative Clinic  
Repair of Inguinal Hernia in Infants, 2 cases PAUL F  
FOX  
Surgical Division of Patent Ductus Arteriosus WILLIS  
J PORTS  
2:00-4:00 *Plastic Surgery* Operative Clinic  
Plastic Surgery on Neck, Repair of Cleft Lip FREDER-  
ICK W MERRIFIELD

## Thursday

9:00-11:00 *Urology* Operative Clinic  
Transplantation of Ureter for Extrophy of Bladder  
KNOWLTON BARBER.  
9:00-11:00 *General Surgery* Operative Clinic  
Aortic-Pulmonary Anastomosis for Pulmonary Stenosis  
WILLIS J PORTS

## Friday

10:00-12:00 *Otorhinolaryngology* Operative Clinic  
Bronchoscopic Clinic PAUL H HOLINGER.

## COOK COUNTY HOSPITAL

## Monday

8:00-12:00 *General Surgery* Operative Clinics  
EDWARD A. CHRISTOFFERSON, SAMUEL J FOGELSON,  
FRANCES H. STRAUS, LEO M ZIMMERMAN, WILLIAM  
M McMILLAN, RICHARD H LAWLER, HERMAN A  
JACOBSON  
8:00-10:00 *Gynecology* Operative Clinic  
FREDERICK H FALLS  
8:00-12:00 *Orthopedic Surgery* Operative Clinic  
HAMPAR KELIKIAN  
8:00-12:00 *Pediatric Surgery* Operative Clinic  
HARRY A OBERHELMAN  
1:30-4:00 *General Surgery* Operative Clinics  
JAMES J CALLAHAN, MANUEL E LICHTENSTEIN, LINDON  
SEED  
1:30-4:00 *Gynecology* Operative Clinic  
ABRAHAM F LASH  
1:30-4:00 *Neurosurgery* Operative Clinic  
HAROLD C VORIS

## Tuesday

8:00-12:00 *General Surgery* Operative Clinic  
Gastric Resection Cholecystomy KARL A MEYER,  
RAYMOND W MCNEALY  
8:00-10:00 *General Surgery* Operative Clinic  
EARLE I GREENE.  
8:00-12:00 *General Surgery* Operative and Nonoperative  
Clinic  
WILLIAM J PICKETT  
8:00-12:00 *General Surgery* Operative and Nonoperative  
Clinic  
Breast Tumors LOUIS P RIVER.

8:00-12:00 *Gynecology* Operative Clinics  
HARRY SERED, AARON E KANTER, WILLIAM H  
BROWNE  
8:00-10:00 *Genitourinary Surgery* Operative Clinic  
HARRY C ROLNICK.  
8:00-12:00 *Orthopedic Surgery* Operative and Non  
operative Clinic  
JAMES K STACK  
8:00-10:00 *Otorhinolaryngology* Operative Clinic  
Burns and Stenoses of the Esophagus JOHN WALSH  
RAY W KERWIN  
8:00-12:00 *Pediatric Surgery* Operative and Nonopera  
tive Clinic  
EGBERT H FELL  
9:00-11:00 *Maxillofacial Surgery* Operative Clinic  
Closing Large Defect of the Throat with Pedicle Flap  
in an Arresting Cancer Case JOSEPH E SCHAEFER  
9:00-12:00 *Maxillo-facial Surgery* Nonoperative Clinic  
Diagnosis of Cancer of the Head and Neck CARROLL  
W STUART  
1:30-4:00 *General Surgery* Operative Clinic Intestinal  
Surgery JOHN B O'DONOGHUE  
1:30-4:00 *General Surgery* Operative Clinics ARKELL  
M VAUGHN, LEON J ARIES, ROGER T VAUGHAN  
1:30-4:00 *Gynecology* Operative Clinic JACOB P  
GREENHILL  
1:30-4:00 *Neurosurgery* Operative Clinic MILTON TINS  
LEY

## Wednesday

8:00-12:30 *General Surgery* Operative Clinics  
Gall Bladder Disease MANUEL E LICHTENSTEIN  
Abdomino Perineal Resection RICHARD K GILCHRIST  
Left Hemicolectomy PETER A ROSI  
8:00-12:00 *General Surgery* Operative Clinics JOHN D  
KOUCKY, FRANK V THEIS, HAROLD I MEYER, WIL  
LIAM M McMILLAN  
8:00-12:00 *General Surgery* Operative and Nonoperative  
Clinic Hand Surgery HARVEY ALLEN  
8:00-12:00 *Genitourinary Surgery* Operative Clinics  
DORRIN F RUDNICK, WILLIAM J BAKER, HARRY C  
ROLNICK, ANDREW McNALLY  
8:00-10:00 *Otorhinolaryngology* Operative Clinic  
Endaural Approach for Chronic Suppuration of the Ear  
NORMAN LESHIN, SAMUEL J PEARLMAN  
8:00-12:00 *Orthopedic Surgery* Operative and Nonopera  
tive Clinic PHILIP LEWIN  
9:00-12:00 *Ophthalmology* Nonoperative Clinic Fundus  
Clinic DERRICK T VAIL, GAIL R SOPER AND AS  
SOCIATES  
10:00-12:00 *Gynecology* Operative Clinic ABRAHAM F  
LASH  
10:00-12:00 *Gynecology* Nonoperative Clinic Pathology  
ALEX B RAGINS  
10:00-12:00 *Maxillofacial Surgery* Operative Clinic  
Dieffenbach Repair of a Cancer of the Lip CASPER  
M EFSTEEN  
1:00-4:00 *Ophthalmology* Nonoperative Clinic Fundus  
Clinic JAMES E LEBENSOHN  
1:30-4:00 *Thoracic Surgery* Operative and Nonoperative  
Clinic GEORGE HOLMES, SAUL MACKLER  
1:30-4:00 *Gynecology* Operative Clinic. JAMES R. FITZ  
GERALD  
1:30-4:00 *General Surgery* Operative Clinic GEORGE L  
APFELBACH

## Thursday

8:00-12:00 *General Surgery* Operative Clinics SAMUEL  
J FOGELSON, EDWARD A CHRISTOFFERSON, GEORGE  
L APFELBACH, JAMES CALLAHAN, CARLO S SCUDERI,



- ROGER T VAUGHAN, HERMAN A JACOBSON, RICHARD H LAWLER.
- 8 00-10 00 *Otorhinolaryngology* Operative Clinic  
Fractures and Plastic Procedures of the Nose MORRIS COTTLE
- 8 00-12 00 *Maxillofacial Surgery* Operative Clinics  
Open Reduction of Fracture of Zygoma Open Reduction of Fracture of Bilateral of Mandible ORION H STUTEVILLE
- 8 00-12 00 *Gynecology* Operative and Nonoperative Clinic. EGAN W FISCHMANN
- 8 00-12 00 *Orthopedic Surgery* Operative and Nonoperative Clinic FRANK G MURPHY
- 8 00-12 00 *Pediatric Surgery* Operative and Nonoperative Clinic HARRY OBERHELMAN
- 9 00-12 00 *Ophthalmology* Nonoperative Clinic Fundus Clinic JOHN G BELLOW, JAMES R FITZGERALD
- 10 00-12 00 *Pathology* Nonoperative Clinic ALEX B RAGINS
- 10 00-12 00 *Radiography* Nonoperative Clinic IRWIN F HUMMON
- 1 00-4 00 *Ophthalmology* Nonoperative Clinic Fundus Clinic. CYRIL V CRANE AND ASSOCIATES
- 1 30-4 00 *Gynecology* Operative Clinic FREDERICK H FALLS
- 1 30-4 00 *General Surgery* Operative Clinic LEON J ARIES
- 1 30-4 00 *Neurosurgery* Operative Clinic MILTON TINSLEY
- 1 30-4 00 *Orthopedic Surgery* Operative Clinic FRED SHAPIRO

*Friday*

- 8 00-12 00 *General Surgery* Operative Clinics JOHN D KOUCKY, RICHARD K GILCHRIST, GEORGE L APFELBACH, LEO ZIMMERMAN, FRANCIS H. STRAUS
- 8 00-12 00 *General Surgery* Nonoperative Clinic  
Burns and Infections HARVEY S ALLEN, WILLIAM REQUARTH
- 8 00-12 00 *Gynecology* Operative Clinics HERBERT E SCHMITZ, AARON E KANTER, JACOB P GREENHILL, HARRY SERED, WILLIAM H BROWNE
- 8 00-12 00 *Orthopedic Surgery* Operative and Nonoperative Clinic DONALD S MILLER
- 8 00-12 00 *Pediatric Surgery* Operative and Nonoperative Clinic EGBERT H FELL.
- 1 30-4 00 *General Surgery* Operative Clinics ARKELL M VAUGHN, HAROLD I MEYER, LINDON SEED, JOHN B O'DONOGHUE
- 1 30-4 00 *Neurosurgery* Operative Clinic H. C VORIS

COOK COUNTY GRADUATE SCHOOL  
OF MEDICINE

*Monday*

- 9 00-11 00 *General Surgery* Nonoperative Clinic  
Indication for Surgery in Peptic Ulcer MANUEL E LICHTENSTEIN

*Tuesday*

- 9 00-12 00 *General Surgery* Nonoperative Clinics  
Chest Surgery GEORGE HOLMES  
Cancer of the Esophagus (Moire) PHILIP THOREK.  
Demonstration in Rectal Anatomy JOHN C BOODEL.  
Knee Joint Derangements GEORGE L APFELBACH

*Wednesday*

- 10 00-12 00 *General Surgery* Nonoperative Clinics  
Gastrostomy JACOB A GLASSMAN  
Clinical Problems in Upper Abdominal Conditions  
MANUEL E LICHTENSTEIN

*Thursday*

- 8 00-10 00 *General Surgery* Nonoperative Clinic Fe  
moral and Umbilical Hernia. RAYMOND W McNEALA
- 10 30-12 00 *General Surgery* Nonoperative Clinics  
Demonstrations—Exposures of Bones and Joints DON  
ALD S MILLER  
Demonstrations Colon Surgery JOHN HONSER.  
Tumors in the Thorax—Slides S MACKLER

*Friday*

- 8 00-12 00 *General Surgery* Nonoperative Clinics  
Colon Surgery KARL A MEYER.  
Surgery of the Biliary Passages MAX THOREK, PHILIP  
THOREK

EVANSTON MEMORIAL HOSPITAL

*Monday*

- 8 00-12 00 *Proctology* Operative Clinics J P NESSEL  
ROD
- 8 00-12 00 *General Surgery* Operative Clinics  
Abdominal Surgery FREDERICK CHRISTOPHER  
General Surgery MARCUS H HOBART
- 8 00-12 00 *Gynecology* Operative Clinics DAVID N  
DANFORTH, CHARLES E GALLOWAY
- 8 00-12 00 *Otolaryngology* Operative Clinics LYNN Mc  
BRIDE, THOMAS C GALLOWAY
- 8 00-10 00 *Urology* Operative Clinic Cystoscopy  
JAMES I FARRELL, J P NESSELROD
- 8 00-9 00 *Anesthesia* Nonoperative Clinic Anesthetic  
Problems J EARL REMLINGER
- 9 00-10 00 *General Surgery* Nonoperative Clinic Car  
cinoma Recto Sigmoid JAMES P GRIER
- 10 00-12 00 *Orthopedic Surgery* Nonoperative Clinics  
Calcium Deposit to Shoulder NEWTON C MEAD  
Painful Back VERNON C TURNER

*Tuesday*

- 8 00-12 00 *General Surgery* Operative Clinics  
General Surgery EDGAR C TURNER  
Thyroid J E KEARNS  
Abdominal Surgery JAMES P GRIER
- 8 00-12 00 *Gynecology* Operative Clinics R M GRIER,  
EDWARD S BURGE
- 8 00-10 00 *Otolaryngology* Operative Clinic L J LAW  
SON
- 8 00-10 00 *Genitourinary Surgery* Operative Clinic  
JAMES I FARRELL.
- 8 00-9 00 *Radiology* Nonoperative Clinic Radiation  
Carcinoma ANNA HAMANN
- 9 00-10 00 *Pathology* Nonoperative Clinic Discussion  
"Fresh" Pathological Lesions JOHN C McCARTER
- 10 00-12 00 *Ophthalmology* Operative Clinic G R  
SOPER
- 10 00-12 00 *Orthopedic Surgery* Operative Clinic  
NEWTON C MEAD
- 10 00-11 00 *Gynecology* Nonoperative Clinic Neo-Natal  
Immunization HENRY J ZETTELMAN
- 10 00-12 00 *Proctology* Operative Clinic Proctoscopic  
Examination J PEERMAN NESSELROD
- 11 00-12 00 *Laryngology* Nonoperative Clinic Tracheal  
Intubation in Treatment of Pseudomyelitis T C  
GALLOWAY

*Wednesday*

- 8 00-10 00 *Obstetrics* Operative Clinic WILLIAM G  
CUMMINGS
- 8 00-10 00 *General Surgery* Operative Clinic FREDERICK  
CHRISTOPHER

- 8 00-12 00 *Gynecology* Operative Clinics WILLIAM C DANFORTH, PHILIP F SCHNEIDER.  
 8 00-10 00 *Otolaryngology* Operative Clinic R H HENDERSON  
 8 00-10 00 *Proctology* Operative Clinic Proctoscopic Examination J P NESSELROD  
 8 00-10 00 *Obstetrics* Nonoperative Clinics Cervix in Pregnancy CHARLES E GALLOWAY  
 Pelvic Measurements DAVID N DANFORTH  
 10 00-12 00 *Gynecology* Operative Clinic HENRY J ZETTELMAN  
 10 00-12 00 *Orthopedic Surgery* Operative Clinic VERNON TURNER  
 10 00-12 00 *Ophthalmology* Operative Clinic MIRIAM D EUBANK  
 10 00-12 00 *Genitourinary Surgery* Operative Clinic Cystoscopy JAMES I FARRELL.  
 10 00-12 00 *General Surgery* Nonoperative Clinics Carcinoma of Breast JAMES P GRIER.  
 Radio-Active Iodine in Thyroid Disease. J EDWARD KEARNS, JR.

*Thursday*

- 8 00-12 00 *Genitourinary Surgery* Operative Clinics Cystoscopy JAMES I FARRELL.  
 8 00-12 00 *General Surgery* Operative Clinics General Surgery JAMES P GRIER.  
 Oral and Plastic Surgery FREDERICK W MERRIFIELD, J EDWARD KEARNS, JR  
 8 00-10 00 *Gynecology* Operative Clinic WILLIAM J BLACKWELL  
 8 00-10 00 *Otolaryngology* Operative Clinic Rhinoplasty T C GALLOWAY  
 8 00-12 00 *Proctology* Operative Clinics Proctoscopy J PEERMAN NESSELROD  
 8 00-9 00 *Anesthesia* Nonoperative Clinic Anesthetic Problems H DENNY  
 9 00-11 00 *General Surgery* Nonoperative Clinics Approaches to Abdominal Organs FREDERICK CHRISTOPHER  
 Cancer of Face and Mouth FREDERICK W MERRIFIELD  
 10 00-12 00 *Orthopedic Surgery* Operative Clinics NEWTON C MEAD, VERNON TURNER  
 11 00-12 00 *Proctology* Nonoperative Clinic Anatomy Rectal Glands J PEERMAN NESSELROD

*Friday*

- 8 00-12 00 *General Surgery* Operative Clinics J EDWARD KEARNS, JR, EDGAR C TURNER, FREDERICK CHRISTOPHER, MARCUS H HOBART  
 8 00-12 00 *Gynecology* Operative Clinics DAVID N DANFORTH, ROBERT M GRIER  
 8 00-12 00 *Ophthalmology and Otorhinolaryngology* Operative Clinic STAFF  
 8 00-12 00 *Proctology* Operative Clinics Cystoscopy Proctoscopy STAFF  
 8 00-9 00 *General Surgery* Nonoperative Clinic Ambulant Surgery, EDGAR C TURNER  
 9 00-10 00 *Anesthesia* Nonoperative Clinic Sympathetic Blocks in Vascular Problems J EARL REMLINGER.  
 10 00-12 00 *Gynecology* Nonoperative Clinics Pre-Sacral Sympathectomy WILLIAM J BLACKWELL.  
 Selected case EDWARD S BURGE.

## ILLINOIS EYE &amp; EAR INFIRMARY

*Monday*

- 10 00-4 00 *Ophthalmology* Operative and Nonoperative Clinics Cataract

*Tuesday*

- 10 00-4 00 *Ophthalmology* Operative and Nonoperative Clinics Glaucoma

*Wednesday*

- 10 00-4 00 *Ophthalmology* Operative and Nonoperative Clinics Retinal Detachment

*Thursday*

- 10 00-4 00 *Ophthalmology* Operative and Nonoperative Clinics Strabismus

*Friday*

- 10 00-4 00 *Ophthalmology* Operative and Nonoperative Clinics Orbital and Lid Plastic.

## ILLINOIS RESEARCH HOSPITAL

*Monday*

- 8 30 *General Surgery* Operative Clinics Hemimandibulectomy and Radical Neck Dissection for Alveolar Ridge Carcinoma DANIEL P SLAUGHTER  
 Ventral Hernia Fascial Repair JOHN T REYNOLDS  
 8 30 *Genitourinary Surgery* Operative Clinics Retropubic Prostatectomy Uretero pyeloplasty Hypospadias Repair Orchidopexy JOSEPH H KIEFER, CORNELIUS VERMUELEN  
 10 00 *Neurosurgery* Operative Clinics Neurosurgical Procedures Arteriogram OSCAR SUGAR.  
 1 00 *Orthopedic Surgery* Operative Clinic Arthrodesis of Foot Fixation of Slipped Femoral Epiphysis FRED W HARK  
 1 00 *Otolaryngology* Operative Clinic Resection of Right Maxilla JOSEPH G SCHOOLMAN

*Tuesday*

- 8 30 *Thoracic Surgery* Operative Clinic Thoracotomy for Mediastinal Tumor Pulmonary Lobectomy for Bronchiectasis WILLARD VAN HAZEL  
 8 30 *Vascular Surgery* Operative Clinic Lumbar Sympathectomy and Amputation of Lower Leg GEZA DE TAKATS  
 9 00 *Neurosurgery* Operative Clinic Neurosurgical Procedures Suboccipital Exploration ERIC OLDBERG  
 9 00 *Otolaryngology* Operative Clinic Endoscopic Examinations PAUL H HOLINGER.  
 1 00 *Otolaryngology* Operative Clinic Rhinoplasty OSCAR J BECKER.  
 2 30 *Otolaryngology* Operative Clinic Fascial Sling G KENNETH LEWIS

*Wednesday*

- 8 30 *General Surgery* Operative Clinic Splenectomy Cholecystectomy WARREN H. COLE.  
 8 30 *Plastic Surgery* Operative Clinic Plastic Operations PAUL W GREELEY  
 9 00 *Neurosurgery* Operative Clinic Neurosurgical Procedures Laminectomy ERIC OLDBERG  
 1 00 *Orthopedic Surgery* Operative Clinic Osteomyelitis of Tibia Resection of Scar of Tibia. THEODORE FOX.  
 1 00 *Obstetrics* Operative Clinics Cesarean Section Repair of Vesicovaginal Fistula Vaginal Hysterectomy and Repair for Prolapse, under Local Anesthesia FREDERICK H FALLS and STAFF



*Wednesday*

- 8 00-12 00 *General Surgery* Operative Clinics  
 Ductus Arteriosus Pyloric Stenosis JOHN L. KEELEY  
 AND ASSOCIATES  
 Gastric Resection. Pyloric Obstruction WM. J.  
 PICKETT AND ASSOCIATES  
 Pyloric Peptic Ulcer Gastric Resection ARKELL M.  
 VAUGHAN AND ASSOCIATES  
 Chronic Duodenal Ulcer Vagotomy ARKELL M.  
 VAUGHAN AND ASSOCIATES  
 Chronic Intestinal Obstruction and Common Duct Ob-  
 struction MANUEL E. LICHTENSTEIN AND ASSOCI-  
 ATES  
 Cholecystectomy Umbilical Hernia W. K. BATES  
 AND ASSOCIATES  
 Tuberculosis of Rectum Anal Fistulectomy Para-  
 rectal Abscess Hemorrhoidectomy CLEMENT L.  
 MARTIN AND ASSOCIATES  
 8 00-12 00 *Neurosurgery* Operative Clinics  
 Ventriculogram HAROLD C. VORIS AND ASSOCIATES  
 Laminectomy HAROLD C. VORIS AND ASSOCIATES  
 8 00 *Orthopedic Surgery* Operative Clinics  
 Surgical Repair of Spiral Fractures of Tibia, Femur, or  
 Humerus JOHN J. CLARIDGE, JOSEPH M. LEONARD,  
 AND ASSOCIATES  
 10 00-12 00 *Ophthalmology and Otorhinolaryngology* Op-  
 erative Clinics  
 Operations HERBERT NASH, CHARLES B. NASH  
 9 00-12 00 Nonoperative Clinics  
 Peripheral Vascular Diseases and Part Played by Radio-  
 active Isotopes MORRIS T. FRIEDWELL, WILLIAM  
 PICKETT, AND ASSOCIATES  
 Cancer of Bladder JOSEPH E. LAIBE

*Thursday*

- 8 00-1 00 *General Surgery* Operative Clinics  
 Carcinoma of the Head of the Pancreas Choledoch-  
 gastrojejunostomy Postoperative Ventral Hernia  
 ARKELL W. VAUGHAN AND ASSOCIATES  
 Direct Inguinal Hernia Appendectomy LOUIS D.  
 MOOREHEAD AND ASSOCIATES  
 Benign Adenoma Resection Benign Tumors of the  
 Breast Cancer of the Breast, Radical Mastectomy  
 LOUIS P. RIVERS AND ASSOCIATES  
 Thyroidectomy Cholecystectomy JOHN L. KEELEY  
 Carcinoma of Lung Pneumonectomy Pleural Decorti-  
 cation GEORGE W. HOLMES  
 8 00 *Orthopedic Surgery* Operative Clinics  
 Open Reduction of Fractures of the Neck of Femur,  
 Use of the Scuderi Callahan Flange. CARLO SCUDERI,  
 EDWARD SCHREY, AND ASSOCIATES  
 10 00-1 00 *Ophthalmology and Otorhinolaryngology* Opera-  
 tive Clinics  
 Operations CARL CHRISTOPHER, MERTON B. SKINNER,  
 DAVID B. MAHER.  
 9 00-12 00 Nonoperative Clinics  
 Present-day Concepts of Thoracic Surgery GEORGE W.  
 HOLMES, WILLIAM LEES AND ASSOCIATES  
 Clinical Pathological Conference FRED STONE AND  
 ASSOCIATES

*Friday*

- 8 00-12 00 *General Surgery* Operative Clinics  
 Carcinoma of the Sigmoid HARRY A. OBERHILMAN  
 AND ASSOCIATES  
 Hemorrhoidectomy Ligation of Saphenous Veins  
 JOHN B. CONDON  
 Right Hemicolectomy Cancer of Sigmoid ARKELL  
 W. VAUGHAN AND ASSOCIATES

- Cancer of Sigmoid Left Hemicolectomy JOHN B.  
 O'DONOGHUE AND ASSOCIATES  
 Chronic Intestinal Obstruction Mastectomy WILLIAM  
 J. PICKETT  
 Cancer of Breast, Mastectomy MICHAEL F. MCGUIRE  
 8 00 *Neurosurgery* Operative Clinics  
 Craniotomy HAROLD C. VORIS AND ASSOCIATES  
 10 00-1 00 *Ophthalmology and Otorhinolaryngology* Op-  
 erative Clinics  
 Operations THOMAS J. NAUGHTON, FRANK W. NEWELL.  
 9 00-12 00 Nonoperative Clinics  
 Surgical Problems of Infancy JOHN L. KEELEY AND  
 ASSOCIATES

## MICHAEL REESE HOSPITAL

*Monday*

- 8 00-12 00 *General Surgery* Operative Clinics  
 Carcinoma of Colon SIDNEY F. STRAUSS  
 Radical Mastectomy SAMUEL GOLDBERG  
 Colon Cases MORRIS L. PARKER.  
 Thyroidectomy LEO M. ZIMMERMAN  
 Lumbar Sympathectomy SAMUEL PERLOW  
 8 00-12 00 *Gynecology* Operative Clinics  
 Vaginal Hysterectomy LESTER E. FRANKENTHAL  
 Vaginal Plastic. RALPH A. REIS  
 Ovarian Resection IRVING F. STEIN  
 Vaginal Hysterectomy EDWIN J. DE COSTA  
 8 00-12 00 *Otolaryngology* Operative Clinics  
 Rhinoplasty and Otoplasty SAMUEL SALINGER, BER-  
 NARD M. COHEN  
 2 00-4 00 *Neurosurgery* Operative Clinics Selected  
 Cases I. JOSHUA SPIEGEL.

*Tuesday*

- 8 00-12 00 *General Surgery* Operative Clinics  
 Gall Bladder and Common Duct Surgery RALPH B.  
 BETTMAN  
 Surgery of the Stomach ALFRED A. STRAUSS  
 General Surgery WILLIAM J. TANNENBAUM  
 Chest Surgery SAUL ALLEN MACKLER.  
 8 00-12 00 *Orthopedic Surgery* Operative Clinics  
 Bone and Joint Surgery PHILIP LEWIN, S. H. FRAER-  
 MAN  
 Orthopedic Cases SIDNEY SIDEMAN, IRVING WOLIN,  
 FRANK GLASSMAN  
 Bone Surgery LOUIS SCHEMAN  
 8 00-12 00 *Otolaryngology* Operative Clinics  
 Rhinoplasty O. J. BECKER  
 2 00-4 00 *Neurosurgery* Operative Clinics  
 Selected Cases MILTON TINSLEY

*Wednesday*

- 8 00-12 00 *General Surgery* Operative Clinics  
 Selected Cases NATHAN N. CROHN  
 Gastrointestinal Cases MORRIS L. PARKER.  
 Gall Bladder Surgery MANUEL LICHTENSTEIN  
 Selected Cases MORRIS T. FRIEDEL.  
 8 00-12 00 *Urology* Operative Clinics  
 Selected Cases HARRY C. ROLNICK, IRVING J. SHAPIRO  
 2 00-4 00 *Otolaryngology* Operative Clinics  
 Rhinoplasty and Otoplasty O. J. BECKER.

*Thursday*

- 8 00-12 00 *General Surgery* Operative Clinics  
 Selected Cases. SAMUEL GOLDBERG, HAROLD LAUFMAN,  
 ERNEST D. BLOOMENTHAL, ARTHUR H. SCHWARTZ,  
 DAVID H. WAGNER.  
 Gastrointestinal Cases. ALFRED A. STRAUSS, SIEGFRIED  
 F. STRAUSS

- 8 00-12 00 *Gynecology Operative Clinics*  
 Total Abdominal Hysterectomy MICHAEL L LEVEN-  
 THAL  
 Radical Wertheim ABRAHAM F LASH  
 Abdominal Hysterectomy J P GRENFILL  
 8 00-12 00 *Otolaryngology Operative Clinics*  
 Rhinoplasty SAMUEL SALINGER, BERNARD M COHEN

## Friday

- 8 00-12 00 *General Surgery Operative Clinics*  
 Diaphragmatic Hernia RALPH B BITTMAN  
 Selected Cases NATHAN N CROWN, MILTON W FISEN-  
 STEIN, RICHARD M BENDIN, GERALD J MENAKER,  
 CHARLES A SCHIFF  
 8 00-12 00 *Orthopedic Surgery Operative Clinics*  
 Selected Cases JEROME G FINDER, HARRY R BAR-  
 VETT, LEONARD WEINSTEIN  
 10 00-12 00 *Gynecology Operative Clinics*  
 Cesarean Section HENRY BUNBAUM

## MOUNT SINAI HOSPITAL

## Monday

- 8 00-12 00 *Orthopedic Surgery Operative Clinics*  
 Orthopedic Surgical Clinic LEO F MILLER  
 Drop Graft for Non Union of Tibia DONALD MILLER  
 8 00-12 00 *Obstetrics Operative Clinics*  
 Cesarean Section S J BENENSON  
 Porro Cesarean Section CHARLES FIELDS  
 10 00-12 00 *Gynecology Operative Clinic*  
 Vaginal Hysterectomy HAROLD BRILL

## Tuesday

- 8 00-12 00 *General Surgery Operative Clinic* Congenital  
 Heart Case I GERT H FELL, BENJAMIN M GASUL  
 8 00-12 00 *Gynecology Operative Clinic* Vaginal Hys-  
 terectomies for Pelvic Herniosis A F LASH

## Wednesday

- 8 00-12 00 *Gynecology Operative Clinic* Vaginal Hys-  
 terectomies and Vaginal Plastics AARON E KANTER  
 8 00-12 00 *General Surgery Operative Clinic* Gastric  
 Resections ALFRED A STRAUSS, SIEGFRIED F  
 TRAUSS

## Thursday

- 8 00-12 00 *General Surgery Operative Clinics*  
 Resection of Colon LARLE I GREFNE  
 Thyroidectomy JOSEPH T GAULT  
 Common Bile Duct Reconstruction LEON J ARIES  
 Sphenous Vein Ligation L WILLARD SHABAT  
 Removal of Foreign Bodies (Needles from Hand and  
 Foot) Demonstration of Electrical Forceps and New  
 Screen Localizer DAVID V WILLIS  
 1 00-4 00 *Neurosurgery Operative Clinic* Neuro-Sur-  
 gical Cases MILTON TINSLEY

## Friday

- 8 00-12 00 *Urology Operative Clinics*  
 Retropubic Prostatectomy HARRY C ROLNICK  
 Transurethral Prostatectomy LEO A MASLOW  
 11 00-12 00 *Pathology Nonoperative Clinic* Clinical  
 Pathological Conference I DAVIDSON

## PASSAVANT MEMORIAL HOSPITAL

## Monday

- 8 00-11 00 *Neurosurgery Operative Clinic* LOYAL  
 DAVIS

- 8 00-11 00 *Gynecology Operative Clinic* JOHN I  
 BREWER  
 8 00-11 00 *Urology Operative Clinic* LEANDER W  
 RIBA  
 8 00-12 00 *General Surgery Operative Clinic* SUMNER  
 L KOCH, MICHAEL L MASON, HARVEY S ALLAN  
 8 00-12 00 *Ophthalmology Operative Clinic* DERRICK  
 T VAIL, IRVING PUNTENFY  
 1 00-4 00 *Orthopedic Surgery Operative Clinic* JAMES  
 K STACK, WILLIAM A LARMON

## Tuesday

- 8 00-11 00 *General Surgery Operative Clinics* JOHN A  
 WOLFFER, THOMAS C DOUGLASS, and WALTER W  
 CARROLL  
 8 00-11 00 *Urology Operative Clinic* KNOWLTON I  
 BARBER  
 8 00-12 00 *Gynecology Operative Clinic* JOHN W  
 HUFFMAN  
 1 00-4 00 *General Surgery Operative Clinic* BENJAMIN  
 F LOUNSBURY  
 1 00-4 00 *Urology Operative Clinic* FREDERICK A  
 LLOYD  
 1 00-4 00 *Gynecology Operative Clinic* STUART ANEL  
 3 00-5 00 *Orthopedic Surgery Nonoperative Clinic*  
 EMIL D W HAUSER

## Wednesday

- 8 00-11 00 *Neurosurgery Operative Clinic* LOYAL DAVIS  
 8 00-11 00 *Gynecology Operative Clinic* JOHN I  
 BREWER  
 8 00-11 00 *Urology Operative Clinic* LEANDER W  
 RIBA  
 8 00-12 00 *General Surgery Operative Clinic* SUMNER  
 L KOCH, MICHAEL L MASON, HARVEY S ALLAN  
 8 00-12 00 *Ophthalmology Operative Clinic* DERRICK T  
 VAIL, IRVING PUNTENFY  
 1 00-4 00 *Orthopedic Surgery Operative Clinic* JAMES  
 K STACK, WILLIAM A LARMON  
 1 00-5 00 *Thoracic Surgery Operative Clinic* GEORGE  
 W HOLMES

## Thursday

- 8 00-11 00 *General Surgery Operative Clinics* JOHN A  
 WOLFFER, THOMAS C DOUGLASS, WALTER W CARROLL  
 8 00-11 00 *Urology Operative Clinic* KNOWLTON I  
 BARBER  
 8 00-12 00 *Gynecology Operative Clinic* JOHN W  
 HUFFMAN  
 1 00-4 00 *General Surgery Operative Clinic* BENJAMIN  
 F LOUNSBURY  
 1 00-4 00 *Urology Operative Clinic* FREDERICK A  
 LLOYD  
 1 00-4 00 *Gynecology Operative Clinic* STUART ANEL  
 3 00-5 00 *Orthopedic Surgery Nonoperative Clinic* EMIL  
 D W HAUSER

## Friday

- 8 00-11 00 *Neurosurgery Operative Clinic* LOYAL DAVIS  
 8 00-11 00 *Gynecology Operative Clinic* JOHN I  
 BREWER  
 8 00-11 00 *Urology Operative Clinic* LEANDER W  
 RIBA  
 8 00-12 00 *General Surgery Operative Clinic* SUMNER  
 L KOCH, MICHAEL L MASON, HARVEY S ALLAN  
 8 00-12 00 *Ophthalmology Operative Clinic* DERRICK T  
 VAIL, IRVING PUNTENFY  
 1 00-4 00 *Orthopedic Surgery Operative Clinic* JAMES  
 K STACK, WILLIAM A LARMON

## PRESBYTERIAN HOSPITAL

## Monday

- 8 30-12 30 *Genitourinary Surgery* Operative Clinics  
Urological Operations HERMAN L KRETSCHMER,  
NORRIS J HECKEL, ROBERT H HERBST, JAMES W  
MERRICKS
- 9 00-12 00 *General Surgery* Nonoperative Clinics  
Arterial Disease of the Extremities FRANK V THEIS  
Prophylactic Use of Anticoagulants in the Prevention of  
Pulmonary emboli JOHN H OLWIN  
Treatment of Thrombophlebitis RUSSELL C HANSEL-  
MAN
- 12 30-1 30 *General Surgery* Nonoperative Clinic Basic  
Science Seminar CHARLES B TAYLOR.
- 1 30-5 30 *Otorhinolaryngology* Operative Clinics  
Repair of Oro-antral Fistula LINDEN J WALLNER  
Techniques of Laryngoscopy, Bronchoscopy and Esoph-  
agoscopy STANTON A FRIEDBERG  
Fenestration Surgery FRANK WOJNIAK  
Rhinoplasty GORDON H SCOTT
- 1 30-5 30 *Ophthalmology* Nonoperative Clinics  
Methods of Cataract Extraction JUSTIN M DONEGAN  
Retraction Syndrome CHARLES F WILSON  
Beta Irradiation in Relation to the Eye. WILLIAM F  
HUGHES, JR.  
Scleral Resection THOMAS D ALLEN

## Tuesday

- 8 30-12 30 *General Surgery* Operative Clinics  
Gastric Resection R KENNEDY GILCHRIST  
Cancer of Rectum, Abdominal Perineal Resection  
VERNON C DAVID
- 9 00-11 00 *General Surgery* Nonoperative Clinics  
Results of the Rouxy preparation for cicatricial contrac-  
tion of the common bile duct CHARLES B PUESTOW  
Gastro jejunal colic fistula STANLEY E LAWTON
- 11 30-12 15 *Genitourinary Surgery* Nonoperative Clin-  
ics  
Nephrectomy in Hypertension Due to Unilateral Renal  
Insufficiency Case Reports JAMES W MERRICKS  
The Use of Anticoagulants (Dicumarol, Heparin) After  
Trans urethral Prostatic Surgery JOHN H OLWIN,  
FRANK B PAPIERNIAK  
A Clinical Study and Review of 100 Consecutive Bladder  
Tumors IRVIN T RIEGER.
- 12 30-4 30 *General Surgery* Nonoperative Clinics  
Tumor Clinic FRANCIS H STRAUS  
Recent Advances in the Treatment of Carcinoma  
DANLEY P SLAUGHTER.  
Therapy of Massive Keloid Formation CLARENCE W  
MONROE  
Use of Hypertonic Solution in Enteric Perfusion FRED-  
ERIC A DE PEYSTER
- 1 30-3 30 *Orthopedic Surgery* Operative Clinic Arthro-  
plasty of the Hip with Use of a Vitallium Cup ELVEN  
J BERKHEISER.

## Wednesday

- 8 30-9 30 *General Surgery* Operative Clinic  
Gastric Surgery FRANCIS H STRAUS
- 9 00-10 00 *General Surgery* Nonoperative Clinic Sur-  
gical Therapy of Coarctation of the Aorta EGBERT  
H FELL.
- 9 30-10 30 *Orthopedic Surgery* Operative Clinic  
Arthroscopy on Knee KELLOGG SPEED
- 10 00-11 00 *General Surgery* Nonoperative Clinic  
Physiologic Considerations in the Diagnosis and Ther-

- apy of Congenital and Acquired Heart Disease  
JAMES A CAMPBELL
- 10 30-12 30 *General Surgery* Operative Clinic Division  
of a Patent Ductus Arteriosus EGBERT H FELL.
- 11 00-12 00 *Genitourinary Surgery* Nonoperative  
Clinics  
Biochemical Procedures as an Aid in the Diagnosis of  
Urological Disease. DOUGLAS A MACFADYEN  
The Artificial Kidney and Fluid Balance S HOWARD  
ARMSTRONG, JR  
Hyperparathyroidism and Renal Calculi GEORGE M  
HASS  
The Management of Acute Cardiac Failure OGLESBY  
PAUL.
- 12 30-1 15 *General Surgery* Nonoperative Clinic  
Clinical Pathological Conference GEORGE M HASS
- 1 30-4 30 *Neurosurgery* Operative and Nonoperative  
Clinic  
Metastatic Brain Tumor ADRIEN VERBRUGGHEN
- 1 30-2 30 *General Surgery* Nonoperative Clinic Bowel  
Obstruction in the Newborn, Experience with Vagot-  
omy for Peptic Ulcer EDWIN M MILLER.
- 2 30-4 30 *Gynecology* Nonoperative Clinics  
Study of Endometriosis HARRY BOYSEN  
Stump Carcinoma RICHARD H ANDRESEN

## Thursday

- 8 30-12 30 *General Surgery* Operative Clinics  
Exploration of the Common Bile Duct. EDWIN M  
MILLER  
Excision of Pulmonary Cyst JOHN M DORSEY
- 9 00-10 30 *General Surgery* Nonoperative Clinics  
Tetrazolium Reaction in Living Tissues FRANCIS H  
STRAUS  
Immediate Skin Grafts for Tissue Loss ARTHUR E  
DIGGS
- 10 30-11 00 *Orthopedic Surgery* Nonoperative Clinic  
Hip Joint Fusion. KELLOGG SPEED
- 11 00-12 15 *Genitourinary Surgery* Nonoperative Clinics  
The Management of Bladder Neck Obstructions HER-  
MAN L KRETSCHMER  
The Diagnosis and Treatment of Undescended Testes  
NORRIS J HECKEL  
Life Expectancy in Papillomata of the Bladder ED-  
WARD A STIKA  
The Diagnosis and Treatment of Male Infertility W  
A Rosso
- 1 30-4 30 *Gynecology* Operative Clinics  
Vaginal Hysterectomy EDWARD D ALLEN  
Plastic Repair of a Prolapse FRED O PRIEST  
Complete Abdominal Hysterectomy AARON E KAN-  
TER
- 1 30-4 30 *General Surgery* Nonoperative Clinics  
Surgery in Diverticulitis of the Colon R KENNEDY  
GILCHRIST  
Surgical Therapy of the Patent Ductus CARL DAVIS,  
JR  
Surgical Approach to the Sciatic and Tibial Nerves  
H H HAMILIN

## Friday

- 8 30-12 30 *General Surgery* Operative Clinics  
Surgery of the Common Duct CHARLES B PUESTOW  
Gastric Surgery HILLIER L BAKER.
- 1 30-5 30 *General Surgery* Operative Clinics  
Operative Surgery for Cancer of the Mouth DANLEY  
P SLAUGHTER.  
Cleft Lip and Palate Surgery LOUIS W SCHULTZ

## ST ELIZABETH'S HOSPITAL

*Monday*

- 8 00-10 00 *General Surgery* Operative Clinic, Abdominal Surgery MARTIN G LUKE, JOHN P WOJTALEWICZ, MARIO V COOK  
 10 00-12 00 *Genitourinary Surgery* Operative Clinic Kidney Extirpation EDWARD F HESS, JOHN A LOEF

*Tuesday*

- 8 00-10 00 *General Surgery* Operative Clinic Abdominal Surgery EDWARD B KALVELAGE, A J NICOSIA  
 9 00-11 00 *Pathology* Nonoperative Clinic Pathological Anatomy of Trauma, J J KEARNS

*Wednesday*

- 8 00-10 00 *Ophthalmology* Operative Clinic Cataract EDWARD A ROLING  
 10 00-12 00 *General Surgery* Operative Clinic Gall Bladder FRANK J LAVIERI  
 8 00-12 00 *Obstetrics and Gynecology* Operative Clinics Cesarean Section FRANK J WALSH, EUGENE W OSTROM, HOWARD GANSER  
 Obstetrical Complications JACK R. LAVIERI, JOSEPH LIEBLING, JOHN J DONLON

*Thursday*

- 8 00-10 00 *Orthopedic Surgery* Operative Clinic General Orthopedics CARLO S SCUDERI, EDWARD L SCHREY  
 10 00-12 00 *General Surgery* Operative Clinic General JOSEPH K NARAT, ARTHUR F CIPOLLA

*Friday*

- 8 00-10 00 *General Surgery* Operative Clinic General A J LINOWIECKI, LIBORIO FIGUEROA  
 10 00-12 00 *Radiology* Nonoperative Clinic Radiographic Aspects of Hiatus Hernia JULIUS BRAMS

## ST JOSEPH HOSPITAL

*Monday*

- 10 00-12 00 *General Surgery* Nonoperative Clinics Gastric Surgery FRANKLIN B MCCARTY  
 A Demonstration of Intracapsular Fracture of Neck of Femur, with Demonstration of Use of Bone Transplant and Screws, without Immobilization of Hips HUGH MCKENNA

*Tuesday*

- 10 00-12 00 *Gynecology* Operative Clinics Gynecologic Operations LEONARD A KRATZ  
 10 00-12 00 *General Surgery* Nonoperative Clinics General Surgery BERTRAM J FITZGERALD  
 Management of Hypertrophic Pyloric Stenosis LEONARD A KRATZ  
 10 00-12 00 *Genitourinary Surgery* Nonoperative Clinic Management of cases of Ureteral Stone. JOSEPH H KIEFER.

*Thursday*

- 10 00-12 00 *Gynecology* Operative Clinic Gynecologic Operations JOHN DURBURG  
 10 00-12 00 *General Surgery* Nonoperative Clinics Gastric Surgery FRANKLIN B MCCARTY  
 Management of Fractures of Neck of Femur Whitman Reconstruction Operation EUGENE A HAMILTON  
 Varicose Veins BERTRAM J FITZGERALD

*Friday*

- 10 00-12 00 *General Surgery* Nonoperative Clinics Demonstration of Cases Operated upon for Obstruction of Bowel, with Follow-up Treatment. HUGH MCKENNA  
 10 00-12 00 *Urology* Nonoperative Clinic Pediatric Urology JOSEPH H KIEFER.

## ST LUKE'S HOSPITAL

*Wednesday*

- 8 00-12 00 *Bronchology* Laryngoscopies (4 cases), Bronchoscopies (4 cases), Esophagoscopies (4 cases), Mercury Bougie, Esophageal Dilatations (2 cases), Pneumatic Esophageal Dilatation (1 case), PAUL HOLINGER, ALBERT H ANDREWS, JR, AND KENNETH JOHNSTON  
 The balance of the clinical program at St Luke's Hospital will be televised to the Normandy Lounge at The Stevens See separate television program

## ST MARY OF NAZARETH HOSPITAL

*Tuesday*

- 8 00-12 00 *General Surgery* Operative Clinics Gastric Resection, Cholecystectomy TADEUSZ M LARKOWSKI  
 Extra Peritoneal Suspension of Uterus, Reconstruction of Ovary and Appendectomy ANTHONY S SAMPOLENSKI  
 1 00-3 00 *General Surgery* Operative Clinic Cholecystectomy, Radical Breast Amputation GEORGE MUELLER

*Wednesday*

- 8 00-12 00 *General Surgery* Operative Clinics Abdominal Perineal Resection of Carcinoma of the Rectum TADEUSZ M LARKOWSKI, ANTHONY S SAMPOLENSKI, EDWARD H WARSZEWSKI  
 Recurrent Hernia, Dermal Graft, New Technique EDWARD H WARSZEWSKI, JOSEPH G KOSTRUBALA  
 Thyroidectomy EDWARD H WARSZEWSKI  
 1 00-3 00 *Otology* Operative Clinic Fenestration MAURICE F SNITMAN

*Thursday*

- 8 00-12 00 *Thoracic Surgery* Operative Clinics Lobectomy, Thoracoplasty MINAS JOANNIDES  
 1 00-2 00 *Urology* Operative Clinic Cystoscopic Examinations JOSEPH WELFELD  
 2 00-3 00 *Plastic Surgery* Operative Clinic Plastic-Nasal Septum FRANK J PISZKIEWICZ.

*Friday*

- 8 00-10 00 *Orthopedic Surgery* Operative Clinic Fracture of Hip and Neck of Humerus—Open Reduction GEORGE L APFELBACH  
 10 00-12 00 *Plastic Surgery* Operative Clinic Reconstruction of Face JOSEPH G KOSTRUBALA

VETERANS ADMINISTRATION HOSPITAL,  
HINES, ILLINOIS*Monday*

- 8 00-12 00 *General Surgery* Operative Clinics Gastro-Esophagostomy CHARLES B PUESTOW  
 Abdomino Perineal Resection WILLIAM E LOONY  
 8 00-12 00 *Neurosurgery* Operative Clinic Osteoplastic Craniotomy JOHN MARTIN

8 00-12 00 *Orthopedic Surgery* Operative Clinics  
Spinal Fusion for Spondylolisthesis, Arthrotomy of  
Knee. FRED W HARK.  
Resection, Distal End, Clavicle, Triple Arthrodesis  
HERMAN JOFFE

8 00-12 00 *Tumor Surgery* Operative Clinic Radical  
Laryngectomy MAURICE F SNITMAN

8 00-12 00 *Thoracic Surgery* Operative Clinic Bron-  
choscopies GEORGE W HOLMES

8 00-12 00 *Plastic Surgery* Operative Clinics  
Scar, Left Side of Face and Neck, Excision of Scar  
Burns, Both Legs, Split-Thickness Skin Graft to Both  
Legs CLARENCE W MONROE

8 00-12 00 *Vascular Surgery* Operative Clinic

Lumbar Sympathectomy ORMAND C JULIAN

8 00-12 00 *Otorhinolaryngology* Operative Clinics  
Bronchoscopies, Esophagoscopy, Tonsillectomy HAR-  
KISHEN SINGH

1 00-5 00 *Orthopedic Surgery* Operative Clinic  
Vitalium Cup Arthroplasty of the Hip WILLIAM A  
LARMON

1 00-5 00 *Thoracic Surgery* Operative Clinic  
Thoracoplasty 1st Stage GEORGE W HOLMES

### Tuesday

8 00-12 00 *General Surgery* Operative Clinics

Gastric Resection JOHN H MOHARDT

Vagotomy and Gastroenterostomy JOHN H OLWIN

5 00-12 00 *Neurosurgery* Operative Clinic  
Hemilaminectomy for Ruptured Nucleus Pulposus  
LOYAL DAVIS

8 00-12 00 *Orthopedic Surgery* Operative Clinics  
Bone Graft Delayed Union Tibia, Third Step, Iliac  
Bone Graft to Osteomyelitic Defect Tibia SAM W  
BANKS

Open Reduction Femur, Insertion of Street Nail,  
Closed Reduction, Spine Fracture FELIX JANSEY

8 00-12 00 *Tumor Surgery* Operative Clinic

Radical Neck Dissection T HOWARD CLARKE

5 00-12 00 *Thoracic Surgery* Operative Clinic

Exploratory Thoracotomy GEORGE W HOLMES

8 00-12 00 *Ophthalmology* Operative Clinics

Cataract Extraction Recesson External Rectus Mus-  
cle, Advancement Internal Rectus Muscle. Iridencler-  
sis for Glaucoma MAX M KULVIN

8 00-12 00 *Otorhinolaryngology* Operative Clinics

Rhinoplasty Submucous Resection Nasal Polypec-  
tomy Tonsillectomy HARKISHEN SINGH

1 00-5 00 *Tumor Surgery* Operative Clinic

Thyroidectomy T HOWARD CLARKE.

### Wednesday

8 00-12 00 *General Surgery* Operative Clinics

Common Duct Stone. CHARLES B PUESTOW

Thyroidectomy WILLIAM E LOOBY

8 00-12 00 *Neurosurgery* Operative Clinic

Suture, Peripheral Nerve JOHN MARTIN

8 00-12 00 *Orthopedic Surgery* Operative Clinics

Sliding Graft, Tibia, Excision Baker Cyst FRED W  
HARK

Excision of Acromion for Recurrent Dislocation (Possi-  
ble Bankhart Repair), Arthrotomy of Knee FELIX  
JANSEY

8 00-12 00 *Thoracic Surgery* Operative Clinic

Lobectomy GEORGE W HOLMES

8 00-12 00 *Ophthalmology* Operative Clinics

Trephine for Chronic Glaucoma Cataract Extraction,  
Kirby Technique Paracentesis Cornea JAMES E  
LEBENSCHN

8 00-12 00 *Otorhinolaryngology* Operative Clinics  
Bronchoscopies Esophagoscopy Submucous Resec-  
tion HARKISHEN SINGH.

1 00-5 00 *Otorhinolaryngology* Operative Clinic  
Tonsillectomy HARKISHEN SINGH.

### Thursday

8 00-12 00 *General Surgery* Operative Clinics

Hemicolectomy for Carcinoma of the Right Colon  
STANLEY E LAWTON Cholecystectomy EDMUND R  
DONOGHUE

8 00-12 00 *Neurosurgery* Operative Clinic

Osteoplastic Craniotomy LOYAL DAVIS

8 00-12 00 *Orthopedic Surgery* Operative Clinics

Arthrodesis of Wrist, Exploration of Shoulder, Rotator  
Cuff FRED W HARK.

Arthrodesis of Shoulder, Arthrotomy of Knee H JOFFE  
Arthrodesis of Hip, Excision Proximal Phalanges for  
Hammer Toe Deformity VERNON TURNER

8 00-12 00 *Tumor Surgery* Operative Clinic

Radical Parotid Dissection T HOWARD CLARKE

8 00-12 00 *Vascular Surgery* Operative Clinic

Thoracolumbar Sympathectomy ORMAND C JULIAN

8 00-12 00 *Ophthalmology* Operative Clinics

Enucleation of Eye with Stone-Jardou-Implant Iriden-  
cleisis for Glaucoma Inverse Cycloclodialysis for Glau-  
coma MAX M KULVIN

8 00-12 00 *Otorhinolaryngology* Operative Clinic

Fenestration HARKISHEN SINGH

1 00-5 00 *Thoracic Surgery* Operative Clinic

Thoracoplasty GEORGE W HOLMES

1 00-5 00 *Plastic Surgery* Operative Clinic

Chronic Ulcer—Right Ankle CLARENCE W MONROE

### Friday

8 00-12 00 *General Surgery* Operative Clinic

Primary Resection of the Sigmoid HAROLD LAUFMAN

8 00-12 00 *Neurosurgery* Operative Clinic

Removal of Spinal Cord Tumor JOHN MARTIN

8 00-12 00 *Orthopedic Surgery* Operative Clinic

Nicola Repair Shoulder LEO F MILLER

8 00-12 00 *Thoracic Surgery* Operative Clinic

Bronchoscopy GEORGE W HOLMES

8 00-12 00 *Plastic Surgery* Operative Clinics

Excision of Split Skin Graft from Left Cheek and Lip,  
Transfer of Tube Pedicle Graft Excision of Keloid—  
Right Side of Face. CLARENCE W MONROE

8 00-12 00 *Ophthalmology* Operative Clinics

Diathermy Coagulation, Walker, for Retinal Detach-  
ment. Recesson Internal Rectus Muscle, Resection  
External Rectus JAMES E LEBENSCHN

8 00-12 00 *Otorhinolaryngology* Operative Clinic

Radical Mastoidectomy HARKISHEN SINGH

1 00-5 00 *Orthopedic Surgery* Operative Clinics

Bankhart Repair, Shoulder, Excision of Ganglion, Wrist  
HERMAN JOFFE

Osteotomy, Tibia for Mal Union and Bone Graft, Am-  
putation of Leg FELIX JANSEY

1 00-5 00 *Tumor Surgery* Operative Clinic

Laryngectomy and Radical Neck Dissection T HOW-  
ARD CLARKE

### WESLEY MEMORIAL HOSPITAL

#### Monday

8 00 *General Surgery* Operative Clinics

Parotid Tumor T HOWARD CLARKE.

Indirect Inguinal Hernia, 2 cases Direct Inguinal Her-  
nia, 2 cases ONIS H HORRALL.



Umbilical Herniorrhaphy Indirect Inguinal Herniorrhaphy RICHARD J BENNETT

9 00 *General Surgery* Operative Clinic  
Pneumonecctomy, Carcinoma Mediastinal Tumor  
JEFFREY R HEAD, THEODORE R HUDSON

9 00 *Orthopedic Surgery* Operative Clinic  
Morton's Toe, Neuromectomy Spinal Fusion Scoliosis  
POMERET T McFARLANE

9 00 *Otolaryngology* Operative Clinic  
Fenestration, 4 cases GEORGE E SHAMBAUGH JR,  
ARTHUR I JUERS

9 00 *Ophthalmology* Operative Clinic  
Resection and Recession Punctulation W A MANN  
*Tuesday*

8 00 *General Surgery* Operative Clinics  
Gastric Resection Abdomino-perineal Resection Resection of Colon and Primary Anastomosis RAYMOND W McNFALLY  
Thoraco-abdominal Sympathectomy Laminectomy, Cord Tumor JOHN MARTIN

9 00 *General Surgery* Operative Clinic  
Ileostomy ARNOLD SCHIMBERG

9 00 *Orthopedic Surgery* Operative Clinic  
Spinal Fusion, Disc Triple Arthrodisce Patelectomy  
EDWARD L COMPERE, CLINTON L COMPERE, WILLIAM J SCHULTE

9 00 *Ophthalmology* Operative Clinic  
Cataract, 2 cases RICHARD A PERRITT

9 00-12 00 *Urology* Operative Clinic  
Nephrectomy, Suprapubic Prostatectomy Dry Clinic  
VINCENT J O'CONNOR, J KENNETH SOKOL

10 00 *General Surgery* Operative Clinic  
Hemorrhoidectomy, Fistulectomy FRANCIS D WOLFE

1 00 *Otolaryngology* Operative Clinic  
Fenestration, 2 cases GEORGE F SHAMBAUGH, JR,  
ARTHUR L JUERS

### Wednesday

8 00 *General Surgery* Operative Clinic  
Gastric Resection Right Hemicolectomy, Cancer of Cecum PETER A ROSI

9 00 *General Surgery* Operative Clinics  
Cholecystectomy Radical Mastectomy WALTER G MADDOCK

Thoracoplasty Lobectomy Tuberculosis JEROME R HEAD, THEODORE R HUDSON

9 00 *Orthopedic Surgery* Operative Clinic  
Scoliosis Anticus Hip Fusion Bunionectiony EDWARD L COMPERE, CLINTON L COMPERE, W J SCHULTE

9 00 *Ophthalmology* Operative Clinic  
Cataract 2 cases VIRGIL WESCOTT

*Ophthalmology* Operative Clinic  
Cataract Detached Retina KENNETH I ROFFER

*Gynecology* Operative Clinics  
Abdominal Total Hysterectomy for Fibroids Vaginal Hysterectomy for Prolapse Plastic Repair of Cystocele and Rectocele

### Thursday

8 00 *General Surgery* Operative Clinics  
Trigeminal Neurectomy Craniotomy Encephalogram  
JOHN MARTIN

Thyroidectomy Gastric Resection EARL O LATIMER  
Inguinal Herniorrhaphy, 3 cases ARTHUR R MERT  
RAYMOND HOLSCHILDRE

Cholecystectomy Gastric Resection SAMUEL J LINTH  
SON

9 00-12 00 *Urology* Operative Clinic  
Ureteral Transplant into Colon Pyeloplasty Epitheliomasostomy VINCENT J O'CONNOR, J KENNETH SOKOL

9 00 *Orthopedic Surgery* Operative Clinic  
Spinal Fusion, Disc Hip Pinning Bunionectiony  
ROBERT T McFARLANE

9 00 *Ophthalmology* Operative Clinics  
Corneal Transplant, 2 cases RICHARD A PERRITT  
Cataract 2 cases WILLIAM A MANN

10 00 *General Surgery* Operative Clinic  
Hemorrhoidectomy Fistulectomy DURAND SMITH

1 00 *General Surgery* Operative Clinic  
Cholecystectomy Radical Mastectomy WILLIAM A HENDRIX

1 00 *Otolaryngology* Operative Clinic  
Fenestration, 2 cases GEORGE F SHAMBAUGH, ARTHUR L JUERS

*General Surgery* Operative Clinic  
Cholecystectomy Segmental Resection Colon, Cancer  
NORMAN G PARRY

*Gynecology* Operative Clinics  
Vaginal Hysterectomy for Prolapse Abdominal Total Hysterectomy for Fibroids Plastic Repair of Cystocele and Rectocele

### Friday

8 00 *General Surgery* Operative Clinics  
Common Duct Exploration, Plastic Repair Repair of Gastro jejunocolic Fistula RAYMOND W McNFALLY

Incisional Hernia Direct Inguinal Hernia RICHARD J BENNETT, JR

Anterior Resection of Colon, Carcinoma WILLIAM M McMILLAN

9 00 *General Surgery* Operative Clinic  
Diaphragmatic Hernia Pneumolysis JEFFREY R HEAD, THEODORE R HUDSON

9 00 *Orthopedic Surgery* Operative Clinic  
Arthrotomy of Knee Arthroplasty of Knee HAMPAR KELLERMAN

9 00 *Ophthalmology* Operative Clinic  
Resection and Recession Cataract KENNETH I ROFFER

1 00 *Otolaryngology* Operative Clinic  
Fenestration, 2 cases GEORGE F SHAMBAUGH, JR, ARTHUR I JUERS

*General Surgery* Operative Clinic  
Radical Mastectomy Cholecystectomy and Common Duct Exploration EARL O LATIMER

## THE CLINICAL CONGRESS TECHNICAL EXHIBITION

**T**HE Clinical Congress Technical Exhibition provides an attractive method of displaying supplies and equipment designed for use in hospitals and surgeons' offices, such as surgical instruments, diagnostic and therapeutic apparatus, pharmaceuticals, medical literature, and other similar items. The 1949 Technical Exhibition will be located in the Exposition Hall of The Stevens James S Shannon, General Manager of The Franklin H Martin Memorial Foundation, publishers of the Official College Journal, SURGERY, GYNECOLOGY AND OBSTETRICS, is Manager of the Technical Exhibition. The list of exhibitors follows:

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# THIRTEENTH CONGRESS, INTERNATIONAL SOCIETY OF SURGERY

(Société Internationale de Chirurgie)

New Orleans, Louisiana, U S A , October 9 to 15, 1949

**T**HE following announcement has been received from Dr L Dejardin, Secretary-General of the International Society of Surgery

Plans for the Thirteenth Congress of the International Society of Surgery, which will take place in New Orleans, Louisiana, under the Presidency of Professor George Grey Turner, of London, England, are now in course of preparation

The scientific program was settled by the General Assembly at the last Congress in London, held in September, 1947 This body, at the recommendation of the Scientific Committee, also accepted two additional subjects, and decided who should open each discussion The final arrangements were as follows

- 1 Surgery and Pathology of the Pancreas, Especially in Relation to Its Endocrine Function Opened by PROFESSOR IAN AIRD, London
- 2 Surgery of the Parathyroid Glands Opened by DR PAOLUCCI, Rome
- 3 Surgery of the Suprarenal Glands Opened by DR. M R FONTAINE, Strasburg
- 4 Pathology and Surgery of the Pituitary Glands Opened by DR M P MARTIN, Brussels
- 5 Treatment of Postoperative Thrombosis and Its Sequelae Opened by DR ALTON OCHSNER, New Orleans, and DR. MICHAEL DE BAKEV, Houston
- 6 Causes of Recurrence after Operations on the Biliary Tract Opened by DR. M R DEMEL, Vienna

In addition, the American Organizing Committee has arranged that two days of the meeting shall be devoted to the presentation of shorter papers on subjects of immediate interest

The program as formulated by Vice President Evarts A Graham, of St Louis, Missouri, is as follows

## *Friday, October 14*

- 9 00 a m The Treatment of Radiation Burns J BARRETT BROWN, M D , St Louis, Missouri, Washington University School of Medicine
- 9 20 Chloromycetin in Gas Gangrene WILLIAM A ALTEMEIER, M D , Cincinnati, Ohio, University of Cincinnati College of Medicine
- 9 35 An Evaluation of Aureomycin and Chloromycetin (Chloramphenicol) in Experimental Clostridium Welchii Infection WILLIAM R SANDUSKY, M D , Charlottesville, Virginia, University of Virginia Medical School

- 9 50 The Use of Pancreatin in the Reduction of the Increased Fecal Nitrogen and Fecal Fat Loss Occurring after Total Gastrectomy TILDEN C EVERSON, M D , MORTON I GROSSMAN, M D , and ANDREW C IVY, M D , Chicago, Illinois, University of Illinois College of Medicine
- 10 05 Potassium Deficiency and Alkalosis in the Surgical Patient EVERETT I EVANS, M D , Richmond, Virginia, Medical College of Virginia
- 10 20 The Use of Hypertonic Sodium Chloride in Experimental Dehydration RICHARD A LEMMER, M D , and ROBERT ELMAN, M D , St Louis, Missouri, Washington University School of Medicine
- 10 35 The Comparative Effects of Various Electrolytic and Nonelectrolytic Hypertonic Solutions upon the Volume of the Brain and Intracranial Pressure BEN WILSON, M D , Dallas, Texas, Southwestern Medical College
- 10 50 Recent Developments on the Temporary Maintenance of Life with an Extracorporeal Circulation JOHN H GIBBON, JR , M D , and THOMAS LANE STOKES, M D , Philadelphia, Pennsylvania, Jefferson Medical College
- 11 05 a m Prolonged Occlusion of the Venae Cavae with Survival by means of an Extracardiac Shunt SANFORD LEEDS, M D , NORMAN GRAY, M D , ORRIN S COOK, M D , and H GLENN BELL, M D , San Francisco, California, University of California Medical School
- 11 20 Cardiovascular Dynamics in Patients with Coarctation of the Aorta, Studied Before, During and After Surgical Treatment of the Disease GEORGE A HALLENBECK, M D , EARL H WOOD, M D , and O THERON CLAGETT, M D , Rochester, Minnesota, Mayo Clinic
- 11 35 Experimental Production and Closure of Cardiac Interventricular Septum Defects HOWARD C NAFFZIGER, M D , MAURICE GALANTE, M D , ROBERT JOHANSEN, M D , RICHARD GARDNER, M D , H BRODIE STEPHENS, M D , and H J MCCORKLE, M D , San Francisco, California, University of California Medical School
- 11 50 A New Suture Technique of Blood Vessels EDGAR J POTM, M D , Galveston, Texas, University of Texas School of Medicine

## *Afternoon Session*

- 2 00 p m The Roentgen Anatomy of the Femoral Vein after Surgical Interruption D EMERICK SZILAGYI, M D , Detroit, Michigan, Henry Ford Hospital
- 2 15 Newer Concepts of Blood Coagulation JOHN KAY, M D , New Orleans, Louisiana, Tulane University School of Medicine

- 2 30 Studies in Cardiac Resuscitation. CHARLES K KIRBY, M D, and JULIAN JOHNSON, M D, Philadelphia, Pennsylvania, University of Pennsylvania Medical School
- 2 45 The Venous Circulation in Experimental Hemorrhagic Shock E FRIEDMAN, M D, H A FRANK, M D, and J FINE, M D, Boston, Massachusetts, Harvard Medical School
- 3 00 Gastric Vagotomy in Peptic Ulcer LESTER R DRAGSTEDT, M D, Chicago, Illinois, University of Chicago Medical School
- 3 15 p m Effects of Vagus Nerve Resection with Subtotal Gastrectomy upon the Development of the Mann Williamson Ulcer JAMES OLIVER, M D, Chicago, Illinois, University of Illinois Medical School
- 3 30 A Study of the Extrinsic Nerve Supply Regulating Gastrointestinal Activity ROBERT M WHITROCK, M D, and HENRY L TICHE, M D, Ann Arbor, Michigan, University of Michigan Medical School
- 3 45 Role of Autonomic Nervous System in Gastric Secretion C FREDERICK KITTLE, M D, Kansas City, Kansas, University of Kansas Medical School
- 4 00 The Effect of Splanchnicectomy and Vagotomy on Pancreatic Function with Special Reference to a New Technic for Obtaining Pancreatic Secretion HUSANG JAVID, M D, Chicago, Illinois, University of Illinois Medical School
- 4 15 The Utilization of Intravenously Injected Human Serum Albumin NICHOLAS S GIMBEL and CECILIA RIEGEL, Philadelphia, Pennsylvania, University of Pennsylvania School of Medicine
- 4 30 Studies in Experimental Frostbite JOSEPH C FINNERAN, M D, and HARRIS B SHUMACKER, JR., M D, Indianapolis, Indiana, University of Indiana Medical School
- 4 45 Treatment of Fibrocystic Disease of the Pancreas and Associated Bronchial Lesions by Splanchnicectomy WILLIAM AYERS, M D, New Orleans, Louisiana, Tulane University Medical School

#### Saturday, October 15

- 9 00 a m Controlled Respiration in Thoracic Surgery JOHN H GIBBON, JR., M D, JOSEPH W STAYMAN, JR., M D, and FRANK F ALLBRITTEN, JR., M D, Philadelphia, Pennsylvania, Jefferson Medical College
- 9 15 The Eck Fistula An Experimental Study ALFRED M LARGE, M D, and D E PRESHAW, M D, Detroit, Michigan, Wayne University College of Medicine
- 9 30 The Effect of Arteriovenous Fistula on Bone Growth, An Experimental Study J M JAMES, M D, and J E MUSGROVE, M D, Rochester, Minnesota, Mayo Clinic
- 9 45 The Use of Arteriovenous Shunts in Ischemic Limbs PRESCOTT JORDAN, M D, and CHARLES G JOHNSTON, M D, Detroit, Michigan, Wayne University College of Medicine
- 10 00 Application of Surgical Therapy to Extraparacardiac Diseases RUSSELL MEYERS, M D, Iowa City, Iowa, University of Iowa Medical School
- 10 15 Lumbar Ganglionectomy in Peripheral Arteriosclerosis LEON GERBER, M D, Washington, D C, George Washington University
- 10 30 The Use of Nor-Epinephrine as a Pressor Drug with Special Reference to Thoracolumbar Sympathectomy R A DETERLING, M D, VIRGINIA AFGAR, M D, and MARCEL GOLDENBERG, M D, New York, Columbia University College of Physicians and Surgeons
- 10 45 A Fluorimetric Method of Blood Adrenalin Determination WILLIAM W SHINGLETON, M D, and HORACE M BAKER, M D, Durham, North Carolina, Duke University School of Medicine
- 11 00 The Evaluation of Pulmonary Function in Surgical Patients JULIUS H COMROE, JR., M D, and WILLIAM S BLAKEMORE, M D, Philadelphia, Pennsylvania, University of Pennsylvania Medical School
- 11 15 a m The Effects of Curare and Pentothal Anesthesia upon Respiratory Control Mechanisms MARION P JENKINS, M D, Dallas, Texas, Southwestern Medical College
- 11 30 The Pathogenesis of Hyperthyroidism PETER HEINBECKER, M D, St. Louis, Missouri, Washington University School of Medicine
- 11 45 Studies of the Oxygen Consumption of Liver Biopsies LAWRENCE O ELY, M D, Iowa City, Iowa, University of Iowa Medical School

#### Afternoon Session

- 2 00 p m Studies in Experimental Alkalosis ROBERT E L BERRY, M D, VIVIAN JOB, M D, DANIEL C THOMPSON, M D, RALPH D MAHON, M D, and SAM J GREER, M D, Ann Arbor, Michigan, University of Michigan Medical School
- 2 15 p m Liver Regeneration in Animals and Man HARRY M VARS, M D, and I S RAVDIN, M D, Philadelphia, Pennsylvania, University of Pennsylvania Medical School
- 2 30 The Fate of Transfused Blood as Determined by Red Cells Tagged with  $P_{32}$  and Albumin Tagged with Iodine 131 JOE MABEY, M D, New Orleans, Louisiana, Tulane University Medical School
- 2 45 Aortic Anastomosis in Pups Studied after Reaching Adulthood JAMES BROOKS, M D, Richmond, Virginia, Medical College of Virginia
- 3 00 Internal Jugular Phlebotomy WALTER H GERWIG, M D, Washington, D C, George Washington University Medical School
- 3 15 Subtotal Gastrectomy with Gastroduodenostomy LAURENCE S FALLIS, M D, Detroit, Michigan, Henry Ford Hospital

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Inquiries should be directed to

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International Society of Surgery

141, Rue Belliard, Brussels, Belgium

\*Deceased

October, 1949

**SURGERY**  
**GYNECOLOGY AND OBSTETRICS**  
*Supplement*

**INTERNATIONAL ABSTRACTS**  
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# INTERNATIONAL ABSTRACTS OF SURGERY

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## COLLECTIVE REVIEW

### EVALUATION OF THE PRINCIPLES CONCERNED IN THE MANAGEMENT OF TRAUMA TO THE KIDNEY

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A REVIEW of the voluminous literature on trauma to the kidney is quite disconcerting. There is a marked divergence of opinion regarding several important problems concerned in the management of renal injuries.

These problems are

- 1 The proper method of examining patients who have sustained a renal injury—whether by means of excretory or retrograde pyelography, or both
- 2 Whether to practice systematic surgical intervention or conservative expectant treatment
- 3 The indications for surgical intervention and the time for such interference
- 4 Whether to repair the kidney or remove it
- 5 The late results that may be expected following the various types of immediate treatment

In order to answer these problems, I have undertaken a collective study of the literature and have reviewed our 27 cases of renal injury at Beekman-Downtown Hospital.

ANALYSIS OF 27 CASES AT BEEKMAN-DOWNTOWN HOSPITAL, (1940-1948)

#### ETIOLOGY

The oldest patient in this series was 76 years of age and the youngest was 17 years. The average age was 44.6 years. All of the patients were

From the Surgical and Genitourinary Services of Beekman Downtown Hospital.

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males. In 16 cases the right side was involved and in 11, the left side.

*Nature of the injuries.* The injuries to the kidney were often variable and disproportionate to the violence to which the patient had been subjected. They were due to

- 1 Direct force—such as sudden severe external trauma to the loin, over the kidney, falls striking the back or abdomen, and crushing force as when run down by automobile (14 cases)

- 2 Indirect force—such as falls with the body landing upon the head, feet, buttocks, without direct trauma over the kidney area (9 cases)

- 3 Kicks or blows over the kidney—the patients attributed their injuries of the kidney to probable blows sustained while playing football (2 cases)

- 4 Penetrating or puncture wounds—there was 1 gunshot wound

- 5 No demonstrable cause or history of injury—there was 1 case of spontaneous perforation of the ureter

#### PATHOLOGY

In this series, there were 11 cases of contusion, 14 of rupture, 1 case of traumatic hydrocele of the kidney, and 1 of spontaneous perforation of the ureter. The severity of the injury did not depend, as a rule, on the trauma producing it, nor upon the manner in which it was applied.

#### SYMPTOMS

The symptoms were variable and inconstant.

- 1 Shock was present in 14 cases and absent in 13 cases. In 6 it was quite severe on admission,

and 3 of the patients in the last group never completely recovered from their shocked condition

2 Pain was present in 21 cases. It was limited to the loin on the injured side in 10 cases, to the loin and abdomen on the injured side in 13, and to the loin, abdomen, and chest in 4

3 Tenderness was present in the costolumbar region in all but 1 of these cases

4 Muscular rigidity was present in the loin of the injured side in 23 cases, over the corresponding side of the abdomen in 11, and generalized over the abdomen in 5

5 Hematuria was present in 26 cases and absent in 1 case. It was microscopic in 9, and gross in 17. Six of the patients could not void after admission, and had to be catheterized, at which time gross hematuria was discovered. There were 2 instances of severe secondary bleeding in patients allowed out of bed too soon, and 2 cases in which the bleeding persisted and was profuse in nature. There was no correlation between the severity of the injury and the amount of hematuria, as in many of these cases the injury appeared to be trivial and the hematuria profuse

6 A large retroperitoneal mass could be felt in 9 cases, and, although present, was missed in 2 other instances

7 Abdominal distention was noted in 19 cases, and abdominal rigidity in 4. Pain in the lower quadrant on the side corresponding to the injury in association with psoas spasm was found in 3 instances

8 Anuria lasting from 24 to 36 hours was seen in 2 patients who were not in shock. This was believed to be due to suppression on the injured side and reflex urinary suppression of the contralateral kidney

9 Severe bruises, discolorations, and ecchymosis in the affected loin were present in 12 cases and absent in 15

10 A severe secondary anemia out of all proportion to the amount of hematuria was noted in 6 cases

A review of the symptoms disclosed that there was no apparent relationship between their severity and the actual injury sustained by the kidney. The symptoms were variable, inconstant, and confusing and did not justify more than a presumptive diagnosis. In 2 of the cases, the symptoms and signs were entirely those of a ruptured intra-abdominal viscus, the injury to the kidney only being realized at a later date

#### DIAGNOSIS

The following diagnostic measures were used in this series

1 A simple abdominal film was taken in 19 cases. It gave only suggestive evidence of kidney injury in 4 cases, and was entirely misleading in 1 case. In the latter, the radiologist reported free air under the diaphragm which was not confirmed by exploratory laparotomy. The simple abdominal film was of value in determining associated lesions in 13 cases in which fracture of the transverse processes of the vertebrae, fracture of the pelvis, or of the lower ribs were diagnosed

2 Excretory urography was done soon after admission in 20 cases. Satisfactory pyelograms for diagnostic purposes were obtained in 6. In 2 cases extravasation was suspected on the excretory study, but on retrograde study only one of these could be confirmed. In 2 other cases, although the intravenous pyelograms showed that the kidney had sustained an injury, there was no demonstrable evidence of extravasation. At operation, both of these kidneys were found to be badly ruptured. Valuable information concerning the uninjured kidney was obtained in 16 of the cases

3 Cystoscopy and retrograde pyelography were done in 9 cases. Extravasation was suspected on the intravenous pyelogram in 2 cases, it was confirmed by the retrograde pyelogram in one instance, and disproved in the other, in 3 cases, although the excretory study was interpreted as normal, the retrograde study demonstrated extravasation. In 2 cases, the excretion on the injured side was indefinite but the retrograde study showed intraparenchymal rupture. In 1 case, there was no excretion visualized on the intravenous pyelogram but the pyelogram was normal by retrograde study. In another instance, observation cystoscopy disclosed a bleeding carcinoma of the bladder as the cause of the hematuria

#### ASSOCIATED COMPLICATIONS

Serious complications were present in 19 cases, and absent in 8. Their prevalence and wide distribution in this and other such series stresses the absolute need of a complete physical examination. The kinds of complicating injuries in this series were as follows

##### A Fractures

- Skull—2
- Bones of face—2
- Lumbar vertebrae—5
- Sacrum—1
- Bony pelvis—2
- Wrist—1
- Clavicle—1
- Ankle—1
- Radius—1

- B Dislocations
  - Ankle—1
  - Separation of symphysis—1
- C Injury to viscera
  - Rupture of liver—3
  - Rupture of spleen—2
  - Rupture of bladder—1
  - Rupture of spleen—1
- D Other complicating injuries
  - Pneumothorax—1
  - Shift of mediastinum—1
  - Hemothorax—2
  - Perforation of diaphragm—1
  - Laceration of brain—1
  - Laceration of facial nerve—1
  - Gas bacillus infection of leg—1
  - Rupture of lung—1
- E Other complicating conditions
  - Carcinoma of bladder—1
  - Malaria—1

Three-quarters of the deaths in this series of cases were a result of the complicating injuries, and not the result of injury to the kidney which in these instances was trivial in nature

## TREATMENT

*Expectant treatment* Twenty-two patients were treated conservatively. In 11 the injury was diagnosed as contusion, in 2, a laceration, and in 9, a rupture of the kidney. Four of these patients had to be operated upon, 2 because of the recurrence of profuse hematoma, 1 because of the development of an infected hydrocele of the kidney, and 1 because of sepsis due to a large perinephritic abscess as a result of extravasation. There were 2 deaths among the conservatively treated patients, a mortality of 12.5 per cent.

*Conservative surgery* This was done in 4 cases. One patient had a decapsulation of the kidney and pyelostomy for an infected hydrocele of the kidney, 1 with spontaneous perforation of the ureter had an incision and drainage of the loin and pyelotomy, and 2 patients had an exploratory laparotomy, 1 of them because of a mistaken diagnosis of ruptured viscus, and 1 because of peritonitis due to a ruptured bladder, liver, and spleen. There was 1 death, a mortality of 25 per cent.

*Radical surgery* Nephrectomy was done in 5 cases. Three of the patients were treated conservatively at first. In 1, because of profuse and persistent secondary hemorrhage, the kidney was explored, and was found to be ruptured although the excretory pyelograms showed no evidence of extravasation. In another patient treated conservatively the excretory pyelograms showed a dilated pelvis and ureter filled with blood clots

but no evidence of extravasation. This patient had persistent gross hematuria for 2 weeks and was finally explored. A ruptured kidney was found and removed. The third patient who was treated conservatively ceased bleeding but developed severe loin pain with evidence of sepsis. Retrograde study revealed extravasation into a large abscess cavity. Nephrectomy was performed. One patient had a rupture of the kidney, liver, and lung due to a bullet, nephrectomy was the procedure of choice because of the severe bleeding. In the fifth case, the patient was explored abdominally because of signs pointing to a ruptured intra-abdominal viscus. The abdominal findings were negative but transabdominal nephrectomy was done for a pulpified kidney. There was 1 death in this group, a mortality of 20 per cent.

## RESULTS

*Deaths* There was a total of 4 deaths in this series of 27 cases, a mortality of 14.8 per cent. In 1 case only should the cause of death be attributed to the kidney (4.1%).

*Cause of death—rupture of kidney* 1. A patient with persistent bleeding in whom the excretion showed no evidence of extravasation was finally subjected to operation because of a constant decline in the clinical picture due to hemorrhage. (At operation the kidney was found to be badly ruptured.) This patient should have been operated upon earlier and I was entirely misled by the normal intravenous pyelograms.

*Cause of death—severe associated injuries*

1. In the first patient there was a contusion of the kidney with hematuria which ceased soon after admission, but the patient died in 48 hours from a ruptured lung, pneumothorax, and mediastinal shift.

2. In the second patient there was also a contused kidney with a ruptured bladder, liver, and spleen, and a fracture of the tibia and fibula. The patient died soon after abdominal exploration and drainage, but at autopsy the kidney was found not to be severely injured.

3. In the third patient there was a ruptured kidney and spleen with compound fracture of the leg and gas bacillus infection of the extremity. Because the patient never came out of shock, he was treated conservatively. At autopsy, the kidney was not severely ruptured.

*Late results* A follow up is available in 23 cases. In the 10 cases of contusion of the kidney, the end result is good, pyelographically and functionally. Four patients who had a nephrectomy are well and symptom-free. The 3 patients on whom





injury Pyelograms taken at a later date reveal either normal or relatively normal excretion, or complete or partial inability to excrete the contrast substance due to replacement of the parenchyma by scar tissue (36, 102, 103, 104, 105, 142, 149)

6 Researches in dogs on the vasoconstrictor reactions to contusion of the kidney reveal that after trauma the blood pressure is 150 mm Hg in all, as compared to 119 mm Hg before the contusion (148, 149)

7 In accordance with the classification outlined before, recovery is uneventful following Type 1 injury, while following Type 2 injuries, healing is slower, but recovery is also uneventful About 80 per cent of the animals died at varying times after Type 3 injuries, although all of the animals with this type of injury who had operative repair survived All animals with Type 4 injuries died (142, 145)

8 Experimentally untreated Type 3 traumatized kidneys in the animals that lived often gave rise to marked loss of function in the injured organ, and occasionally produced complications of such magnitude that some form of surgical intervention became necessary later (22, 109, 127, 141, 142)

9 Fat is an excellent hemostatic agent, and has been found to control bleeding in from  $\frac{3}{4}$  to  $1\frac{1}{2}$  minutes while muscle does so in from 16 to 20 minutes The efficacy of ribbon gut has also been demonstrated by Lowsley In no case following experimental surgical repair was the kidney destroyed Microscopically, actively functioning tubules and glomeruli are found at the edge of the reparative scar tissue in these surgically repaired kidneys (64, 75)

10 Fibrin foam, gelfoam, and oxycellulose gauze used in the control of bleeding kidney wounds produces a narrow scar with little or no sclerosis of the surrounding renal parenchyma (54, 74, 75, 76, 77)

11 Following severe injuries to the kidney, there may be a marked secondary anemia, persistent and unrelated to the hemorrhage Reticulocyte counts suggest that this phenomena is due to toxemia from the degenerated and necrotic kidney tissue Simultaneous depression of hemopoiesis by the toxic agent is not ruled out, however (140)

There are no pathognomonic symptoms since any or all of the so-called classical symptoms of pain, hematuria, and shock may be absent I wish to discuss briefly the symptoms that may be encountered in renal trauma, and to point out their implications

**Shock** If present, shock is usually slight at the outset and is proportional to the character and magnitude of the external force rather than to the extent of the actual kidney injury Wesson (156) has pointed out that shock at the time of the trauma is usually due to injury of the solar plexus, whereas, if it occurs after a lapse of several hours, it is due to hemorrhage If the degree of shock which has been present at the outset does not disappear in a relatively short time but shows a tendency to become aggravated, or if it continues to be severe, one should consider the possibility of an associated injury of the abdominal viscera, the thorax or spinal cord, or of an exacerbation of bleeding from the kidney itself

**Hematuria** Microscopic or gross hematuria is a cardinal sign of renal injury, and occurs in from 75 to 90 per cent of the cases It was found in 26 of the 27 cases in our series (96%) Hematuria may not appear for hours or days after the accident Occasionally, it may be absent entirely if the injury is slight, if blood clots are blocking the ureter, if the ureter has been completely severed, if the pelvis or calyces are blocking the line does not enter the pelvis or calyces For all of these reasons, there is no correlation between the presence or absence, or the amount and duration, of hematuria with the existence or degree of the renal injury As a general rule, however, the more profuse the hematuria, the more extensive the injury

There is a tendency for the hematuria to cease by the fourth or fifth day unless the injury has been extensive, or unless secondary bleeding occurs The latter is usually noted in the second or third week after the injury, and has been reported as late as 2 months, it differs from the primary bleeding in that it is more severe and persistent, and frequently gives rise to blood clots (40) Two of our patients had marked secondary bleeding on being allowed out of bed too soon, and on 1 of these, immediate nephrectomy had to be performed because of the alarming and persistent hemorrhage

Bailey has estimated that in 8 per cent of cases, acute retention ensues because of clots in the bladder (6)

**Mass in loin** A mass in the loin on the outside, found in 25 per cent of the complicated cases, is a feature of ruptured kidney It was present

## SYMPTOMS AND SIGNS

A review of the symptoms and signs of renal injuries in reported cases and in our series impresses one with the fact that there is a wide difference of the clinical picture presented

11 (43%) of the cases in our series. The mass may be of variable size, and slow to rapid in its development, it is usually noted soon after the injury. As a rule, its size is an index of the degree of severity of the injury, and its palpation and delineation may be very difficult because of the accompanying loin rigidity and tenderness, and abdominal distention. Occasionally, the presence of a retroperitoneal mass or hemorrhage may be missed or overshadowed by the presence of the signs of peritonitis. Backus has reported 7 such cases, in 6 of which the patient was subjected to exploratory laparotomy with negative abdominal findings (5).

The mass may be absorbed, and the time required for such absorption is directly proportional to the initial size of the mass. Infrequently, it may become encysted and calcified, and form a large calcified cyst as reported by Goldstein (164, 165). Occasionally, it becomes infected and produces a perirenal cellulitis or abscess and, secondarily, cortical abscesses of the kidney. In 2 of our cases, it persisted to form a large cyst of the lower pole, and in 1 case degeneration occurred to form a large perirenal abscess.

*Pain and tenderness* in the affected costolumbar region and/or the upper quadrant anteriorly are usually present and were found in more than 85 per cent of our patients. They are directly proportional to the severity of the injury, but seem to bear no relation to the extent of the kidney damage produced. They may be due to trauma of the abdominal wall, fracture of the lower ribs, contusion of the soft parts, pull on the pedicle, and occasionally to clots in the ureter. An interesting finding which has often been noted but not stressed sufficiently is that outlined by Prather (105, 106), namely, pain and tenderness in the lower quadrant on the corresponding side of the injury in conjunction with psoas spasm, appearing from 12 to 36 hours after the injury, which are diagnostic of extravasation of blood and/or urine. They indicate true rupture of the kidney long before blood pressure or pyelographic changes make one suspicious of such an eventuality. They were observed in 3 of our cases, and were of inestimable value in establishing an early diagnosis in each instance.

*Peritoneal irritation.* Nausea, vomiting, hiccup, and signs of paralytic ileus may be reflexly produced by the injured kidney. These may so dominate the picture within a few hours that the possibility of an abdominal injury is strongly entertained, especially in the cases in which there is an absence of hematuria. As a general rule, if the abdominal signs are reflexly produced, they tend to subside or disappear within a short time, where-

as, if there is an actual intraperitoneal injury, they tend to persist and increase. Difficulty in differential diagnosis may be encountered in instances in which laceration of the peritoneum occurs in association with a kidney injury without any injury to an abdominal viscus, as was seen in one of our cases.

*Suppression of urine.* A variable diminution in the urinary output is usually noted. This is due to the temporary suppression of the injured kidney, to possible ureteral occlusion by blood clots, or to an injury to the ureter or pelvis on the affected side. Reflex suppression on the normal side has been reported and was seen in 2 of our cases. The urinary suppression, as a rule, subsides quickly and is soon followed by polyuria. A period of extended suppression may denote a severe injury to both kidneys, to one kidney with severe reflex suppression of the uninjured kidney, or an injury to the only good kidney that the patient possesses.

*Associated injuries.* An injury to the kidney may be associated with injury to other regions, namely, fracture of the last two ribs, fracture of the transverse processes of L 1, 2, 3, and 4 on the affected side, or contusion or rupture of the liver or spleen, or of both. Coincidental damage to the pancreas offers a grave prognosis, but the most serious of all is an injury to any part of the intestinal tract. Of injuries to the kidney and thorax, 40 per cent are associated with intrathoracic lesions (50). Fracture of the skull, concussion of the brain, and fractures of other bones of the body (including the pelvis) have also been found as associated injuries. Serious associated lesions were present in 19 cases and absent in 8 cases of our series. Their prevalence and wide distribution, and the fact that they are usually more serious than the kidney lesion itself illustrates how important they are in the course and management of renal trauma. Three of the 4 deaths were due to an associated lesion.

#### *Coincidental findings*

1. If bleeding is profuse, or if there is an associated injury of the liver or spleen, there is a rapid fall of the red blood count and hemoglobin. Leucocytosis, which develops in a short time after the injury, subsides quite quickly unless extravasation is present and infection supervenes.

2. Some fever, usually low grade, is common soon after injury to the kidney in more than 50 per cent of the cases, unless shock is present. This soon subsides and may again appear about the fifth day because of resorption of blood from the retroperitoneal space. Sudden elevation or persistence denotes serious infective complications.

3. In some patients a secondary anemia out of all proportion to the degree of trauma or to the

# ORKIN MANAGEMENT OF TRAUMA TO THE KIDNEY

amount of hemorrhage may appear on the fourth or fifth day (140) This is a toxic phenomenon and was observed in 6 patients in our series

4 Bile in the urine and jaundice denote injury to the liver Some degree of cyanosis may be observed in those patients who are in some degree of shock, or in those with an injury to the lung with hemothorax, pneumothorax, or both Air hunger may be seen at times in patients who are bleeding profusely

## DIAGNOSIS OF RENAL INJURIES

The diagnosis of a renal injury in the majority of instances is relatively simple A history of an accident, with or without external evidence of injury, pain and tenderness in the kidney area, and the finding of hematuria, more than suffices to warrant a diagnosis of trauma to the kidney However, in some cases, even after a careful critical examination, one may not be able to make an exact clinical diagnosis In these instances, the history of trauma may be trivial or absent and the external evidence of injury may be lacking In addition, as I have previously outlined, the symptoms may be confusing or misleading, or vital subjective and objective findings may be missing This is true especially in those cases in which we have associated visceral or bony injuries of such magnitude that the latter injuries are considered as of paramount importance and the kidney injury as trivial in nature Equally disconcerting are those cases in which, for one reason or another, no blood is found in the urine Backus recently reviewed 7 cases in which the presenting signs and symptoms were those of an acute abdomen In all but 1 of these cases, the mistaken diagnosis had led to exploratory laparotomy with negative abdominal findings before the true underlying pathology of renal injury was realized We have recently had such a case at Beekman-Downtown Hospital (Fig 1), of a young man who after a fall on his buttocks in the bathtub apparently sustained a trivial kidney injury in that he had no distinctive loin tenderness and only from 10 to 15 red blood cells per high power field in the urine The presenting symptoms were those of a ruptured intra-abdominal viscus A simple abdominal film disclosed what was interpreted as free air under the diaphragm and he was explored by the surgeons with negative abdominal findings Urological investigation later disclosed an intraparenchymal rupture of the upper calyx of the left kidney

In a very small number of instances the renal injury is so extensive, or the associated injuries are of such magnitude, that the individual dies

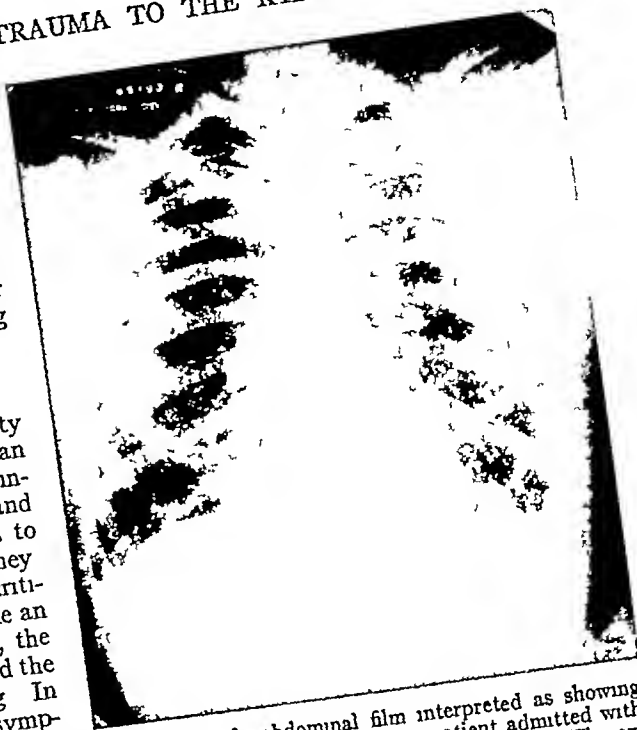


Fig 1 Simple abdominal film interpreted as showing free air under the diaphragm in a patient admitted with abdominal rigidity after a fall on his buttocks The exploratory laparotomy was negative. Urological investigation later disclosed an intraparenchymal rupture of the left kidney

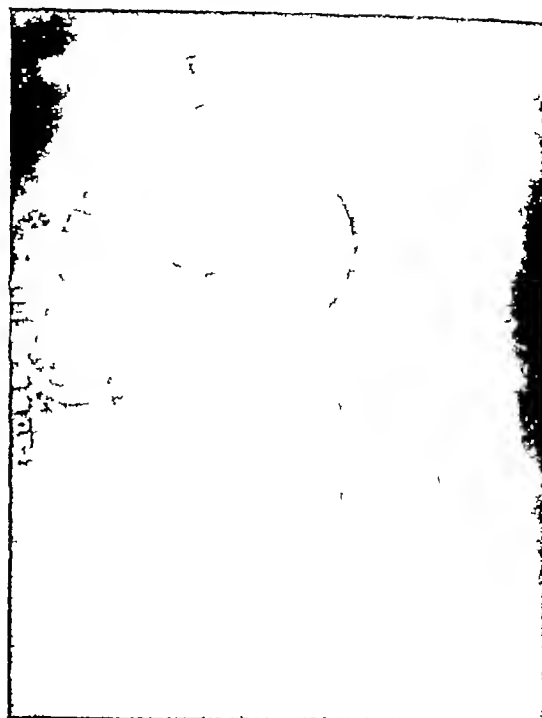
before or soon after he reaches the hospital Fortunately, however, in the great majority of injuries to the kidney, the trauma sustained does not immediately threaten the life of the individual

Following an injury that may in any way conceivably involve the genitourinary system, an immediate and complete physical examination should be made, with care to note whether any complicating associated injuries exist It should be remembered that complicating injuries of the brain, abdominal viscera, and chest may be latent in manifesting themselves

If there is hematuria, it is first necessary to rule out rupture of the urethra and bladder Roentgenograms will disclose fracture of the pelvis Ruptures of the urethra will soon make themselves evident locally If the bladder is suspected, late films of the bladder in the excretory pyelograms will be of help, and may show intraperitoneal or extraperitoneal extravasation Signs of fluid in the peritoneal cavity and of peritonitis should be carefully looked for All patients should be made to void soon after admission and the urine carefully studied Subsequent urines should also be examined If the individual cannot void, he



a



b

Fig 2 Simple abdominal film in a case of rupture of the right kidney showing the gas that may be associated with a rapidly developing paralytic ileus a, No information is discernible concerning the kidneys b, Treatment with the Miller Abbot tube

should be gently catheterized to distinguish between inability to void due to the severe pain of the injury, urinary retention due to clots in the bladder, and a possible ruptured bladder or urethra. Six of our patients were catheterized because of inability to void and in each instance renal trauma was suspected after finding gross blood in the urine.

Since there is no relation between the intensity of the traumatism, the clinical signs, the symptomatology, and the gravity of the renal lesion, the patient should be investigated urologically as quickly and completely as is possible. It is only by this approach that a genuine anatomicopathologic diagnosis can be made, which is so necessary in the evaluation of conservative versus operative interference. The following methods have been proposed for urological investigation (1) simple roentgenography, (2) excretion urography, and (3) cystoscopy and retrograde pyelography.

#### SIMPLE ROENTGENOGRAPHY

A simple film of the abdomen should be made soon after admission and may give an initial lead as to the injury. It may even be made while the

patient is receiving treatment for shock. Under excellent circumstances, the following data may be discerned on the simple film (2, 55, 86, 115)

- 1 Absence of the renal shadow
  - 2 Enlargement of renal shadow due to subcapsular hematoma
  - 3 Obliteration of the psoas line
  - 4 Scoliosis of the spine with concavity toward affected side due to reflex muscular spasm
  - 5 Raised hemidiaphragm—found more often on the left side
  - 6 Extraperitoneal hematoma—large soft tissue mass of slightly greater density than remainder of the posterior abdominal wall
  - 7 Associated bony injuries—fracture of the eleventh and twelfth ribs, fracture of the bony pelvis, and injury of the lumbar transverse processes or vertebrae
  - 8 Air under diaphragm—representative of ruptured viscus
  - 9 Fluid levels in dilated loops of bowel
- However, except for the demonstration of a grossly enlarged kidney on the affected side, of air under the diaphragm, or of associated skeletal fractures, the simple film is disappointing and



Fig 3 Excretory urography performed at the bedside using a portable x ray unit. The patient had fallen down an elevator shaft and had sustained a fracture of the twelfth thoracic vertebra, and the left tenth and eleventh ribs. There was marked tenderness in the left loin. He was bleeding moderately from the urinary tract and he was in shock. Because of these normal pyelograms, the patient was treated conservatively.

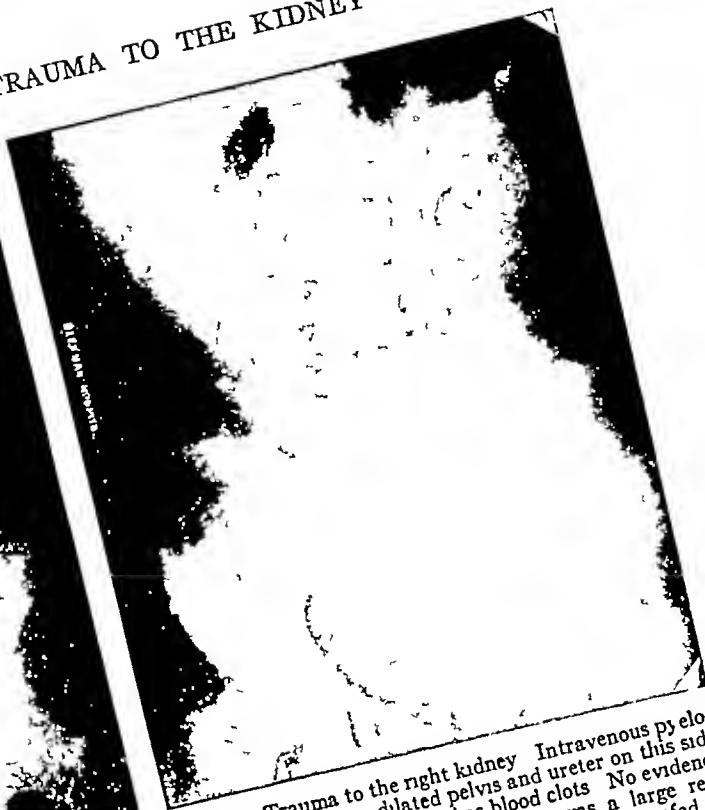


Fig 4 Trauma to the right kidney. Intravenous pyelograms demonstrate a dilated pelvis and ureter on this side with filling defects interpreted as blood clots. No evidence of extravasation. At operation there was a large rent bisecting the kidney in the region of the pelvis roofed by the blood clot.

does not, as a rule, supply valuable information (2, 22, 115). The film is usually not diagnostic because it is largely obscured by gas associated with a rapidly developing paralytic ileus (Fig 2). In my experience, the simple film was of value in 13 cases in determining associated skeletal injuries. In my cases it was either misleading or not diagnostic as applied to the renal lesion. In instances of dire emergency, one may have recourse to a simple film, but, if at all possible, once the patient is out of shock, one should perform excretory urography. Certainly, if the exigency is such that emergency surgery is contemplated, it is imperative to at least take a simple film in order to attempt to demonstrate that another kidney shadow exists besides the traumatized one.

## EXCRETION UROGRAPHY

Excretory urography has been recommended by many but employed by too few people as a routine procedure in every case of potential renal injury. Storck has re-emphasized its value and has plead-

ed for its wider use, even at the bedside if the patient cannot be moved (Fig 3). Intravenous pyelography is simple of execution, free of potential infection, and may give valuable information if properly interpreted.

Although the optimal time for doing an intravenous pyelogram should be determined for each patient, it would appear from the reported experimental and clinical evidence that the best pyelograms are obtained immediately after the injury (149). Stirling and Lands (142) were able to make a positive diagnosis from initial pyelograms in 23 of 34 cases, while Ferrier and Knigge were able to make a conclusive diagnosis in 44 of 53 (82%) severely injured cases. Similar experiences are reported by Hareide, Wood (164, 165), and Schenck. McKenna has reported several cases of rupture diagnosed by excretory urography and confirmed by operation. Prather (105) has described instances of lack of function soon after admission, but function became evident in from 5 to 7 days. It would appear from this that if the initial pyelogram shows no excretion or if it is unsatisfactory, it should be repeated within a

few days. Most men do not advise excretory urography if the patient is in shock, or if the blood pressure is below 90 mm systolic. The decided value of intravenous pyelography even in such circumstances is illustrated by a case of William Ginzberg. This patient was a female who had suffered a severe injury in an automobile accident. On admission to the hospital, she was in shock with a blood pressure of 78 mm Hg, and she was bleeding profusely. X-rays revealed a large soft tissue mass on the injured left side with a non-functioning kidney and a perfectly functioning right kidney. Nephrectomy was done with a great deal of assurance that the patient's remaining kidney was perfectly normal. The following information may occasionally be gathered from excretory urography (53, 86).

#### *Injured side*

- 1 Normal or relatively normal pyelogram—minor injury
- 2 Diminution or absence of excretion on affected side
  - poor shadow or absence of dye due to
    - a Actual renal damage
    - b Pressure of extrarenal hematoma
    - c Reflex from shock
    - d Too long a delay in obtaining pyelograms
- 3 Deformity of pelvis or calyces due to actual destruction or blood clot
- 4 Extravasation of the dye
  - a Within the kidney parenchyma
  - b Outside the renal capsule
- 5 Displacement of ureter, ureteropelvic junction, or both

*Noninjured side* The presence and function of the opposite kidney. Turton and Williamson have reviewed 5 cases in which trauma was sustained by a congenital solitary kidney, and in 4 of these nephrectomy was unwittingly performed. Although congenital solitary kidney is not frequent, congenital hypoplastic kidney occurs frequently enough to make one extremely careful before doing a nephrectomy for renal injury without having demonstrated a normal kidney on the contralateral side (135). Although some hypoplastic kidneys may sustain life, the majority will not.

From the foregoing, it can be seen that excretory urography is of great diagnostic value immediately following renal injuries. Its immediate usefulness is found in the cases in which the injury is minor or moderate and in which the secretory power is not disturbed. If the ruptured kidney is damaged to such an extent that its secretory power is reduced or abolished, the pyelo-

grams will be of little value except perhaps to demonstrate a good contralateral kidney. If a ruptured kidney with multiple fractures and a large perirenal hematoma is excreting the dye, the extravasated urine is mixed with the media and can be demonstrated only with great difficulty. Further, in severe renal injuries, by the time the patient has recovered from shock and sufficient urinary output is present to warrant utilization of excretory urography, intractable ileus and abdominal distention supervenes to further obscure the films.

The experimental findings of Stirling and Lands (142), and of Domrich, that excretory urography aids in locating the side involved and the gravity of the lesion, but that it does not reveal the extent or type of injury, has been confirmed by clinical experience. Hamilton Bailey states that in his experience he has had disappointing results with excretory urography in assessing kidney damage on the affected side. This has been reiterated by McGregor, Adams, Sargent (122), Foulds and Shannon, Farman, Gordon-Taylor, Scholl (127), Mathe (82), and others.

In one of my first cases of renal trauma, excretory urography revealed a dilated pelvis and ureter filled with blood clots, with no evidence of extravasation (Fig 4). The patient was treated conservatively for 2 weeks, at the end of which time operative interference was undertaken because of persistent and increasing hemorrhage. Nephrectomy was performed but the patient died soon after operation. The specimen showed a large rent roofed by blood clot, almost bisecting the kidney in the region of the pelvis. I feel quite certain that had a retrograde pyelogram been done in this case, extravasation would have been demonstrated, and operative interference undertaken much earlier, thereby perhaps saving this man's life. Excretory urography gave me a false sense of security in this case which was not justified by the existing pathology.

In another case excretory urography disclosed an intraparenchymal rupture, and the patient was treated conservatively, the hematuria ceasing on the third day. Ten days later he had a sudden profuse secondary hemorrhage warranting operative interference. This disclosed a large rent in the upper pole, and nephrectomy was performed with good result. Here too, I feel that if retrograde study had been done, the patient would have been operated upon sooner.

In some of my cases, as illustrated in Figure 5, the excretory pyelogram of the injured kidney may appear normal, but retrograde study of the traumatized organ may demonstrate extravasa-

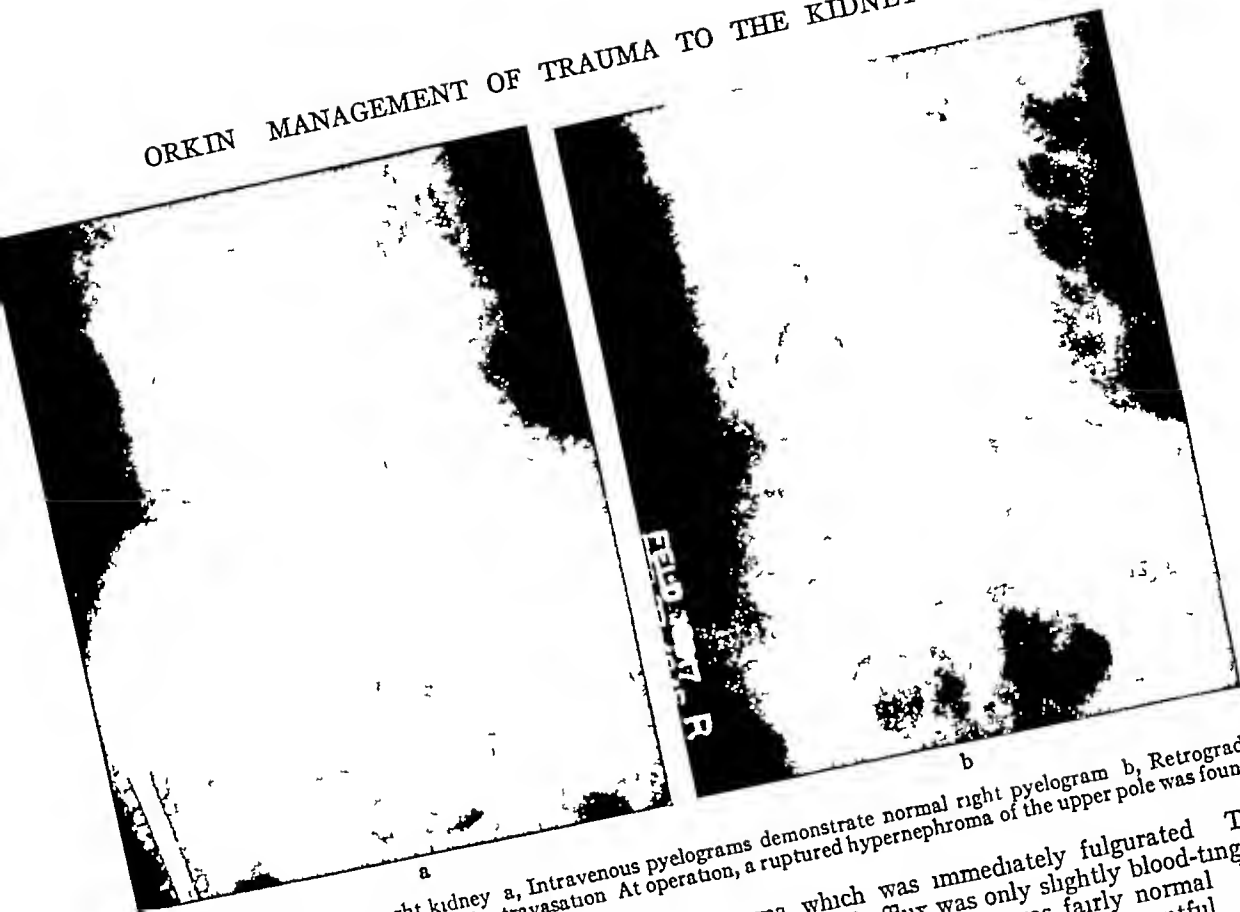


Fig 5 Trauma to the right kidney a, Intravenous pyelograms demonstrate normal right pyelogram b, Retrograde pyelogram on this side indicative of extravasation At operation, a ruptured hypernephroma of the upper pole was found

tion On several occasions, I have found no excretion of the contrast substance to be present on the injured side, but on retrograde pyelography, I had a perfectly good pyelogram demonstrative of either a normal pelvis or unmistakable evidence of extravasation

In addition, observation cystoscopy at the time of the retrograde study may also be helpful in visualizing the interior of the bladder, in studying the ureteral efflux and indigo carmine excretion of both kidneys, and in unplugging a ureter filled with blood clot Two cases in my experience illustrate this point strikingly One was that of a patient admitted to Beckman-Downtown Hospital whose foot was caught by a tow rope while working on a ship, he was thrown to the floor striking his left loin and sustaining a fracture dislocation of his ankle Because of the left loin pain and hematuria, excretory urography was performed This revealed a normal right pyelogram and an unsatisfactory but apparently normal left pyelogram, and he was treated conservatively However, because of persistent and profuse hematuria with clots which lasted longer than 24 hours, he was examined with the cystoscope This revealed a large ulcerated bleeding bladder carci-

noma which was immediately fulgurated The left ureteral efflux was only slightly blood-tinged, and the left pyelogram was fairly normal His further urological progress was uneventful Another case was that of a man whose right loin was struck by a log flying off a sawmill He was admitted in shock, bleeding profusely, and was given supportive therapy When he had recovered sufficiently, excretory urography was performed This revealed a normal pyelogram on the right side with no evidence of extravasation, there was no excretion from the left side Because of his persistent and profuse bleeding, he was examined with the cystoscope on the following day, this revealed the bleeding to be coming from the right side, and careful inspection of the bladder showed no left half of the trigone and no left ureteral orifice It was quite evident that we were dealing with a traumatized congenital solitary kidney Although the condition improved with conservative treatment, the knowledge obtained by cystoscopy would have been of inestimable value had surgical intervention been necessary

Because of this accumulative experience and evidence, I now strongly agree with Sargent (122, 123) and Farman that cystoscopy and retrograde



TABLE I—REPORTED MORTALITIES IN RENAL TRAUMA (IN PERCENTAGES), FROM 1896 TO 1937

Author	Year	Collected cases	Expectant treatment	Conservative surgery	Nephrectomy	Total mortalities
Kuster	1896	—	—	—	—	47 0
Riese	1903	490	21 1	4 7	17 9	18 9
Watson	1903	562	29 0	Without complication	18 3	
				With complication	44 0	30 4
Suter	1905	701	20 6	14 6	16 7	17 3
Keller	—	478	22 0	—	—	22 0
Guterbock	—	13	—	—	30 7	30 7
Willis	—	14	—	—	55 5	55 5
Gravitz	—	108	—	—	—	46 2
Lardennois	1908	767	20 0	28 0	18 0	22 0
Ponomareff	1914	123	9 0	—	—	—
Bugbee	1916	8	0 0	0 0	0 0	0 0
Delzell	1928	11	14 3	33 3	—	18 1
Osgood	1929	52	29 5	55 5	—	34 6
Beach	1930	10	25 0	—	—	10 0
Floyd	1932	6	0 0	0 0	0 0	0 0
Simpson	1933	9	0 0	0 0	0 0	0 0
Pratt	1934	21	9 9	25 0	12 5	14 3
Schenck	1934	42	26 8	16 6	20 0	23 8
Sweetser	1935	12	0 0	40 0	0 0	16 6
Herman	1936	85	12 2	36 3	—	24 2
Jones	1936	4	0 0	0 0	0 0	0 0
Wood	1937	25	8 0	18 0	—	12 0
Bottone	1937	85	12 0	36 0	—	15 3

pyelography should be routine as this gives a much better pyelogram and demonstrates extravasation, when present, much more assuredly and definitely than excretory urography. Although excretory urography was done 20 times in this series of 27 cases, satisfactory pyelograms for diagnosis were obtained in only 6. Extravasation was demonstrated in only 1 instance, and missed in 5 cases. Two of the latter cases were diagnosed at operation, and 3 by retrograde study. In another instance, extravasation which was suspected as being present on the intravenous pyelograms was not confirmed on the retrograde. Cystoscopy also occasionally gives us valuable information concerning concomitant lesions in the bladder.

The argument against retrograde pyelography has concerned itself with the danger of introducing

infection and increasing or reactivating bleeding. Redi, Gutierrez and Farman (45) believe that this is more theoretical than actual. That the retrograde dye acts as an irritant on the traumatized renal parenchyma has been disproved by Campbell and Lynch. In answer to the statement that retrograde pyelography may disseminate infection, I can only state that most urologists believe that if there is extravasation of blood, urine, or of both, infection may supervene without retrograde injection of the contrast substance. In a careful review of the literature, I have been able to find only 1 instance of increased bleeding following retrograde catheterization. This was a case of Peacock's, but in this case also it must be remembered that secondary bleeding might have arisen even without cystoscopic manipulation. In my experience, I have not encountered a single instance of aggravation of the general signs or increase of the hemorrhage or the size of the hematoma. This procedure has been of inestimable value in the instances in which I used it, and it might have saved the only patient who should not have died in this series, had I used it. However, I wish to caution that if retrograde study is performed, it be done under strict aseptic technique, and that the dye be instilled by the gravity method as recommended by Wesson.

If we admit the possible hazards of retrograde pyelography, their sum total does not equal the danger of case management without it. The only reliable and scientific basis for an anatomicopathological diagnosis as to the type and extent of the injury is by retrograde study, so necessary in the evaluation of conservative or operative intervention.

#### MORTALITY AND COMPLICATIONS

A study of Table I in which mortality statistics have been collected up to the year of 1937 suggests that the mortality in renal trauma, whatever the treatment, is high, averaging over 20 per cent.

In the larger series of collected statistics, as reported by Riese, Watson, Suter, Lardennois, Keller, Ponomarett, and Osgood, the mortality figures would seem to favor operative interference as against expectant treatment. These early statistical reports, still quoted by recent textbooks and writers, are in some measure valueless and misleading as applied to the present-day management of renal injuries. In the years from 1938 to 1948 (Table II), there has been a decided decrease in the death rate from renal trauma.

There was no mortality reported by Mertz, Priestley, Harrison, Cheetham, and Adams, for patients treated expectantly or by operation. A

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TABLE II—REPORTED MORTALITIES IN RENAL TRAUMA (IN PERCENTAGES), FROM 1938 TO 1948

Author	Year	Collected cases	Expectant treatment	Conservative surgery	Nephrectomy	Total Mortalities
Droschl and Fink	1938	45	0 0	0	0 0	0 0
Mertz	1938	5	0 0	0 0	0 0	0 0
Kindall	1938	10	0 0	0 0	0 0	0 0
Priestly	1938	45	0 0	0 0	33½	33½
Farman	1939	3	0 0	0 0	0 0	0 0
Harrison	1940	27	0 0	0 0	50 0	11 5
Peacock	1940	26	5 2	0 0	0 0	20 0¹
Prather	1940	20	14 2¹	33 3¹	0 0	0 0
Chestham	1941	43	0 0	0 0	0 0	0 0
Shure	1941	9	0 0	50 0¹	0 0	15 3
Robertson	1942	26	10 0	0 0	0 0	27 0¹
Adams	1943	7	0 0	34 0¹	0 0	2 0
Fernier	1943	137	20 5¹	3 0	0 0	25 0
Culp	1947	48	0 0	0 0	25 0	13 0
Lynch	1948	23	12 5¹	25 0¹	20 0	14 8¹
Orkin	1948	27	12 5¹	25 0¹	20 0	14 8¹

¹Severe associated lesions.

review of the reports of Prather (106), Robertson (115), Fernier, Lynch, and Orkin reveals that the total mortality in their series varies from 11 to 27 per cent. If one eliminates from consideration the patients who enter the hospital in a moribund condition or with very severe associated injuries, the mortality rate drops to about 4 per cent.

The reasons for this marked reduction in mortality are not difficult to find according to Scholl (127). Modern accurate diagnostic measures, a better knowledge of the pathology resulting from renal trauma, a clearer understanding of the criteria for surgical intervention, blood banks and the more generous use of available blood, skillful conserving parenchymal plastic procedures, and efficacious, widely used antibiotics have all served to improve the prognosis. On the other hand, despite all of these influences, the mortality will always tend to be high in certain types of cases. One type includes those instances in which the patient is exsanguinated or severe rupture of the kidney because of either pulpification or severe rupture of the kidney. Schenck and Osgood had 4 such cases in their series. The mortality will always be high in complicated cases. Laewen, quoted by Strauss (145), reported a series of 57 cases of gunshot wounds, there were only 5 cures, a mortality of 87.7 per cent. The results of Wallace, Lockwood and his coworkers, Fraser and Drummond, and Walters and his associates published in 1917 and later reviewed by Young for the Surgeon General's report, covered a series of 2,121 cases of gunshot wounds of the abdomen. The kidney was involved in 155 instances, and there was a mortality of 57 per cent. There were 13 cases of stab and gunshot wounds of the kidney with 6 deaths due to intra-abdominal involvement in 155 instances. The association of a ruptured liver or intestines and a ruptured kidney carries with it a mortality of from 50 to 72 per cent. Desjardes reported a series of 57 cases of coincidental injuries of the spleen and kidney. In addition to intra-abdominal involvement, one may encounter severe general or skeletal injuries. Fernier and Knigge had 31 such cases, and in our series 2 patients died with minor renal lesions—one with a gas bacillus infection of a traumatic amputation of the leg, and the other with a severe injury to the chest and shift of the mediastinum. In Table II, in which there is reported the mortalities of the period from 1938 to 1948, I have marked the mortalities with a superior number 1 in the instances in which I felt that severe associated complicating injuries were of such magnitude as to alter the mortality greatly. In most of these, the renal injury was of minor consequence and the

complicating injury was undoubtedly the cause of death. For example, Prather (105) observed the immediate death of 2 patients within 4 hours of injury before shock could be terminated to permit surgical intervention. One of his operative patients died from laceration of the liver and peritonitis. There were 4 deaths in Robertson's series (115), 2 operative and 2 nonoperative. The 2 nonoperative deaths followed gunshot wounds, one injuring the lung, spinal cord, and kidney, and the other injuring the kidney, abdominal viscera, and lung. The operative deaths were due to anuria and a fractured kidney, respectively. In the total series of 137 cases reported by Fernier and Knigge, there were 37 deaths, a mortality of 27 per cent. In their series, the kidney injury was named as the cause of death in only 5 of the 31 cases of severe general injuries. If we consider merely these 5 cases, it leaves 5 instances in a total of 111 cases, a mortality of 4.5 per cent. In our series of 27 patients, there were 4 deaths, 2 operative and 2 nonoperative. Of the operative deaths, 1 occurred in a case of ruptured liver, spleen, bladder, and urethra in addition to the kidney injury. Of the nonoperative deaths, one was of a patient with a gas bacillus infection resulting from traumatic amputation of the leg, and the other was of a

patient with a ruptured lung and shift of the mediastinum. The renal injury was of a minor degree in each of these cases. If we consider only 1 of the operative deaths as uncomplicated, leaving out the 3 in which the associated lesion was responsible for the individual's demise, we have 1 death in 24, a mortality of 4.1 per cent.

Although in the last 10 years there has been a decided decrease in the death rate due to trauma of the kidney, numerous men have pointed out the occurrence of an astoundingly large group of complications as an aftermath of such injury. These serious after effects, which often require nephrectomy for their cure, usually occur in the patients with ruptured kidney who have been treated expectantly. Cheetham saw 25 patients with late complications at various intervals after the trauma. Three could be treated medically and 22 had to be operated upon. Dozza (38) reported 82 cases of injury to the kidney. Operation was performed in 3, and conservative management was satisfactory in 79. Twenty-seven of the patients, seen from 6 months to 30 years after the injury, had to be operated upon for consequences of the renal injury. In Priestley and Pilcher's series (109) of 45 patients treated medically, 25 per cent had symptoms referable to their injury. Colston and Baker (23) presented 13 cases which came under their personal observation at periods varying from 4 months to some 30 years after the trauma, among which they found cyst formation in 6. These authors state that while it is not their purpose to condemn conservative treatment of kidney injuries, they believe that the surgeon must be completely familiar with the changes which may occur in the kidney or perirenal tissue as a late result of the injuries and that he should take the proper steps to prevent their development. In our series of 27 patients, there were 6 with a ruptured kidney who were treated expectantly. Follow up after 5 years revealed that the result is poor in all. In 2, a large cyst is present at the lower pole of the kidney, and in 4, kidney function as determined by excretory urography and indigo carmine excretion is shown to be reduced to 25 per cent or less of normal.

Obstruction at the ureteropelvic junction by stricture, band, or adhesions due to a more or less complete division of the ureter in this region or to a periureteral inflammatory reaction often leads to hydronephrosis or pyonephrosis (26, 42, 57). An acute perinephritic abscess may develop in the course of breakdown of a hematoma, or localized necrosis of the kidney (26, 57). In the chronic form, following degeneration of the hematoma, there may be the formation of a perirenal collec-

tion of fluid between the fibrous capsule and the kidney or in the fatty capsule, with the formation of perirenal cysts or pseudohydronephrosis (144) (Fig 6).

Fibrous perinephritic changes may produce some degree of compression and atrophy of the kidney with resultant chronic pain (20). Persistent pain may also result from involvement of nerves in scar tissue. Although Cabot (16) doubts the possibility of nephroptosis, O'Connor found 12 instances of this condition which could be classified as being definitely post-traumatic. Lazarus reported a case of renal calculus developing 13 weeks after an injury. Sklarz and Cabot (16) report post-traumatic calculi around a coagulum (Fig 7). Kindall had several cases in which the renal calculus was in close proximity to the renal scar. Interference with the blood supply may produce atrophy of the kidney. Some people have supposed that the vascular damage incident to the trauma may conceivably produce a partial ischemia and hypertension (91, 148). This has not been universally accepted as Braasch, in a review of 50 cases with clinical evidence of renal trauma, found that in only 1 instance was renal injury a possible factor in the causation of the hypertension.

Instances of renal tumor following injury have been cited by Bonar and others, but this also is difficult to evaluate. Other late complications that have been mentioned are persistent urinary fistula and secondary bleeding subsequent to conservative surgical interference.

The more widespread use of excretory and retrograde pyelography has served to unearth the ever-increasing number of complications. In addition, these procedures have brought out the fact that although the ruptured kidney may heal without any of these after effects, a definite and marked diminution in its function may occur. Wesson (156) believes that subcutaneous ruptures of the kidney may heal without operation and with a functional loss of about 50 per cent. The late results in several of my cases have shown that this functional loss may be even greater than that predicated by Wesson.

In contradistinction to the aforementioned complications that may follow renal ruptures treated expectantly, I have been impressed with the end result, as have others who have advocated conservative surgery in these cases. The freedom from symptoms and the excellent functional picture as determined by roentgenography and function tests justify in my mind a continuation of this plan of treating true rupture of the kidney (Figs 8 and 9).



Fig 6 Injury to right kidney 5 years before at which time a rupture of the kidney with a large hematoma was found. The patient was treated conservatively. At the present time, intravenous pyelograms demonstrate a distorted picture with a large cyst of the lower pole on the right side.



Fig 7 Injury to left kidney 4 years ago. Intravenous pyelograms demonstrated a large calculus with no function in the left kidney. Retrograde study revealed a distorted upper ureter and a large calculus in the kidney with no excretion of indigo carmine from this side. At operation, the upper ureter was severely strictured. The calculus on chemical analysis contained a blood clot as its nidus.

## TREATMENT OF RENAL INJURIES

The implication in the more recent literature concerning the treatment of renal injuries has been that the majority of deaths are due, on the one hand to the severity of the primary injury, and on the other, to procrastination in exploration. Since there are two general groups of cases, namely, those complicated by other injuries, and those with renal injury alone, and since each group may vary in severity, it is immediately evident how difficult it is to be dogmatic or to establish any standard rule in the management of renal trauma. While every case must be considered individually, it seems to me that in order to attain a successful end result in any patient, the following factors must be considered in every instance of renal trauma.

- 1 Prompt recognition of any intra-abdominal trauma or other associated lesions
- 2 The magnitude of the renal injury
- 3 Prompt decision if operation is necessary
- 4 The correct time for, and the type of, operative interference

In addition, if one keeps in mind the necessity of stopping hemorrhage early and of combating infection later on, a correct decision concerning management will more often be made than not.

In some cases, the injury to the kidney is so extensive, or the associated lesions are of such magnitude (or both) that death occurs almost immediately. Patients who sustain a laceration of the renal vessels succumb before or soon after they are admitted to the hospital. Fortunately, immediate exitus does not occur in the majority of instances of extensive injury to the kidney or associated lesions (or both), and the patients, as a rule, are admitted to the hospital in shock. The latter is due to the pain of the trauma, the severe injury, and the loss of blood, and should be combated with all available means—external heat, intravenous fluids, plasma, and blood. Morphine should be withheld until a careful evaluation of the abdominal findings have been made. Estes has recommended that the treatment of shock be carried out close to the operating room in order to have as

For reasons previously enumerated, I agree with Sargent (124) that cystoscopy and retrograde pyelography should be routine in every case of renal injury and should be done wherever feasible as soon as possible.

In the management of patients in whom the kidney only is involved, there is one important question whether to intervene surgically or to treat the patient expectantly. This has met with divergent opinions. One group (2, 12, 98) has believed that the treatment should always be conservative unless absolute indications for operative interference arises. Another group headed by Lowsley (75) believes that it is conservative to explore if the hematuria lasts longer than 24 hours. Still another group is of the opinion that in view of the possible dangers and sequelae following renal injuries and the slight risk of exploration, surgical interference should be early and frequent rather than late and rare (23, 165). The adherents of the last two opinions state further that the proponents of conservative treatment should realize that surgical interference does not imply nephrectomy, but an attempt to conserve the kidney by drainage and arrest of bleeding. Early exposure enables one to inspect the kidney and make the necessary repairs, to practice conservative surgery and prevent secondary complications, and to perform a primary nephrectomy when indicated (165).

The indications for immediate or emergent operation are determined entirely by the clinical picture of grave hemorrhage and/or signs of an associated intra-abdominal lesion. The indications for delayed surgical interference have never been universally agreed upon and seem to have been limited to those cases in which the clinical picture as described does not improve. I believe that pyelographic evidence of extravasation should determine the need and should be the basis for delayed surgical interference before any deterioration in the clinical picture makes such intervention necessary. I again wish to reiterate that from my experience and that of others, I believe that retrograde pyelography is the only absolute method of establishing an anatomicopathologic diagnosis so necessary in the further management of these cases. By this method it is possible to decide what type of injury has been sustained, and one can institute the necessary treatment with reasonable assurance and avoidance of possible sequelae.

Statistically, contusion of the kidney (Type 1 and 2 injuries) makes up about two-thirds of all renal injuries, and true rupture (Types 3 and 4) about one-third. It is universally agreed that if

the diagnosis has been definitely established as that of a contusion, the patient should be treated conservatively and kept in bed at least 2 weeks (94). O'Connor and Adams have presented cases in which there was a recurrence of bleeding in patients gotten out of bed too soon. One of my patients with an intraparenchymal rupture of the kidney stopped bleeding 5 days after his injury and on getting out of bed the next day began to bleed so profusely that emergency nephrectomy had to be performed. In the conservatively treated contused kidney, clinical improvement is usually noted and the further course is uneventful. If, as may rarely happen, the primary or secondary bleeding becomes profuse and uncontrollable or if sepsis supervenes, re-evaluation of the condition and possible operative interference become necessary.

The opinions concerning the treatment of true rupture of the kidney (Types 3 and 4) are very divergent. One group feels that this type of case should be treated conservatively unless persistent and profuse hemorrhage warrants operative intervention. It is of the opinion that if nephrectomy becomes necessary, it may be done at a later date. Another group feels that this type of injury should be subjected to operative interference. The experimental findings of Stirling and Lands (140), and the clinical experience cited by Wood (165) and Prather (106) stress the fact that while true rupture may at times heal without complication, this is the exception rather than the rule. The feeling would seem to be that earlier surgery may result in greater conservation of renal tissue with no increase in loss of life. To be more specific, too long delayed surgery in a true rupture may result in irreparable infection and necessitate nephrectomy, while comparative early surgery, after the period of shock is passed, should decrease our mortalities and nephrectomies. In accordance with my experience, I subscribe to this view wholeheartedly.

The time to operate has to be determined in each case. If it is done too early, the result may be fatal. If, however, in the face of alarming bleeding, one procrastinates, hemorrhage and shock may occur. In the absence of a peritoneal tear or injury of an intraperitoneal viscus, the emergency of a ruptured kidney seldom demands immediate operative interference. Wood (106) believes that exploration is more easily and safely carried out 3 or 4 days after the injury. If a patient is operated upon too early, he may bleed profusely and fatally once the clots are evacuated. This delay in time allows the small vessels to contract and the clots to organize. It also permits

provement in the patient's general condition by the administration of blood and other aids. Further, opportunity is afforded during this recovery period for an evaluation of the clinical and roentgenographic findings, and operative intervention can be done with a greater feeling of assurance. In addition, if infarction of part or all of the kidney occurs, this will be visible to the surgeon at the end of 72 hours.

In the treatment of wounds of the kidney there are three possible surgical procedures according to Scholl (8, 9, 127): (1) drainage of the renal region with or without decapsulation, (2) partial nephrectomy and repair, and (3) nephrectomy.

1 *Drainage of the renal region* This is the simplest procedure and may be done quickly with minimal risk to the patient. It is indicated in those conditions in which time or the condition of the patient contraindicates extensive surgery, and in those instances in which a good contralateral kidney cannot be demonstrated. Foreign bodies and loose fragments of tissue should be searched for and removed. Drainage should be free and adequate by means of many Penrose drains. The use of tampons, although condemned by Wesson (156) as it may lead to sinus formation, may in selected cases be lifesaving. A large infected perirenal mass may be drained to improve the patient's general condition before nephrectomy. In some of these cases, further treatment may later be found to be unnecessary as satisfactory healing and progress may take place. In others, subsequent nephrectomy may have to be done, but with much less risk. If hemorrhage is encountered, every effort should be made to control it. Sutures of fine chromic catgut tied over fat may be used, or repair with ribbon gut according to the method of Lowsley (74, 75) may be employed. Oxygel or gelfoam may be placed over bleeding points or on the suture line. Kindall has reported a case of rupture of the kidney from the pelvis through the entire parenchyma which he repaired with complete functional recovery. Usually complete hemostasis cannot be obtained as one often encounters a continuous ooze in the field. Exposure through the loin permits firm packing, and this can be done with plain gauze. It is advisable to place a rubber dam under the packing as in this way the packing can easily be removed and there is no danger of secondary hemorrhage following such removal. If nephrectomy is contemplated but cannot be done because of either a deep short pedicle or a precarious condition of the patient, the area may be packed until such a time as secondary nephrectomy may safely be undertaken. If drainage is instituted, it

should be continued for at least 10 days. In some instances of severe parenchymatous infection or extravasation under the capsule, decapsulation may be performed. This relieves pain and tends to minimize any resultant cicatrization. Decapsulation may also be done in post-traumatic hydrocele of the kidney, such as was performed in one of my cases with complete relief of symptoms.

Mention should be made of the patient who has had a severe rupture of the kidney with a large perirenal hematoma upon whom operation cannot be performed either because of severe shock or severe associated lesions such as a fractured skull, laceration of the brain, ruptured lung, and the like. In the typical case, the patient has had a stormy course and has bordered on shock because of one or both of these conditions for a week or longer. At the end of this period, when the patient is no longer in shock and appears to be on the upgrade, surgical interference may be contemplated in an attempt to evacuate a large hematoma in the loin which may or may not be infected. Experience has shown that in this type of case, operation is fraught with grave risks. The patient may go into shock again, complete evacuation of the hematoma and blood clots is difficult, and drainage is almost impossible as the entire retroperitoneal area is involved. Indeed, some of the areas may pocket off, and become reinfected. In some of these instances, a patient who seems to have weathered the storm with expectant treatment, may, with operative incision and drainage, and evacuation of the clots, be converted to a severely infected individual who rapidly becomes exhausted. It is my feeling that in this type of case, one might leave well enough alone and chance the risk of post-traumatic renal sequelae.

2 *Partial nephrectomy and repair* Even under ideal conditions, partial nephrectomy and plastic repair may be unsuccessful. Cases have been reported in which the lower pole of the kidney was knocked off and mattress sutures tied over fat were used to close the defect and arrest the bleeding, in which a satisfactory functioning hemikidney was obtained. As a general rule, this procedure is not recommended for various reasons. It is difficult and time-consuming, and carries with it very little likelihood of success in an infected wound. Extensive plastic procedures on the pelvis or upper ureter may produce a functionless kidney, and necrosis and late bleeding may necessitate a secondary nephrectomy. Also, partial nephrectomy is not likely to remove the cause of the bleeding in a patient already depleted. It would seem to be poor judgment to expose him to a fresh hemorrhage from suture

If the ureteropelvic junction is partially torn, repair over a splinting catheter with nephrostomy drainage might be successful. If the lower pole of a solitary kidney has been avulsed, closure of the defect and control of the hemorrhage with mattress sutures tied over fat becomes imperative.

3 *Nephrectomy* is simpler than most conservative operations. It removes the cause of bleeding and the potential field for infection. It is also less time-consuming. It eliminates the possibility of future bleeding and secondary operations either as a result of the primary operative procedure or of the late sequelae. Nephrectomy should never be done unless one has demonstrated a good contralateral kidney. It is indicated in the following situations:

- 1 Extensive destruction of renal tissue
- 2 Multiple deep lacerations
- 3 Grossly torn or injured pedicle
- 4 Irreparable damage of the pelvis, ureter, or both
- 5 Persistent or marked secondary bleeding
- 6 Tear into a short pedicle preventing delivery of the kidney for a conservative procedure
- 7 Hydronephrosis or other serious disease of the kidney
- 8 Persistent urinary sinus
- 9 Cortical abscesses of the kidney

Nephrectomy however, is rarely indicated immediately after the injury. It is extremely hazardous and carries with it a high mortality because of the facts that the patient has just come out of shock, the tissues are extremely friable, and profuse and fatal hemorrhage may arise on freeing of the fresh blood clots. Increased experience has shown that better results are obtained by waiting 3 or 4 days after the injury if possible, and if at that time nephrectomy cannot be safely performed, it is much wiser to drain and pack, and leave the nephrectomy till a later date. If it becomes urgent to remove the kidney and the pedicle is friable or extremely indurated, it is much safer to leave the pedicle clamps in place following nephrectomy rather than to attempt tying the pedicle with the risk of the suture's slipping off or cutting through. The clamps may then safely be removed in 7 days in the operating room under gas anesthesia. In any operation on the kidney for trauma, it should be remembered that the field is infected and it is good judgment to close only about half of the wound. This will prevent deep infections of the kidney and wound.

The care of the late sequelae, such as kidney abscess, perirenal suppuration, subphrenic abscess, hydronephrosis, pyonephrosis, and of other complications is based on the principles of

treatment of these conditions, whatever their etiology may be.

Throughout the management of renal trauma, be it conservative or surgical, one should make use of blood and the appropriate chemotherapeutic agents as the case requires. Both conservatively and surgically treated patients should be checked with excretory urography and retrograde studies. These should be repeated at regular intervals for at least 10 years in order to determine and treat any secondary complications that may arise. It is only by following all cases of renal trauma over a long period of time that adequate statistics can be set up to determine whether the principles which have been outlined in this article are correct.

#### SUMMARY AND CONCLUSIONS

1 An evaluation of the principles concerned in the management of renal trauma has been undertaken in order to answer several important problems relative to this subject.

2 A review of this and other series of renal injuries reveals that since there is no relation between the intensity of the traumatism, the clinical signs, the symptomatology, and the gravity of the renal lesion, the patient should be examined urologically as quickly and completely as possible. While a simple film and excretory pyelography should be done in every case immediately after the injury, even at the bedside if necessary, retrograde study is indicated as a routine procedure whenever feasible. It produces a better pyelogram and demonstrates extravasation, when present, much more assuredly than excretory urography. It is the only reliable and scientific basis for an anatomicopathologic diagnosis which is so necessary in the evaluation of conservative versus operative intervention.

3 Since 1937 there has been a decided decrease in the death rate due to renal trauma. The reported mortality is upward to 27 per cent, but if one eliminates the patients in a moribund condition or with severe associated injuries on admission, the mortality drops to about 4 per cent.

4 Despite the decrease in mortality, there has been an astoundingly large group of complications and a reduction in kidney function as an aftermath of renal injury. Experimentally and clinically, these complications occur in the cases of ruptured kidney treated expectantly.

5 In the patients who do not die soon after their injury, the indications for immediate or emergency operation are determined by the clinical picture of grave hemorrhage, a severe associated intraperitoneal lesion, or of both.



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6 The indications for delayed surgery have never been agreed upon. I believe that the pyelographic evidence of extravasation should determine the need and be the basis for delayed surgery before deterioration in the clinical picture makes such interference necessary.

7 If the case is proved to be one of contusion in bed for at least 2 weeks is advised. If the case is one of true rupture (Type 3 or 4), early surgical interference is advised. This may best be done 3 or 4 days after the injury. Although the indications for nephrectomy have been enumerated, one should never nephrectomize a patient without having demonstrated another good kidney.

8 A careful follow-up of my series and that of others impresses me with the excellent end results of ruptured kidneys treated by conservative operative intervention. This clinical experience fortified by experimental evidence has justified a continuation of this practice.

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# ABSTRACTS OF CURRENT LITERATURE SURGERY OF THE HEAD AND NECK

## HEAD

**Complications and Sequelae of Untreated Fractures of the Facial Bones and Their Treatment** F T MOORE and T G WARD *Brit J Plast Surg*, 1949, 1 257

Because facial fractures may not seriously affect the patient's general condition and because the general surgeon often does not have the training and equipment to treat them properly, these deforming injuries are often given little or no treatment, with the rationalization that the plastic surgeon may correct the deformities later if the patient so desires. It must be stressed that early treatment of such injuries is more convenient and effective for both patient and doctor than the treatment of a malunion with refracture, reduction, bone grafts, and other procedures which may be necessary at a later date. Co-operative effort of the plastic, orthopedic, neurological, and ophthalmic surgeons must be effective from the beginning to avoid extensive, multiple-stage plastic procedures to correct facial deformities later.

Fractures of the middle third of the face may result in multiple complications. Aside from the obvious deformity, they include nasal obstruction, anosmia, diplopia, lacrimal apparatus involvement, enophthalmos, injuries to the eye or optic nerve, malocclusion, and injuries to the maxillary division of the fifth cranial nerve.

If malunion of facial fractures has occurred, with any of these complications, the method of choice is refracture and realignment of the fragments. Immobilization is essential and is accomplished by the authors by means of a vertical rod in front of the face, fixed at its upper end to a plaster headcap and at its lower end to a bar attached to full cap splints on the upper and lower teeth. The movable fragment may then be pinned with a wire bowstring which is fixed to the vertical rod. Such an apparatus is illustrated in the original article. The orbital floors and other antral walls may be immobilized by packing the antra with ribbon gauze, which was left in place 37 days in 1 case. The antra are reached through incisions in the buccal sulcus.

A classification of maxillary fractures is presented, according to the location and direction of the fracture.

STANLEY W TUELL, M D

EYE

**Ocular Cysticercosis** 1949 32 523

The author discusses ocular cysticercosis from the following points of view: history, pathogenesis,

casuistics, diagnosis, treatment, prognosis, pathology, prophylaxis, and iconography. He points out that cysticercosis of the eye is a rare disease which may be overlooked by an inexperienced observer. The diagnosis is especially difficult when only a single part of the parasite is found such as its hooks.

Schott and Sommering in 1829 independently observed the same cysticercus in the anterior chamber. Schott extracted the parasite. Siebold, in 1838, reported a subconjunctival cysticercus observed by Baum. Coccius reported a cyst in the vitreous resembling a cysticercus. In 1854 cysticercus in the vitreous and under the retina was reported by von Graefe who by 1866 had seen more than 80 cases among 80,000 patients.

Ocular cysticercosis follows the same laws of general infestation as cysticercus cellulosa, the larva of *tenia solium*. Heteroinfection is more common than autoinfestation. The parasite may be found in all the tissues of the eye except the lens. If an exudative inflammatory reaction occurs the following may develop: exudate, iritis, uveitis, purulent iridocyclitis, panophthalmitis, detachment of the retina, synechia of the iris, complicated cataract, and atrophy of the eyeball.

Ocular cysticercosis is a rare occurrence. There were 116 cases in a series of 54,000 patients, a ratio of 1 to 1,383. The first symptom is reduction in vision. If the media are clear, the cysticercus can be identified by its bluish white spherical vesicle with peripheral iridescent reflexes and slight undulatory movements and by its scolex which, when evaginated, reveals the sucking cups and when invaginated appears as a denser white spot in the center of the vesicle, if the media are turbid diagnosis is more difficult. The subconjunctival cysticercus resembles a lymphatic cyst from which it can be distinguished by a denser white spot in the center.

The complement fixation reaction in the blood is positive in 73.2 per cent of cases.

Although extraocular cysticercus is benign, intraocular complications usually result in blindness. The parasite, alive or dead, is destructive to the eye. Medical therapy and destruction of the parasite by caustics, diathermy, or electrolysis is ineffective. When it is situated behind the lens, extraction by the transcleral route is necessary. In 40 attempts, 34 extractions from the vitreous or from the subhyaloid area were successful. In 21 trials, 15 parasites were removed from beneath the retina, 7 of these being spontaneous extrusions after incision of the sclera and choroid. In early cases of subretinal cysticercus, extraction by means of diathermic localization under ophthalmoscopic control is recommended.

Control and inspection of meat, and personal and dietary hygiene, especially in rural areas, are necessary prophylactic measures

JOSHUA ZUCKERMAN, M D

**Tumors of the Optic Nerve Long Survival in 3 Cases of Intracranial Tumor** MAFTIN POSNER and GILBERT MORRAY *Arch Ophth*, Chic., 1948, 40 56

Tumors of the optic nerve may be classified into two general groups (1) intraneural tumors (the gliomas) arising within the nerve stem, and (2) extraneural tumors arising in the nerve sheath and comparable to the meningiomas of the brain. Additionally, a fibromatosis of the sheath is rarely observed. Any type of optic nerve tumor may spread intracranially or intraorbitally (or both).

Tumors confined to the orbit cause a painless unilateral exophthalmos followed by progressive amaurosis. Intracranial spread or origin may cause symptoms simulating those caused by other tumors of the chiasm or suprasellar region. The diagnosis of intracranial tumor of the optic nerve is suggested by unilateral exophthalmos and failure of vision, together with a normal visual field and central visual acuity in the other eye in a patient showing no other evidence of intracranial disease. Roentgenographic evidence of an enlarged optic foramen or erosion under the anterior clinoid process is significant.

Three patients, aged 8, 52, and 18, respectively, have been followed for periods of 12, 10, and 4 years after craniotomy and removal of optic nerve tumors. The chief complaint of all was a progressive reduction in vision of one eye ending in blindness. Two of the patients had a unilateral optic atrophy, while the third had a protrusion of the tumor into the eye at the disc, giving the appearance of papilledema which subsided after removal of the main growth. The long survival of these patients following surgery suggests that these tumors have not a uniformly hopeless prognosis, as was previously believed, and that patients are benefited even if the tumor is not completely removed. FRANK W. NEWELL, M D

## EAR

**Ménière's Syndrome Its Relation to Chemistry, an Etiologic Study** GRANT SELFRIDGE. *Arch Otolar*, Chic., 1949, 49 1

The cause of Ménière's disease is unknown and has been ascribed variously to many things, such as high or low blood pressure, syphilis, infection, various metabolic disturbances such as those due to salt, potassium magnesium iodine, and calcium. No one has noted the relationship between nutritional disturbances and vertigo, which is the purpose of the present article.

Because the lack of sufficient amounts of vitamin, particularly thiamine, nicotinic acid, riboflavin, pantothenic acid and pyridoxine, plays a part in the aging process, one is justified in saying Ménière's disease is a function of the aging process. In one report of 33 cases all of the patients were over 50

years of age. In the other cases all of the patients of 40 years or older showed thiamine and nicotinic acid deficiency in the urine.

Allergy has been mentioned as a cause of vertigo. Grove stated that many patients presented extraural symptoms—headaches, vasomotor rhinitis, gastrointestinal symptoms, insomnia, and urticarias.

The value of histamine in the treatment of Ménière's disease varies according to the authors, but the majority of the authors do not consider that it tells the whole story.

Many authors consider Ménière's disease to be due to disturbance of the water metabolism. In treatment the tinnitus was not much affected.

In summary and conclusion, the author states that deafness (and this includes Ménière's disease) is not related to one thing, but is related to all factors involved in growth, i.e., endocrine products, electrolytes, amino acids, and vitamins, including vitamin A. In the author's experience, patients with eighth nerve deafness with only slight upper tone loss recovered in a few weeks with thiamine chloride and nicotinic acid, while patients who had an abrupt loss did not show any recovery.

A review of the literature gives the impression that the most favorable results have been obtained from the use of several vitamins, and severance of the eighth nerve is not as popular as formerly. It hardly seems preposterous to make the claim that Ménière's disease is a chemical problem still requiring further study, and that it is related to nutritional and environmental factors. JOHN F. DE LUCA, M D

**Ménière's Syndrome Observations on Vitamin Deficiency as the Causative Factor, The Vestibular Disturbance** MILES ATKINSON. *Arch Otolar*, Chic., 1949, 49 151

In earlier articles the author described two groups of cases of Ménière's disease on the basis of the degree of reaction to histamine administered intradermally. In the group with a small response the condition was interpreted as being due to vaso-spasm and that with a strong response as due to a primary vasodilatation.

Eighty seven cases of Ménière's disease were examined for clinical evidence of deficiencies of the vitamin B group. These deficiencies were correlated with the type of vertigo and the character of the response to histamine given intradermally.

The following conclusions were drawn:

1 The patients who experience rotational vertigo alone show signs of nicotinic acid deficiency, they give a small response to histamine, and can be relieved of their attack with nicotinic acid.

2 The patients with positional vertigo alone, described as momentary dizziness on sudden movements of the head, or as longer periods of general unsteadiness, have riboflavin deficiency symptoms, they give a strong response to histamine, and are relieved by the administration of riboflavin.

3 The patients who have both types of vertigo show signs of deficiency of both vitamins, give an

intermediate response to histamine, and respond only when both nicotinic acid and riboflavin are given  
JOHN R. LINDSAY, M D

### Surgery of Chronically Discharging Ear HOWARD P HOUSE *Arch Otolar*, Chic, 1949, 49 135

The author describes several important anatomic landmarks and surgical maneuvers in endaural temporal bone surgery for chronically discharging ear.

A perforating burr is used to enter the antrum. The point of entrance is such that an imaginary line drawn directly posterior from the superior margin of the external bony ear canal will cross the upper margin of the completed perforating burr hole. A line drawn directly superior from the posterior margin of the bony external ear canal will cross the anterior margin of the completed perforating burr hole. This burr hole should never be deeper than the cutting portion of the burr.

In the simple mastoidectomy, after the posterior bony ear canal wall has been thinned, the dural plate exposed, and the horizontal canal identified, a small burr is used to remove the zygomatic cells. The removal of these cells exposes a thin shelf of bone which forms the external wall of the epitympanum.

The modified radical mastoidectomy is a continuation of this procedure. The thin bone shelf overlying the epitympanum is removed and the short crus of the incus and the neck and head of the malleus are exposed. The posterosuperior bony ear canal wall is then taken down. The narrow Lempert elevator is used to separate the membranous canal wall from the bony bridge which is then removed with the rongeur. Pathologic tissue is removed from the epitympanic area. If there has been necrosis in the ossicular chain, the incus and the head and neck of the malleus are removed. A flap may be created as in the fenestration operation. If the epitympanic pathologic tissue has been satisfactorily removed the skin flap is not created and the cavity is allowed to heal as in a simple mastoidectomy. The attic perforation usually closes spontaneously.

In the radical mastoidectomy all remnants of the incus and malleus are removed. A skin flap may be created or completely removed. When the skin flap is preserved, an additional graft may be acquired from the postauricular area and when used seems to expedite healing of the cavity. Before granulations are removed from the middle ear the fallopian canal must be brought into view to avoid injury to the facial nerve. This is accomplished by carefully elevating the periosteum over the horizontal canal until its anterior extremity is reached. The dull ring curette is then directed over the processus cochleariformis into the middle ear. The processus cochleariformis is fractured externally and the tensor tympani muscle and all accessible pathologic tissue in the middle ear are removed.

Granulations over the stapes area can be more safely removed if one uses a posterior to anterior maneuver, which takes advantage of the counterpull of the stapedius tendon. JOHN R. LINDSAY, M D

### Lempert Endaural Subcortical Mastoidotomy for the Cure of Chronic Persistent Suppurative Otitis Media JULIUS LEMPERT *Arch Otolar*, Chic, 1949, 49 20

The chief complaint of almost every patient suffering from chronic otitis media without intracranial complications, for whom mastoidotomy is indicated and advocated by his otologist, is, as a rule, the annoying discomfort of the persistence of his long-standing middle ear discharge, the arrest of which has resisted all available medicinal therapy.

Both the unwillingness of the otologist to assure the patient reasonably of a permanently dry middle ear and his volunteering the information that intracranial extension of the infection will thus be prevented are, as a rule, based on his own experience with mastoidotomy without any attempt on his part to analyze and determine the causes which make such inconsistent facts possible.

The prevention of intracranial extension of the infection is naturally governed by the same surgical factors in the performance of mastoidotomy which govern the arrest of the suppurative discharge, namely, the complete extirpation of the foci of infection. Therefore, it is inconsistent for an otologist to give hope for the prevention of extension of the infection in the face of his lack of confidence regarding his ability to arrest the discharge.

The traditionally accepted and most commonly employed technique of mastoidotomy, known as the Schwartze postauricular radical mastoidectomy, is not conducive to, and does not encourage, the average otologist either to explore successfully, or to eradicate completely by surgery when explored, the varied and multiple pathologic processes which may be encountered. Only after a large experience with this technique can the especially skilled otologist cope successfully with the commonly encountered small sclerotic mastoid process and perform a complete mastoidotomy, and then not always without accident.

The average otologist, when performing the Schwartze radical mastoidectomy, does not in the majority of instances remove completely the pathologic process responsible for the middle ear discharge. The inadequate performance of the Schwartze postauricular radical mastoidectomy is usually prompted by the surgeon's fear of injuring instrumentally one or more of the many vital anatomic structures which may be encountered blindly.

The adjective "radical" when applied to the Schwartze technique is therefore an exaggeration, for the way it is practiced by the average otologist makes the adjective "incomplete" more appropriate and more explanatory.

It is a well established fact today that mastoidotomy can be performed through endaural incisions alone without a supplementary postauricular incision. The postauricular incision is therefore not only unnecessary but also nonsurgical in principle since it involves a sacrifice of soft tissue greater than necessary for accomplishing the desired result.

The technique is fully described and illustrated with 13 drawings

Certain advantages are claimed for the endaural method, such as eliminating the blind search for the antrum by directing all the instrumentation away from the vital structures toward the operation with no danger of a postauricular fistula

Any well trained otologist of average skill, though young in experience, can successfully perform the endaural subcortical mastoidotomy with-out being handicapped by the mental hazards which prevent him from performing the Schwartze radical mastoidectomy successfully

JOHN F. DELPH, M.D.

**Reconstruction of the Auricle with Diced Cartilage Grafts in a Vitallium Ear Mold** LYNDON A. PEER. *Plast Reconstr Surg*, 1948, 3 653

This article is profusely illustrated with 24 photographs and drawings, all with descriptive texts. Essentially, the technique of reconstructing the auricle consists of exposing the ear cartilage and burying it beneath the skin and during the same operation an ear mold filled with diced cartilage is inserted in an abdominal pocket. Five months later the cartilaginous framework is removed from the mold, and the upper part of the framework, which corresponds to the ear defect, is buried in the skin in the exact location of the defect. An Esser inlay is used to cover the back of the framework and raw scalp surface.

Whenever possible the first operative step to reconstruct an auricle should begin when the child is about 4 years old. This allows the surgeon a sufficient time interval in which to complete the ear before the child enters school, which lessens his handicap and facilitates adjustment with his schoolmates.

Autogenous cartilage is always the material of choice for transplantation. It survives as living tissue, is not subject to invasion or absorption, and, like an autogenous skin graft, it remains until the individual in whom it is transplanted dies. This is true whether the cartilage is transplanted with or without its perichondrium.

Preserved cadaver grafts are invaded by fibrous tissue usually over long periods of time, but occasionally they are absorbed rather suddenly. Therefore, preserved cadaver cartilage is not good grafting material to support an ear in a young child with a possible 60 year life expectancy.

Dupertuis demonstrated the growth of costal cartilage grafts in rabbits, and the author's own experimental studies with young human costal cartilage grafts indicated that there was a small increase in the size of the graft in most cases. It should be emphasized, however, that the growth possibilities in an ear framework constructed of multiple segments of young costal cartilage grafts are not known.

From a clinical standpoint, at this time, the author forms the reconstructed ear slightly larger than the normal ear and plans to make any necessary adjustments when and if they are necessary.

JOHN F. DELPH, M.D.

**Modified Radical Mastoidectomy: Preservation of the Cholesteatoma Matrix, a Method of Making a Flap in the Endaural Technique** SHIRLEY HAROLD BARON. *Arch Otolaryngol*, Chic., 1949, 49 280.

The somewhat confused literature on chronic otorrhea and its therapy is reviewed. The pathology and pathogenesis divide chronic otorrhea into a benign type with central perforation and mucoid discharge, and a dangerous type in which cholesteatoma is present. Cholesteatomas are squamous epithelial lined cysts filled with epidermoid debris and its decompensation products. They are subdivided into true cholesteatomas and pseudocholesteatomas, which are pathologically identical. True cholesteatomas (better called *congenital cholesteatomas*) are not associated with the ear. They are due to the rather rare congenital epithelial rests occurring anywhere in the skull. Pseudocholesteatomas (better called *acquired cholesteatomas*) are due to a process which takes place after birth. They are differentiated into primary acquired cholesteatomas, in which there is no previous acute suppurative process, and secondarily acquired cholesteatomas, which are secondary to an acute necrotic middle ear infection. This infection destroys not only all of the mucous membrane of the middle ear but all or at least a marginal portion of the drum and allows healing to take place by an ingrowth of squamous epithelium into the middle ear. This results in a cholesteatomatous cyst or sac of which the neck is connected to a marginal perforation in the tympanic membrane. The primarily acquired cholesteatoma is an epithelium lined cholesteatomatous sac of which the neck is connected to a perforation in the Shrapnell membrane. This type is secondary to a chronically obstructed eustachian tube with retraction of Shrapnell's membrane or to infantile otitis.

The author believes that cholesteatomas cannot be cared for safely by conservative therapy such as attic irrigations, at least not in most cases. She also believes that in almost all cases cholesteatomas can be cared for by the modified radical operation which has the great advantage that no further damage is done to the conductive mechanism of the middle ear, so that hearing is preserved and sometimes actually increased as the ear becomes dry. The modified radical operation should be done in all cases in which the lateral half of the cholesteatomatous sac can be exposed without injury or destruction of any vital portion of the middle ear conduction mechanism. In most cases this means attic cholesteatomas in which the outer attic wall can be taken down to expose the cholesteatomatous sac. The outer half of this sac and the outer half of the neck of the sac are removed. The previously elevated skin of the superior canal wall is slit longitudinally to communicate with the neck of the sac and then is laid backward to provide a plastic skin graft to help line the new addition to the canal wall. This procedure incorporates the attic portion of the tympanic cavity and the excavated outer attic wall into the bony canal wall. The inner portion of the cholesteatomatous sac is left as it helps to

epithelize the cavity. The outer portion of the meatal skin flap is then laid anteriorly to help epithelize the anterior canal wall.

In cases in which complete exposure of the cholesteatoma requires removal of the ear drum and other hearing structures, a radical mastoidectomy must be done. Postauricular incision may be used but the endaural approach is much more satisfactory.

WILLIAM K. WRIGHT, M.D.

## NOSE AND SINUSES

**The Role of the Septum in Rhinoplasty** JACQUES W. MALINIAC *Arch Otolaryngol*, Chic, 1948, 48:189

The author attempts to elucidate the supporting function of the septal, triangular (upper lateral), and quadrangular (alar or lower lateral) cartilages of the nose. He believes a rhomboid "weak spot" in the cartilaginous framework is present at the junction of the upper and lower lateral cartilages anteriorly and is a likely spot for a depression deformity of the nasal profile in the event of an excessive removal of the nasal septum. The alar dome, he alleges, "is suspended by the upper lateral cartilages from above and supported by the lower lateral cartilages from below."

Suggestions as to technique are made for three types of septal deformities: (1) septal deflection with oversized hump deformity, (2) crushed septal fracture with depressed external deformity, and (3) septal deflection with external lateral deflection. "As a general rule, if the deflection is such as to interfere with the successful performance of corrective rhinoplasty, it should be repaired simultaneously with, or prior to, the latter."

JOHN J. BALLENGER, M.D.

**Potential Hazards from Radiation Treatment of Hypertrophied Lymphoid Tissue in the Nasopharynx** LAURENCE L. ROBBINS and MILFORD D. SCHULZ *Laryngoscope*, 1949, 59:147

A warning is issued of the possible dangers in the use of the radium applicator in treating hypertrophied lymphoid tissue of the nasopharynx.

Latent radiation necrosis has been seen from 10 to 20 years after treatment of benign lesions of the skin. The radiation dosage in some of these cases was approximately the same as that now recommended for use in the nasopharynx for the reduction of hypertrophied lymphoid tissue.

The following suggestions are made:

1. The use of radium treatment with the monel metal applicator should not be routine.

2. Except in selected cases the treatment, when given, should consist of no more than an erythema dose.

3. The erythema dose should be determined individually for each applicator and, if any other means of determining the proper dose for a particular applicator fails, the dose may be estimated by trial on the operator's skin.

JOHN R. LINDSAY, M.D.

## MOUTH

**Chemosurgical Treatment of Tumors of the Parotid Gland** FREDERIC E. MOHS *Ann Surg*, 1949, 129:381

The main object of parotid tumor surgery is (1) the complete removal of the neoplasm, and (2) the preservation of as much of the facial nerve as possible.

After premedication with morphine sulfate (0.015 gm.) a keratolytic, dichloroacetic acid is applied to the portion of tumor covered by skin. Whitening of the skin indicates that the keratin layer has been rendered permeable to the zinc chloride. The latter is applied as a paste about 3 mm. thick; it contains 40 gm. of stibnite (80 mesh sieve), 10 gm. of powdered sanguinaria, and 34.5 c.c. of a saturated solution of zinc chloride. The treated area is covered with a thin layer of cotton and then a second layer of cotton with petrolatum to get a moisture-tight closure.

After 24 hours a layer of tissue about 1 cm. thick is excised, if there is doubt about the extent of neoplastic involvement frozen sections are made. As a rule, there is no pain and no bleeding because the incision is made through killed and fixed tissue. Following the excision the fixative is reapplied, and the procedure is repeated after 24 hours. After several days it is usually impossible to differentiate grossly normal from cancerous tissue. Therefore frozen sections are made and the areas of cancer are marked with red pencil on a corresponding map, the latter corresponding to an area marked on the lesion with merbromin. The fixative is then reapplied to the involved area. This process is repeated for several days until all involved areas are gradually excised.

In some areas the neoplasm extends more than 2 cm. beyond the grossly visible tumor, it may follow the perineural lymphatics of the facial nerve or the perimysium of the stylohyoid muscle. Without systematic microscopic control these extensions would have been missed.

The treatment of 17 patients is reported. A case of an 80-year-old patient is described; he was treated for a parotid squamous cell carcinoma, grade 3, measuring 6.5 by 8 cm. and with a central ulceration. The procedure lasted for 20 days, and the defect was healed 2 months later with paralysis of only the mandibular branch of the facial nerve.

In younger patients a prophylactic or therapeutic neck dissection is recommended, also a carotid ligation before treatment is at times advisable in order to avoid hemorrhage, which occurred in 4 of 17 cases and required a suture-ligature or pressure dressing. Ligation of the external carotid artery was performed, once prior to therapy because of obvious deep extension, and a second time because extension around the external carotid was found. Salivary fistulas lasting from 1 week to 21 months were encountered in 15 of the 17 cases reported. Only 4 fistulas persisted over 4 months. Fistulas may be

# SURGERY OF THE NERVOUS SYSTEM

## BRAIN AND ITS COVERINGS, CRANIAL NERVES

**Thorotrast Pyograms in Cerebral Abscess** G K TUTTON and W H T SHEPHERD *Brit J Surg*, 1949, 36 240

Although the value of thorotrast visualization of intracranial abscesses has been well recognized, there has been comparatively little written about their detailed appearance and its implications. The authors report their study of 56 cases of intracranial abscesses in which thorotrast visualization (pyograms) had been carried out. Thirty-eight of the abscesses were due to a direct spread of otogenous origin, paranasal sinusitis, or osteomyelitis of the vault, there were 6 deaths in this group. Seven cases were post-traumatic with 2 deaths. Nine cases were metastatic with 7 deaths, and 2 were of postoperative infection with 1 death. Hence, among the 56 cases there were 16 deaths.

The usual routine in the treatment of a brain abscess is a needle exploration for the abscess through a burr hole. When the cannula is within the abscess cavity its position is maintained and pus is permitted to escape spontaneously. Gentle aspiration is then performed, after which "a mixture of the appropriate antibiotic and 2 c.c. of thorotrast are injected through the cannula." If air is not spontaneously sucked into the cavity, about 2 c.c. are injected, after which the needle is withdrawn and the incision is closed.

A standard roentgenologic technique is advocated in order to permit accurate comparisons with future films. Besides the more routine positions of skull studies, a lateral film in the brow up and brow down position is particularly important. Usually repeat studies are made 4 days after the initial injection, or earlier if necessary, and thereafter at weekly intervals. If the pyograms reveal an insufficient amount of thorotrast, a second injection is made. The initial roentgenograms reveal the thorotrast as an ill-defined shadow, irregular in outline and density. The abscess capsule is usually not visualized until between the sixth and thirty-fifth days after injection in the more acute abscesses which have been present less than 28 days. In abscesses of 30 days or older, the capsule is usually seen within 4 days.

The course of the abscess can be followed in the late stages by the roentgenologic changes of the capsular shadow. Cases in which the head has not been moved about freely or in which a small amount of thorotrast has been injected reveal only a part of the capsule to be well visualized. This would be the most dependent portion. Initially the shadow is spherical, ovoid, or loculated. After resolution of the abscess either by repeated aspirations or a natural process, the capsule becomes thickened and crinkled. If the outline becomes smoother and more

spherical, it indicates that the abscess is enlarging. This is a most important point, since the clinical signs may be very late in appearing.

An important finding by the authors is that the presence of tracts, communications, or pointing of the capsule may suggest the origin of the infection. With shrinkage or contraction there is usually a migration toward the site of origin or attachment which may not have been obvious in the initial pyogram.

Loculation was present in almost half of the cases. Twelve were recognized in the first pyogram and 9 were recognized either at later studies or in retrospect. In 2 cases of verified loculation, the pyograms were negative. Loculation was most easily demonstrated in temporal and cerebellar abscesses.

Four cases of associated intracerebral and subdural abscess were observed in this series. Subdural abscesses on the medial or inferior surfaces of the hemisphere can be definitely recognized only by pyography since it can be tapped only by passing through the cerebral substance.

The progress of the capsule formation is the most definitive indication for surgical excision since both the age of the abscess and the thickness of the capsule can be formulated. In the present series the average thickness of the capsule at time of surgical removal was 2.7 mm and the average age was 76 days. The abscess was usually extirpated through an osteoplastic flap unless it was felt that to do so would cause irreparable functional damage.

JACK I. WOOLF, M.D.

**Abscess of the Frontal Lobe Secondary to Ethmoiditis** JOSEPH H. KLER *Arch. Otolaryngol.*, Chic., 1949, 49 125

The author discusses 3 cases of ethmoiditis which were complicated by single encapsulated frontal lobe abscesses. They presented signs of increased intracranial pressure, meningeal irritation, and periorbital swelling.

Chronic infection of the ethmoid cells is more likely to develop into cerebral abscess than acute infection. The infection passes by continuity through the bone and the meninges, or extends by way of thrombophlebitis of the veins communicating with the dura.

Chemotherapy and adequate draining of the local infection and its intracranial and intracerebral extension is the treatment recommended.

GEORGE PERRET, M.D.

**Rathke's Cleft and Its Cysts** M. L. BAYOUMT *Edinburgh M. J.*, 1948, 55 745

This article deals with the incidence and histology of Rathke's cleft and its cysts and is based on a study of 200 pituitary glands that were collected from autopsy cases of the Neuropathology Department, Royal Infirmary, Edinburgh. As a routine



procedure, the glands were divided sagittally into two halves. Fixation was carried out in Hellv's fluid, formalin, or alcohol. Frozen sections were cut when necessary. The rest of the glands were embedded in paraffin. Serial sections were cut at 6 micra. Two sections were mounted at every one hundred and sixty-sixth cutting. One section was stained with hematoxylin eosin and the other kept for further use. Sudan III and Mayer's mucicarmine stains were used to demonstrate fat and mucin, respectively.

The author noted a distended cleft separating the anterior lobe from the rest of the gland through the whole length of the sagittal plane in 26 of 200 cases (13 per cent).

With regard to the structure of Rathke's cleft cysts, the cyst is lined in parts by tall columnar mucus-secreting epithelial cells possessing numerous delicate cilia. The nuclei are small, rounded, and deeply stained, and lie at the bases of the cells. The ciliated epithelial cells are especially noticeable at the upper and posterior part of the cyst wall. They are invariably visible on serial sectioning. In other parts of the cyst wall, the epithelial lining has become compressed, flattened, and has lost its cilia. The cysts usually contain one or more of the following elements:

- 1 Large foam cells with granular swollen cytoplasm and pyknotic excentric nuclei. Fat stains are negative, while the mucicarmine is positive, which indicates that the cells are derived from degenerating desquamated epithelium.

- 2 Cholesterol crystals.

- 3 Mucinous material and granular debris with remains of disintegrated pyknotic nuclei.

Rathke's cleft cysts may enlarge to such an extent as to give rise to symptoms. Clinically, they are identical with the hypophysial duct tumors (craniopharyngioma) arising from the lower group of epithelial rests at the root of the stalk. Histologically, these cysts form a separate entity from the epidermoid tumors.

The differentiation of Rathke's cleft tumors from other congenital neoplasms of the hypophysis on histogenetic evidence is discussed and verified.

HOWARD H. LANDER, M D

**Tuberous Sclerosis with Cerebral Neoplasm** J C PARR *N Zealand M J*, 1948, 47 550

Tuberous sclerosis is an uncommon hereditary disease usually manifesting itself in infancy or early childhood and is characterized by defective mentality, progressive epilepsy, and a facial rash called adenoma sebaceum. The latter is a reddish or skin-colored papulelike growth distributed in "butterfly" fashion over the face. Occasionally associated retinal tumors are found. Although no symptoms may have resulted from their presence, autopsy often reveals affection of other organs, such as hypernephromas and cardiac rhabdomyomas.

The authors presented a case report of a 43 year old male who had been a successful farmer until

recently when he had a sudden change in mentality and personality. Past history revealed that he had convulsions as a baby, and a rash on his face had been present since boyhood. His mother, who had always enjoyed good health, had a similar rash. Funduscopic examination revealed numerous pearly white nodules in the retina and papilledema. Ventriculography was done. The third ventricle was filled only in its upper portion and displaced to the right. The left lateral ventricle was displaced upward. The lateral ventricles were enlarged and a space-occupying lesion in the thalamus on the left was suggested. Treatment consisted of ventriculocysternostomy followed by deep x-ray therapy. Thereafter, his papilledema subsided and his condition was improved generally, but he remained slow and listless.

DANIEL RUGE, M D

**Massive Intraventricular Epidermoid** Review of the Literature and Report of a Case HOWARD W. DUEKER and J. MA. SANCHEZ-PEREZ *Bull Los Angeles Neur Soc*, 1948, 13 220

Another case is added to reports in the literature of approximately 200 intracranial epidermoids. The authors review the case of a male, 47 years of age, who complained of unusual fatigue and nervousness of 10 years' duration. For 20 years the patient had occasional generalized convulsive seizures accompanied by unconsciousness. Physical examination revealed left homonymous hemianopia, minimal left spastic hemiparesis, and mental confusion. Electroencephalography, pneumoencephalography, cerebral angiography, spinal fluid examination, and ventriculography were done and showed abnormalities compatible with a space-occupying lesion on the right side. An osteoplastic flap was turned in the parietal region but the tumor was not located. The patient expired on the first postoperative day. Post-mortem examination revealed a tumor, 7.1 cm by 4.3 cm, occupying the posterior half of the right lateral ventricle.

According to the authors the ventriculograms and, to a lesser extent, the angiograms and the electroencephalogram served, in retrospect, to accurately outline this epidermoid tumor. Ventriculograms and photographs of the coronal sections of the brain containing the specimen are reproduced.

The review of the literature is very brief, the majority of the paper being devoted to the case history, laboratory findings, and postmortem examination of the brain.

JOHN L. BELL, M D

**Fetal Cell Adenomas of the Hypophysis Cerebri** M. L. BAYOUNT *Edinburgh M J*, 1948, 55 750

A study of the adenomas of the human hypophysis and their classification on a histogenetic basis reveals a group of tumors arising from embryonic cells. These neoplasms form a special entity with a characteristic morphological picture.

The material studied consisted of two groups. The first group comprised 105 cases of hypophysial chromophobe adenomas removed surgically.



suture less subject to tension. In 16 of these a portion of the clavicle was resected.

The experience at the Center with this resection has been that in cases of extensive destruction of all or a great part of the elements of the brachial plexus, such as those with complicating fracture and osteomyelitis, in which the resultant cicatricial development has been excessive, the better exposure of the field of operation will shorten the time of operation materially. In some cases of short-necked and fat individuals proper exposure cannot be obtained without it. In the cases of interruption of the seventh and eighth cervical and first dorsal roots the necessary suture would be impossible without approaching the shoulder to the trunk.

The simple cutting through of the clavicle, even when placed toward the inner or outer end of this bone, will, as a rule, result in overriding and the development of abundant callus which will bring the menace of later pressure on the plexus.

The clavicle is a rudimentary bone and its functioning will be taken over satisfactorily by the associated musculoligamentous complex of the shoulder. The absence of the clavicular bone will not leave any particular deformity or false posture of the arm. There may possibly remain a slight lowering of the shoulder in comparison with the other side and a slight narrowing, but these will not noticeably show through the ordinary clothing.

Six photographs are appended, showing the insignificant character of the resultant deformity from 2 to 5 years after the operation. Some of these illustrate a regaining of function in the extremity supplied by the injured plexus, which suggests an actual advantage gained by the procedure.

JOHN W. BRENNAN, M.D.

#### Traction Injuries of the Brachial Plexus in Adults

ROLAND BARNES *J Bone Surg*, 1949, 31-B 10

The author presents a review of 63 cases of closed injuries of the brachial plexus in patients who were treated in British peripheral nerve injury centers during the war. Most of these traction injuries occurred as the result of motorcycle accidents, in which forcible separation of the head and shoulder was the main factor. Thirteen injuries were classed as non-degenerative lesions. In degenerative lesions the pattern of recovery was fairly constant, lesions of the three upper roots recovered well, and lesions of the entire plexus did not completely recover.

Rupture of nerve roots with complete separation of the torn ends occurred only rarely in this series, as verified by operative exploration. The main damage to the plexus was intraneural. When rupture of nerves was encountered, it was impossible to perform satisfactory end-to-end suture after adequate resection of the scarred stumps. Horner's syndrome is considered a grave prognostic sign indicating irreparable injury of the lower roots and often of the entire plexus.

The author advocates conservative, nonoperative treatment for this type of injury of the plexus. Be-

cause the chief barrier to regeneration was found to be intraneural scarring, early or late explorative operation was not deemed justifiable except for the relief of pain in selected instances. According to the author, reconstructive procedures to improve the function of the limb after the extent of recovery has been established should not be considered earlier than 15 months after injury. An extensive routine of physical therapy is advocated for patients with traction injuries of the brachial plexus.

JOHN L. BELL, M.D.

#### Late Spinal Paralysis after Avulsion of the Brachial Plexus

WILDER PENFIELD *J Bone Surg*, 1949, 31-B 40

This unusual case presentation is that of a man who, as a boy, suffered a severe traction-avulsion injury of the brachial plexus, during which accident the extremity was completely avulsed. The patient recovered without any immediate spinal cord paralysis, and lived to die of cardiac disease at the age of 65.

In early adult life he began to show some evidence of cord involvement, mainly on the right side (the side of his injury), and he had evidence of cervical autonomic involvement on this side. He was subjected to a laminectomy at the age of 60, and it was found that the cord was angulated sharply and pulled out into the first thoracic intervertebral foramen on the right. It was believed that not only had the original injury pulled the cord over, because of traction on the root, but that the cord had, by the gradual process of scar formation, been pulled slowly into this enlarged foramen.

The right first thoracic nerve was cut across, and the cord moved back toward the midline of the vertebral canal into its normal position. The cord was, surprisingly enough, found not to be particularly atrophied, even after being out of its proper position for such a long time in the presence of surrounding scar tissue.

JOHN MARTIN, M.D.

#### Treatment of Residual Paralysis—Brachial Plexus Injuries

A. M. HENDRY *J Bone Surg*, 1949, 31-B, 42

In the present article the author makes a plea for the preservation of the patient's own upper extremity after severe paralysis following brachial plexus injury, rather than the use of amputation and an artificial limb.

The important point is made that even though the patient requests amputation of the apparently useless extremity, he should be prevailed upon to try less radical methods to preserve his arm by such reconstructive surgery as might be suited to his case.

The author has considered the severe paralysis following brachial plexus injury according to the functional levels of the extremity—that is, the hand, wrist, forearm, elbow, and shoulder—and case reports are given to illustrate his approach to the problem in the various levels. He feels that when nerve repair is impossible, the transposition of muscles which are still functioning or likely to regain func-

tion must be carefully considered and worked with. Very frequently a well chosen arthrodesis will place the extremity, or part of it, in at least a semifunctioning position. He points out that even a flail-like hand can thus be placed into some semblance of a functional position, and that an elbow which hangs fully extended causes incapacity of the extremity. Again, transposition of the proper muscles or the placement of a bone-block behind the elbow, permitting initial flexion, will greatly improve the weight-carrying angle. It is believed that arthrodesis of the shoulder joint should be the last treatment of a paralyzed upper limb, however, when indicated, arthrodesis of the shoulder may add greatly to the rehabilitation of the extremity.

JOHN MARTIN, M D

**An Operative Approach to Supraclavicular Plexus Injuries** J E BATEMAN *J Bone Surg*, 1949, 31-B 34

In the treatment of 21 patients requiring supraclavicular exploration of the brachial plexus following injury, the author's operative approach was different from the classical supine position. He advocates the sitting position with the head rotated away from the injured side and the shoulder in the dependent position.

The procedure is as follows:

A vertical incision is made, extending from the midpoint of the lateral border of the sternocleidomastoid to the middle third of the clavicle, the external jugular vein is ligated, following retraction of the sternocleidomastoid, the omohyoid muscle is divided, the suprascapular and transverse cervical vessels are ligated, following which the brachial plexus is exposed. Although seldom necessary in the present series, further exposure may be attained by division and retraction of the clavicle. As the clavicle is pulled down by the dependent shoulder, it is possible to explore a larger field from above, and the structures of the plexus remain more superficial than when the supine position is employed.

JOHN L BELL, M D

**The Surgical Routes in High Lesions of the Sciatic Nerve** (Le vie chirurgiche nelle lesioni alte dello sciatico) G MORANDI *Chir org movim*, 1948, 32 383

Basically, four routes have been proposed to expose the anatomic lesion of the high portion of the sciatic nerve:

1 A longitudinal incision perpendicular to the course of the nerve from its origin to the upper third of the thigh, also called Foerster's longitudinal incision on the median line. It involves the skin, subcutaneous tissue, aponeuroses, gluteus maximus, and origin of the femoral biceps muscle, and provides good visibility of the nerve, but forces the surgeon to operate on a deep plane which, especially in obese subjects, makes the surgical manipulations of the nerve difficult.

2 Iselin's incision follows the lateral border of the gluteus maximus from the iliac crest down and

runs for a few centimeters on the median line between the great trochanter and the ischiatic tuberosity. It cuts the skin, subcutaneous tissue, and aponeurotic fascia, and detaches the insertion of the gluteus maximus or, if the lesion is very high, respects the lower two-thirds of the insertion. Medial retraction of the flap exposes the sciatic nerve from the piriform muscle to the femoral biceps.

3 The incision of Toennis begins at the level of the posterosuperior iliac spine and runs along the medial border of the buttock to the intergluteal sulcus in the form of a reversed question mark to join the median line between the great trochanter and the ischiatic tuberosity, from where it descends on the thigh for a few centimeters. It cuts the skin, subcutaneous tissue, part of the upper insertion, and then the muscular tissue of the gluteus maximus lower down. Lateral retraction of the flap exposes the apparent origin of the sciatic nerve down to the gluteal fold, and removal of part of the sacral ala exposes the roots of the nerve.

4 The oblique incision following the course of the fibers of the gluteus maximus begins at the level of the great trochanter and allows separation of the muscle bundles to reach the sciatic nerve which crosses the operative field. It exposes only a small portion of the nerve and is impractical because the surgeon has to work in a deep groove in which vision is poor.

On the basis of 58 firearm lesions of the sciatic nerve involving the portion between its apparent origin and the upper third of the thigh, which were operated upon, the author draws the following conclusions:

In lesions at the limit or immediately below the lower bundles of the gluteus maximus, the median incision at the upper third of the thigh associated with partial section of the lower muscular bundles of the gluteus is indicated. When the lesion is between the apparent origin of the nerve and the lower limit of the gluteal mass, Iselin's incision with distal detachment of the gluteus maximus is used. In lesions involving the roots of the nerve, the Toennis incision with removal of part of the sacral and iliac ala is indicated. In all cases in which the gluteus has been detached proximally (Toennis) or distally (Iselin) or cut in the median line, the region must be put at rest by the use of a hip plaster cast which is removed after 30 days unless the nature of the operation on the nerve (suture) requires 45 days, this will allow the formation of a solid scar for the gluteal muscle and a return to normal conditions.

RICHARD KEMEL, M D

## MISCELLANEOUS

**Preoperative and Postoperative Care in Neurosurgery** (Cuidados preoperatorios y postoperatorios, en neurocirugía) RAMÓN DEL CUETO, JR *Asia* 1949, No 29 1912

With the exception of the surgery of the heart, blood vessels, and lungs, there is no field of surgery

concluded that until a further examination of this material can be carried out in 5 years' time, the supraclavicular glands should be removed with the axillary group of glands when the latter are seen to be macroscopically invaded. In contradistinction, the authors state that removal of supraclavicular glands is not necessary in the absence of any axillary glandular involvement.

In 2 previous series of investigations, practically speaking, the same incidence of recurrence in the supraclavicular glands was found as in this present series, in which microscopic metastases were found after the preventive removal.

The great question to decide is whether microscopic metastases of the supraclavicular glands should be judged in the same light as clinically established supraclavicular glandular involvement, that is to say that the case is inoperable and that consequently the removal of the supraclavicular group of glands is unnecessary. This question will be answered by subsequent examinations.

### TRACHEA, LUNGS, AND PLEURA

**Practical Correlative Anatomy of the Bronchial Tree and Lungs** JOHN FRANKLIN HUBER *J Natl M Ass*, 1949, 41: 49

The lung, in its ultimate analysis, is the total branching of the bronchus leading to the lung. As the main bronchus gives off a branch going to a lobe, the lobe can be considered as the total branching of the bronchus going to it. Each branch of the bronchus entering a lobe divides to form a definite portion of that lobe. Thus, there are three branches of the right upper lobe bronchus, and the total branching of each of these branches forms a definite portion of the right upper lobe, so that the right upper lobe is divided into three parts on the basis of the bronchial distribution. The name bronchopulmonary segment is commonly used for the portion of lung substance which is the total branching of a bronchus.

Based on this concept, the lungs may be divided into the following segments:

Right lung		Left lung	
Lobes	Segments	Lobes	Segments
Upper	Apical	Upper	Upper { Apical posterior division
	Posterior		Anterior
Middle	Anterior	Lower	Lower { Superior
	Lateral		lingular
Lower	Medial	Lower	division { Inferior
	Superior		Superior
	Medial basal		Anterior medial
	Anterior basal		basal
	Lateral basal		Lateral basal
	Posterior basal		Posterior basal

The subdivisions of the lung having thus been named, the bronchus is named according to the subdivision of the lung to which it goes.

This concept of bronchial branching and related subdivision of the lung is of clinical importance. A bronchoscopist is immediately able to relate the bron-

chial orifice he sees to a definite portion of the lung. The radiologist can more specifically locate the abnormality he finds. The thoracic surgeon can do a segmental resection rather than a lobectomy.

The question of the predilection of disease for certain segments requires much study. Thus, the posterior segment of the upper lobe is a favorite for tuberculosis. Lung abscess is apt to appear in the superior segment of the lower lobe or in adjacent parts of the anterior and posterior segments of the upper lobe. Bronchiectasis commonly involves the lower lobe, the adjacent part of the middle lobe on the right side, and the lower or lingular division of the upper lobe on the left. Pneumonia may have a slight predilection for the superior segment of the lower lobe.

SAMUEL KAHN, M D

**Bronchostenosis of Inflammatory Origin, with a Report of 6 Cases** H F FABRITIUS AND H ØDEGAARD *Acta radiol*, Stockh., 1948, 30: 385

Bronchial obstruction is believed to be the commonest cause of atelectasis. Obstruction of the lumen, changes in the bronchial wall, or extrabronchial compression may occur. The changes in the bronchial wall may be inflammatory or neoplastic. In the present article the authors deal with obstruction due to inflammation.

Six cases of bronchial stenosis with associated peripheral changes in the lung are reported. In all of these patients the stricture was caused by local inflammation. The condition was verified by roentgenography and bronchoscopy in each case. All patients gave a history of prolonged bronchial symptoms. In 1 case the inflammation originated around a foreign body, in 2 cases the tuberculous bacillus was demonstrated, but after extirpation no evidence of tuberculosis was found. The author points out that chronic bronchitis may mask a bronchostenosis caused by localized inflammation in a bronchus.

ROBERT E FLORER, M D

**A Case of Arteriovenous Aneurysm of the Lung Cured by Resection** OLAF BRØBECK *Acta radiol*, Stockh., 1948, 30: 371

The clinical characteristics of arteriovenous aneurysm of the lung are cyanosis, polycythemia, clubbing of fingers, and x-ray findings. Other clinical findings are dyspnea and fatigue, small hemangiomas of the skin, and a murmur over the aneurysm. In this condition some blood passes through the pulmonary circulation without having been oxygenated. On x-ray examination, a small or large rounded shadow is seen in the lung field and sometimes pulsation may be observed by fluoroscopy. A more characteristic finding is that the shadow is connected with the hilar region by broad sinuous densities. A case is presented of a 34 year old woman with a history of cyanosis and dyspnea since childhood. She was poorly nourished, there were many superficial angiomas on the face, there was stasis of the veins of the neck and brow, and clubbing of the fingers. On x-ray examination, a dense, well defined shadow was ob-

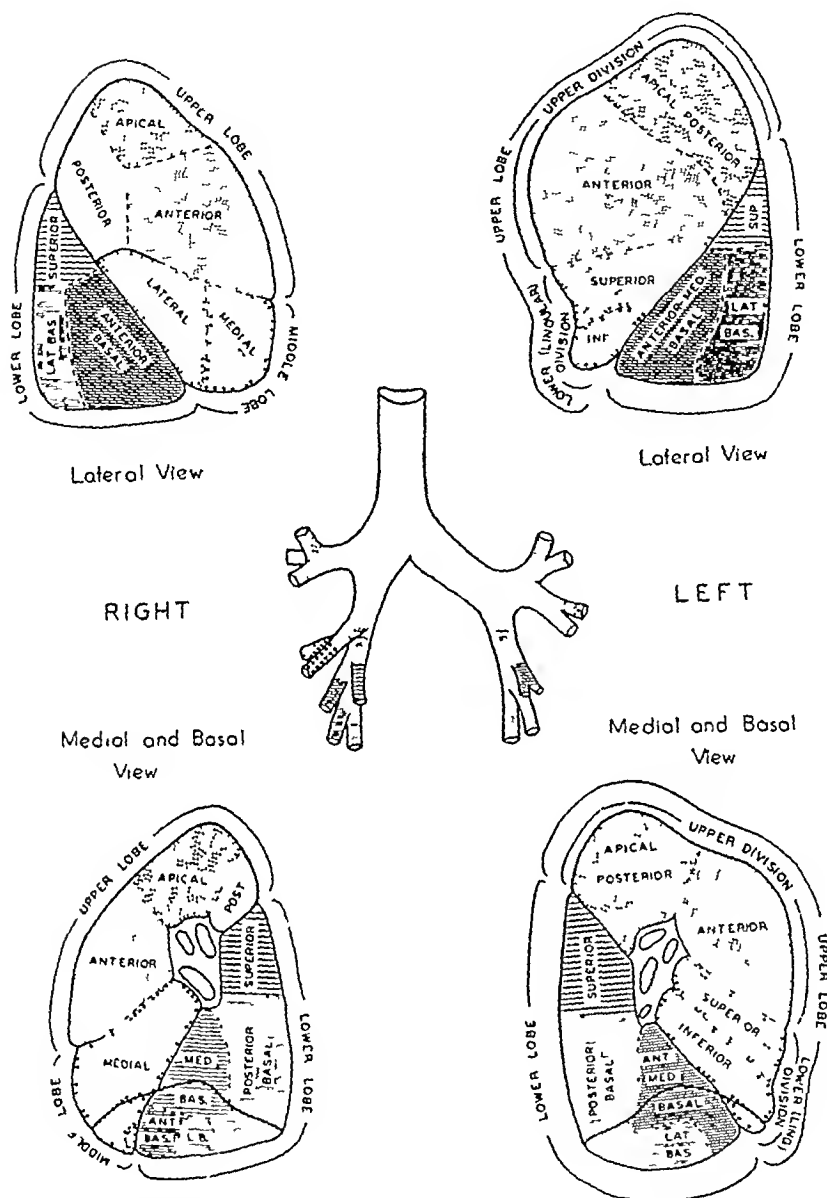


Fig 1 (J F Huber) The tracheobronchial branching as far as the "segmental" bronchi correlated with the subdivision of the lungs on the basis of bronchial distribution. The terminology used is that suggested by Jackson and Huber. Because of insufficient space the word "segment" was omitted in each case from the labelling of the segments. The symbols in each bronchus indicate which segment it branches out to form. Each bronchial branch should be designated by the name of the subdivision of the lung supplied by it.

ved in the left lower lung field near the cardiac shadow. Pulsation of the tumor could not be demonstrated by fluoroscopy.

On thoracic exploration it was found that anterior in the lower lobe there was apparently a sac the size of a large walnut which was so thin-walled that

the blood could be seen passing through it. This sac was seen to be connected with the lingula where it continued in a much larger thin-walled sac. The sac entered the inferior pulmonary vein. The aneurysm was resected. The postoperative course was uneventful.

ROBERT E. FLORER, M.D.

**Streptomycin as an Adjunct in the Surgical Treatment of Pulmonary Tuberculosis** DANIEL A. MULVIHILL, LAURENCE MISCALL, ROBERT KLOPSTOCK, and JOSEPH BITSACK *J Thorac Surg*, 1949, 18, 1

The authors' experience with streptomycin as an adjunct in the surgical treatment of pulmonary tuberculosis in the Triboro Hospital, Jamaica, Long Island, during the year 1947 is presented. The results in 65 cases of pulmonary, pleural, and chest-wall tuberculosis treated with streptomycin are summarized, and case histories typical of each group are cited. Twenty additional thoracoplasty patients who had not received streptomycin are included as controls. The efficacy of preoperative and postoperative streptomycin treatment in the prevention of postoperative complications in pulmonary resection for tuberculosis and thoracoplasty is evident. Beneficial effects of topical application of the drug in combination with open operations for bronchopleural fistulas and residual tuberculous empyema spaces are outlined. The dosage, mode of administration of the drug, and toxic reaction are reviewed.

In the authors' experience, streptomycin has been a most valuable adjunct in the surgical treatment of pulmonary tuberculosis, and has proved efficacious for the following indications:

- 1 Preoperatively and postoperatively for all pulmonary resections and intrapleural surgery on tuberculous patients
- 2 Preoperatively and postoperatively for all thoracoplastics considered substandard risks, or with complications such as contralateral pneumothorax, diabetes, etc.
- 3 For acute exudative postoperative spread, in cases in which streptomycin has not been used prophylactically
- 4 Intrapleurally, for pure tuberculous empyema without bronchopleural fistula
- 5 In combination with open Schede thoracoplasty for tuberculous mixed empyema with bronchopleural fistula
- 6 In infected chest wounds and sinuses

JOHN J. MALONEY, M.D.

**The Role of Streptomycin in the Surgery of Pulmonary Tuberculosis** PAUL T. CHAPMAN, E. J. O'BRIEN, PAUL V. O'ROURKE, and BRUCE DOUGLAS *J Thorac Surg*, 1949, 18, 15

Patients receiving streptomycin were divided into the following groups:

**Group 1** Those in whom the authors hoped that collapse or other surgical measures could be avoided or reduced in amount.

**Group 2** Those in whom surgical procedures (contraindicated because of the patient's condition) could be made possible through streptomycin.

**Group 3** Patients who received the drug as a prophylactic measure against spreads following surgical and collapse procedures or as a means of clearing these spreads if they occurred, and of making operation possible at an earlier time.

**Group 4** Patients with proved or suspected tracheobronchial disease.

In Group 1, composed chiefly of patients with early, minimal, and moderately advanced disease, the authors have found that streptomycin has decreased the necessity of collapse measures by over 50 per cent. Even in more extensive disease, the results are sometimes so startling that further procedures are found unnecessary to complete the arrest of the disease.

In Group 2, the authors have found that the number of patients in whom surgical procedures (especially thoracoplasty) were possible was doubled by the administration of streptomycin. Many lesions seen before the administration of streptomycin were so extensive and of such character that collapse measures could not be performed. Also, the condition of many patients was too grave, and there were complications such as gastrointestinal, peritoneal, pelvic tuberculosis contraindicating surgical procedures. Streptomycin is markedly effectual in these complications, and after they have subsided and sufficient clearing of the lesion has taken place surgical procedures may frequently be completed with the expectancy of good results. The authors have often seen patients who were extremely ill, with high temperature and dyspnea (some almost moribund and in oxygen tents), in whom the temperature became normal rapidly, the oxygen tent was removed, and the patients continued to improve, making surgical procedures (with good results) possible later.

Group 3 somewhat overlaps Group 2, but is considered separately. This group includes patients in whom major procedures are contemplated, in whom soft lesions exist on the operation side, or an unstable lesion is present in the contralateral lung. Streptomycin is used here to prevent contralateral spread, and to clear or protect the contralateral lesions during and after surgery. In Negroes and others with known lack of resistance, the use of the drug is imperative. The authors are now operating on much softer lesions, earlier, and have observed fewer spreads since they have used streptomycin. They now believe that in all patients undergoing major surgical procedures it should be used prophylactically.

With regard to Group 4, there is no question as to the results obtained in proved ulceration. These lesions often heal as if by magic soon after the drug is started. The number of bronchoscopies performed for these lesions has been strikingly reduced. Prolonged treatment with silver nitrate is no longer necessary. Bronchoscopy is now done for diagnosis, and again after streptomycin therapy, the latter being virtually unnecessary, however, except for statistical purposes, because it is so rare not to find ulcers healed after streptomycin therapy.

As would be expected, the results were most striking in soft, mixed, and in the majority of recent lesions. However, occasionally in apparently old, fibrotic lesions excellent results have been obtained.

In almost all patients, some clearing of the lesions and clinical improvement have been noted. One of the great problems is to know what to do with these "old chronics" in whom the outlook seems hopeless. If we give streptomycin to them as a last resort, we shall probably tend to put the drug into disrepute.

In the authors' experience, the results of streptomycin therapy, in properly selected patients, have frequently been so amazing that there is an inclination to be overzealous in our attitude toward it.

JOHN J. MALONEY, M.D.

**An Evaluation of Streptomycin as a Protective Agent in Pulmonary Resection for Tuberculosis**  
JULIAN A. MOORE, JAMES D. MURPHY, and PARKER D. ELROD. *J. Thorac. Surg.*, 1949, 18: 45

The authors are of the opinion that streptomycin is a suppressive or bacteriostatic agent of proved value against the tubercle bacillus. It is not a cure for tuberculosis. In certain types of cases, however, it has proved to be of inestimable value in controlling the disease. They believe that it is too early for any one to attempt to assess its value in the treatment of tuberculosis, and that this cannot be done until several years have elapsed. From their clinical experience they consider that its chief place in the treatment of tuberculosis is as an adjunct to establish collapse procedures. With the use of streptomycin it has been possible for them to perform a lobectomy or a pneumonectomy for tuberculosis with a low morbidity and mortality rate and with excellent early results.

If the late results following pulmonary resection prove to be as gratifying as those after thoracoplasty, it is believed that indications for resection will be greatly extended.

JOHN J. MALONEY, M.D.

**Comparison of Results in 200 Consecutive Resections for Pulmonary Tuberculosis**  
CHARLES P. BAILEY, ROBERT P. GLOVER, and THOMAS J. E. O'NEILL. *J. Thorac. Surg.*, 1949, 18: 36

From the authors' appraisal of their entire experience with pulmonary resection for tuberculosis, they have come to the conclusion that the beliefs first voiced upon the use of streptomycin in resection for pulmonary tuberculosis, by Glover, Clagett, and Hinshaw, are essentially corroborated. Provided that a previous course of streptomycin therapy has not rendered the patient bacteria streptomycin-fast, a definite suppression of the tuberculous process is produced during preoperative therapy. The patient's disease then temporarily assumes a more chronic course, so that it can be subjected to surgery with a much greater margin of safety. In the treated group, the incidence of tuberculous operative spreads and flare-ups become practically nil. Infections of the pleura and chest wall were remarkably reduced in spite of the inclusion of 14 cases of empyema (with proved bronchopleural fistula in 12 cases) in the streptomycin-treated group.

The complications which are essentially due to the resection rather than to the tuberculosis were un-

changed. While more difficult cases were frequently chosen for surgery in the streptomycin-treated group, improvements in surgical technique rendered the nonspecific complications and mortality about the same.

The authors believe today that the mortality in pulmonary resection for tuberculosis can be set at any figure over 5 per cent (dependent upon the type of case selected for resection) and the choice between radical or conservative management must be left to the judgment of each individual clinic.

JOHN J. MALONEY, M.D.

**Disposal of the Bronchial Stump in Lobectomy and Pneumonectomy for Bronchiectasis**  
ERIK UNONIUS. *Acta chir. scand.*, 1949, 97: 442

As long as the tourniquet method was used, with or without separate ligation or suture of the vessels and bronchus, infection of the mediastinum and pleura, bronchial fistula, abscess around the stump, late hemorrhage, and sepsis were frequent sequelae. The technique of dissecting the hilus and disposing of the vessels and bronchi separately, however, did not itself ensure satisfactory results. The method of closing the bronchi is of great importance. The structures in the hilus of the part of the lung to be resected are anatomically dissected. After ligation of the vessels, the bronchus is divided and the outermost ring of cartilage is removed for the purpose of obtaining a soft invaginable stump. The edges are coated with 3 or 4 interrupted silk sutures, avoiding the mucous membrane. The stump is closed with a continuous catgut suture. The corners are invaginated with silk, and the midpart of the bronchus with a few interrupted silk sutures. The wound in the mediastinum is powdered with a mixture of 30,000 units of penicillin and 5 gm. of sulfathiazole, and the stumps of bronchi and vessels are then buried separately into mediastinal tissue. A continuous pleural suture then closes the entire area.

Forty-nine of 53 patients so treated recovered. No case of insufficiency of the bronchial stump occurred, the stump in each case healing by first intention.

SAMUEL KAHN, M.D.

**On Abscess of the Lung**  
V.-M. ANTONEN and HEINO LAITINEN. *Ann. med. int. fenn.*, 1948, 37: 183

The present article is based on a study of 106 patients with lung abscess who were treated at Kivela Hospital, Helsinki, and in the Third Medical Department of the University of Helsinki. More than one-half of the patients were between 30 and 50 years of age, and 75 per cent of them were males. The primary diseases were pneumonia, primary atypical pneumonia, bronchiectasis, sepsis, and pulmonary tumor. In 94 per cent of cases the abscesses were single. It is pointed out that multiple abscesses may result from conditions such as bronchiectasis, as well as from bacterial embolism. In this series the symptoms were fever, cough, pain, purulent sputum, bloody sputum, loss of weight, and weakness. The causative agents were mostly penicillin-sensitive.

aerobic cocci. It is suggested that a cavity with a fluid level represents a phase in lung abscess. It is sometimes intermittent, and frequent x-ray studies are necessary in some cases. Abscesses occurred more often in the right lung than in the left.

From a therapeutic standpoint, it is believed that medical care with combined sulfonamide-penicillin therapy is efficacious in a high percentage of cases of lung abscess. Treatment with these drugs can be followed safely for a longer period than the usually accepted 2 months.

The complications in this series were pleural empyema, exudative pleurisy, amyloidosis, and profuse lung hemorrhage.

ROBERT E. FLORER, M.D.

**Clinical Considerations in a Case of Tumor of the Upper Lobe of the Right Lung (Pancoast's Syndrome) with Secondary Infection, Diffusion of the Process to the Right Supraclavicular and Laterocervical Region, and Subsequent Fistulization** (Considerazioni cliniche su di un caso di tumore del lobo superiore del polmone destro [sindrome di Pancoast] con infezione secondaria, diffusione del processo alla regione sopraclavicolare e laterocervicale destra e successiva fistolizzazione) VINCENZO MIADONNA *Minerva med.*, Tor., 1949, 40, 69.

This case of lung tumor was observed in a man of 40 years, in whom an adenocarcinoma originated in a bronchus and developed superficially in the right pulmonary apex, and thereby caused Pancoast's syndrome. The onset of the tumor was evidenced by a bronchopneumonic process in the pulmonary zone depending from the bronchus which was involved by the tumor. The process spread to the supraclavicular and laterocervical lymph nodes and soon invaded these two regions entirely. Simultaneously, infection of the tumor occurred, probably through some bronchus in which the secretions stagnated and offered a favorable medium for the development of the bacteria. The infection spread to the entire neoplastic mass, causing a phlegmon of the jugular region and the appearance of fistulas in the right supraclavicular area. The course of the disease was marked by intense pain which required the use of large doses of narcotics. Death occurred 16 months after the onset of the first symptoms.

It is recognized that pulmonary tumors can at times appear suddenly, as if they were common bronchopneumonic foci, but the present case was peculiar. In June, 1945 an opacity of bronchopneumonic type in the stage of resolution was observed in the subclavicular region, while in December the clinical and roentgen pictures differed in site and aspect: there was no trace of the previous opacity, but another more marked and completely different shadow had appeared in the apical zone. It is difficult to establish a pathogenetic connection between these two findings and the literature is silent on the subject, but a study of the case allows the following deductions:

The diagnosis of a bronchopneumonic focus was correct, the focus presented an irregular course and

delayed resolution but eventually healed as examination 2 months later demonstrated the disappearance of the shadow and clinical signs. However, the patient continued to have his disturbances and his general condition did not improve, then another examination revealed the apical opacity with its peculiar aspect.

The bronchial secretion is carried upward by the action of cilia of the bronchial epithelium, but at some point this epithelium is altered by the presence of a tumor, some stagnation of the secretion must result below the alteration even if the bronchial lumen is not decreased. This explains how the seat of the inflammatory focus may be totally different from that of the tumor, and also how the inflammatory focus may undergo resolution through the normal processes of immunization.

As the tumor developed superficially in the apical zone, it would seem difficult to establish its point of origin in a bronchus. But it must be remembered that a tumor sometimes does develop far from its bronchial origin and that the histologic aspect of the present tumor, an adenocarcinoma, demonstrates its origin from the elements of the bronchial glands.

RICHARD KEMEL, M.D.

**Diagnosis of Carcinoma of Lung** LEWIS B. WOOLNER and JOHN R. McDONALD *J. Am. M. Ass.*, 1949, 139, 497.

An analysis of 200 cases in which a diagnosis of carcinoma was made on the basis of examination of smears of sputum or bronchial secretions was carried out. In 190 cases a final diagnosis of bronchogenic carcinoma or pulmonary metastatic carcinoma was made. In 4 cases a carcinoma in the esophagus, larynx, or trachea was demonstrated. In 4 cases the diagnosis was proved to be falsely positive. In the remaining 2 cases the final diagnosis was uncertain.

Exfoliated carcinoma cells in sputum or bronchial secretions provided the only preoperative microscopic evidence of cancer in 29 of 74 cases of bronchogenic carcinoma in which surgical exploration was carried out. In 13 cases of bronchogenic carcinoma in which the lesion proved removable, a preoperative diagnosis of cancer was based on the cytologic characteristics of the sputum or bronchial secretions. In 6 cases of Pancoast's tumor and in 4 cases of alveolar cell tumor there were carcinoma cells in the sputum.

Cytologic examination of sputum is of great diagnostic value in the case of patients suspected of having bronchogenic carcinoma and in whom bronchoscopic examination is contraindicated.

**Carcinoma of the Lung with Intracranial Metastasis: Successful Removal of Metastatic and Primary Lesions** H. THOMAS BALLANTINE, JR., and FRANCIS C. BYRON *Arch. Surg.*, 1948, 57, 819.

The authors have estimated that the incidence of intracranial metastasis from pulmonary carcinoma (based on data from several sources) is 23 per cent. The accepted theory with regard to the occurrence of metastases is based on the fact that the carcinoma



cells can enter the blood stream without passing through the capillary filter of the lung. The authors cite several reports of cases in which the patients lived from 2 months to 6½ years after removal of metastatic lesions. A case is presented in which both the metastatic lesion and the primary lesion were removed. The authors state that they were unable to find in the literature any report of such a case.

The patient was a 54 year old white man who complained of left-sided weakness, jacksonian epileptic attacks, and uncontrolled movements of the left foot. At operation, a subcortical cyst in the region of area 4 was removed, and radical extirpation of carcinomatous tissue in this area was done. Later a pneumonectomy was performed. Five months after the last operation there was residual spastic paresis of the left leg. There was no evidence of recurrence of either carcinoma.

The authors state that in dealing with these cases, frequently one must consider the brain lesion first because of the patient's intolerance to increased pressure from these expanding lesions. Care must be taken to localize the intracranial lesion as much as possible before surgery. Craniotomy is indicated in the presence of only two well localized intracranial lesions, whether or not the primary tumor can be removed.

ROBERT E. FLOERER, M.D.

#### Pulmonary Resection for Metastatic Malignancy

DOUGLAS ROBB *Brit J Surg*, 1948, 36: 200

Prompted by Alexander and Haight's report in *SURGERY, GYNECOLOGY AND OBSTETRICS* (1947, 85: 129), of 24 collected cases (19 of their own and 5 collected) of resected pulmonary metastases in which 12 patients survived without recurrence for periods varying from 1 to 12 years, the author reports 3 cases of resection of metastatic hypernephroma to the lung.

In the first case a 42 year old woman had a left nephrectomy for hypernephroma of 4 years' duration. Eight years later a tumor developed in the left lower lobe for which left lobectomy was performed 6 years later. This patient has remained disease-free for 2½ years.

In the second case a 63 year old man had a right nephrectomy for hypernephroma, which was followed 6 years later by cough and blood-stained sputum. Left pneumonectomy disclosed metastatic hypernephroma in the lower lobe, with two small nodules in the anterior border of the upper lobe. After metastases became apparent in other sites, 11 months after pneumonectomy and at 14¼ months, the patient died with widespread multiple metastases involving the original site, the inferior vena cava, the diaphragm, and the right lung.

In the third case a 65 year old woman was not followed up after pneumonectomy. She was found to have an abdominal tumor 10 years before right nephrectomy was done, 10 years later symptoms of lung tumor developed. Left pneumonectomy disclosed metastatic hypernephroma at the hilum, with a small nodule near the edge of the lower lobe.

It is characteristic of hypernephroma metastases to appear after long intervals of apparent surgical cure of the primary lesion. Also, occasional cases of spontaneous regression of pulmonary metastases are reported (*Surg Gyn Obst*, 1937, 65: 433).

Chest films at 3 to 6 month intervals up to 10 years after nephrectomy are recommended as an important feature of the follow-up of hypernephromas.

FRANK B. QUEEN, M.D.

#### Experimental and Clinical Studies of the Role of Streptomycin in the Pleural Cavity

EDWARD J. BEATTIE, JR., BRIAN BLADES, and CHARLES HORTON *J Thorac Surg*, 1949, 18: 25

Experiments and clinical studies were carried out to determine the pathologic effect and the absorption rate of streptomycin in the pleural cavity.

Operations were performed on 9 dogs. Three of these received 100 c.c. of saline into the pleural cavity, and biopsies were taken from the pleura 7 days later. Six of the dogs received 0.5 gm. of streptomycin in 100 c.c. of saline into the pleural cavities. Streptomycin assay studies were carried out on pleural fluid and venous blood. Biopsies of the pleura were performed 7 days after injection.

The absorption rate of streptomycin in the pleuras of dogs was rapid and the maximum blood levels were reached in 30 to 60 minutes.

There were no apparent differences in the microscopic picture of the pleura of animals receiving saline and of animals receiving streptomycin.

Twelve humans received streptomycin intrapleurally. These 12 cases can be subdivided into 6 cases of unscarred pleura, 2 cases of moderately scarred pleura, and 4 cases of markedly scarred pleura. The absorption curves were similar in all three types. The absorption is rapid, maximum absorption usually occurs in 30 minutes and falls to low levels in from 6 to 8 hours.

The following conclusions are drawn:

No harmful effects were seen either in the gross or the microscopic picture of pleura removed from dogs 7 days after the dogs received streptomycin in the pleural cavity.

The absorption of streptomycin from the pleura of dogs and human beings is rapid and high levels are reached.

Scarred pleuras were found to absorb streptomycin as well as unscarred pleuras.

JOHN J. MALONEY, M.D.

#### Streptomycin in Surgical Patients

EDWARD J. BEATTIE, JR., and BRIAN BLADES *J Am M Ass*, 1949, 139: 902

The value of streptomycin as an adjunct to the surgical treatment of pulmonary tuberculosis is shown. Since 1933 approximately 600 cases of resection for pulmonary tuberculosis have been reported, in these there was a 25 per cent mortality rate with 12 per cent empyemas and 8 per cent bronchopleural fistulas. Since the preoperative and postoperative use of streptomycin, there has been a re-



duction in the number of complications due to tubercular spread as well as a reduction in the immediate operative mortality. Not enough time has elapsed to determine whether the long range survival rate will be better in patients treated with streptomycin than in those undergoing resection for pulmonary tuberculosis prior to the use of streptomycin.

One gram of streptomycin in two divided doses appears to be the optimum amount. Streptomycin therapy should be started 7 days prior to, and continued for 14 days after, operation. This dosage almost completely obviates toxic effects. The pleural absorption of streptomycin is rapid and high levels are reached in 1 hour. Resistance of the tubercle bacillus to streptomycin develops soon, some evidence indicating that this can occur within 40 days.

With the added protection which streptomycin affords pulmonary resection for tuberculosis, it is technically possible to carry out major resection in desperate risk patients. In view of the fact that resistance of the tubercle bacillus to streptomycin develops, it is important that streptomycin be reserved for surgical treatment in any case which may be potentially surgical, and not be used in instances of minimal pulmonary tuberculosis.

C. FREDERICK KITTLE, M.D.

### HEART AND PERICARDIUM

**An Experimental Study of Collateral Coronary Circulation Produced by Cardiopneumonopexy**  
B. NOLAND CARTER, EDWARD A. GALL, and CHARLES L. WADSWORTH. *Surgery*, 1949, 25: 489.

In view of the prevalence of coronary artery disease, several intensive studies have been directed within the last decade toward devising means of producing collateral coronary circulation. Several possible sources of such a collateral blood supply exist: the thoracic wall, including the pectoral muscles, the internal mammary artery, and the intercostal arteries, the pericardium, the omentum, and the lung. Investigators in this country and abroad have undertaken experimental studies utilizing various of these sources.

The results of the experiments described clearly indicate that vascular communications between the heart and the adherent lung can be produced by cardiopneumonopexy. They also show that the survival rate following ligation of the anterior descending branch of the left coronary artery is significantly improved following this operation and that the degree of myocardial damage is decreased. There are, however, several important physiologic questions which should be answered and which are concerned with the practical applicability of the procedure. These are chiefly three in number: (1) What is the direction of the blood flow and is it from the lung to the heart or vice versa? (2) How great a volume of blood can be delivered through the newly established channels and how long will such channels continue to function? (3) What is the degree of oxy-

genation of the blood supplied through the collateral vessels arising from the pulmonary circulation?

Gross and microscopic evidence has been obtained that by this operation new vascular channels can be produced between the myocardium and the adherent lung, but the amount of blood flow, the direction of the flow, and the duration of the patency of these channels has not been established.

In the instances in which cardiopneumonopexy was performed on normal hearts, injections of 10 per cent suspension of India ink in blood at normal pressures revealed some filling of the superficial vessels in the myocardium, but in the case of hearts rendered ischemic by coronary artery ligation there was considerably greater filling not only of the superficial vessels but of the deep ones as well.

Comparison of specimens obtained from dogs in which ligation of the anterior descending branch of the left coronary artery had been performed after cardiopneumonopexy with specimens from dogs in which ligation alone was done revealed less extensive infarcts and a lower mortality in the protected series. Therefore, the mortality in the protected series was 20 per cent, and in the animals with simple ligation it was 48 per cent. Severe infarction occurred in 75 per cent of the animals with simple ligation, but in only 23 per cent of the animals with ligation subsequent to cardiopneumonopexy.

JOHN E. KIRKPATRICK, M.D.

**Experimental Anastomoses of Vessels to the Heart**  
FRANK GERBODE, JAMES YEE, and F. F. RUNDLE.  
*Surgery*, 1949, 25: 556.

Superior vena caval obstruction is frequently due to aneurysm or tumor, but in cases in which it is due to one of the various types of fibrosing mediastinitis it has been considered possible that the establishment of an alternative venous route to the heart will relieve the attendant symptoms of elevated venous pressure of the upper extremities and trunk, edema, and pleural effusion.

Using dogs, the authors have devised three operations for the relief of superior vena caval obstruction.

1. Approximately one week after placing a constricting ligature about the superior vena cava, above the level of the azygos vein, the azygos vein was anastomosed to the superior vena cava with the result that there was relief from the symptoms of vena caval obstruction. In a similar fashion, obstruction was produced at a level below the junction of the azygos, and relief was obtained by anastomosis of the azygos vein to the right auricle. It was hoped that the azygos would dilate somewhat to accommodate the physiologic load, however, this did not occur, and in several animals elevated pressures and angiograms indicated occlusion at the sites of anastomosis. Autopsy of these animals showed fibrosis and narrowing supposedly due to the muscularity of the auricular wall.

2. An atriocaval anastomosis was developed to create a shunt around the experimentally produced obstruction made below the level of the azygos. The

# SURGERY OF THE THORAX

technique is sketched in the original article. There were no deaths following this procedure. Seven of the 10 animals having this shunt had a normal postoperative course, without exhibiting the usual signs of occlusion of the superior vena cava. Three animals developed late thromboses at the suture line, and in each instance some technical explanation could be furnished. Three of the animals have been followed up for more than a year and are known to have no arrhythmia detectable in the postoperative electrocardiograms. It is suggested that inasmuch as these anastomoses between the superior vena cava and the auricle are technically possible, such anastomoses might be applied to man under suitable circumstances.

JANE C. MACMILLAN, M.D.

## ESOPHAGUS AND MEDIASTINUM

**Retained Food Remnants in Esophageal Diverticula Resembling Tumor and Dysphagia in Cases of Small Esophageal Diverticula at the Bifurcation Level** SVEN ROLAND KJELLBERG  
*Acta radiol*, Stockh., 1948, 30: 435

The author stresses the similar roentgenological appearance produced by a polypoid neoplasm of the esophagus and a diverticulum of the esophagus when the latter is partially filled with food. He cites 2 illustrative case histories in females aged 45 and 66 years, respectively. They presented a history of intermittent dysphagia which was most pronounced during the ingestion of solid food. Barium swallow in both patients revealed a filling defect in the esophagus at the level of the tracheal bifurcation suggesting a polypoid tumor. Repeat examination 2 weeks later, however, visualized a large diverticulum at the same site. This presumably contained food remnants during the first study. The diagnosis of esophageal diverticulum was suspected because of

the character of the dysphagia, it was intermittent, of long duration, and worse with solid food or large particles.

C. FREDERICK KITTLE, M.D.

**Tuberculous Esophageoepigastric Fistula (Fistola esofago-epigastrica tuberculare)** VALENTINO DE FAZIO  
*Riforma med*, 1949, 63: 145

An extremely rare esophageocutaneous fistula of tuberculous origin and with its external orifice in the epigastric region, is reported by the author.

The patient was a man aged 26 years. Five years prior to admission to the hospital he developed pain in the right hip which subsided after 7 months. Roentgenograms of the spine were negative. Two

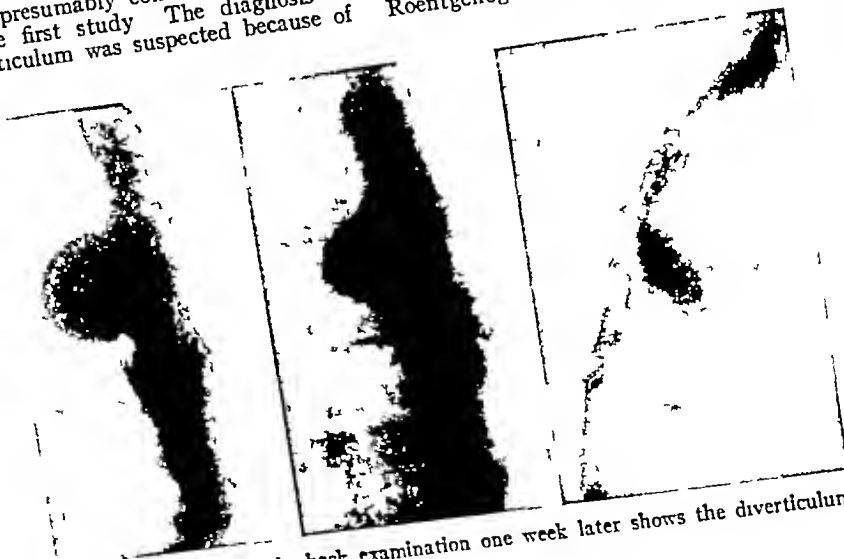


Fig 2 (Kjellberg) A check examination one week later shows the diverticulum filled with contrast substance

years later the patient noticed a hard, small tumefaction in the gluteal region from which a fistula developed. The diagnosis of sacroiliac arthritis was made. After a few months the condition subsided. Several months later severe pain developed in the right hypochondriac region and was followed by the appearance of a tumefaction, which in turn led to the formation of a fistula.

After the injection of lipiodol, an elongated sac leading toward the right costal arch and from there to the stomach was visualized.

Further x-ray studies established the existence of a connection between the fistula and the thoracic portion of the esophagus.

Six similar cases have been reported in the literature. The absence of subjective symptoms focusing attention on the esophagus, such as dysphagia, was noticed in all cases.

The author believes that tuberculous lymphadenitis was responsible for the condition, but a focus in the bones could not be excluded.

Drainage of the sac, followed by x-ray therapy, produced a cure.

JOSEPH K. NARAT, M.D.

#### **The Treatment of Mediastinitis from Perforation of the Esophagus** ARNE HOMB *Acta chir scand*, 1948, 97: 189

The esophagus in almost the whole of its course stands in close relation to various vital organs, and a perforation thereof may easily lead to serious complications. The most frequently encountered of these is infection of the mediastinum. It is especially the posterior part of the mediastinum that is of interest in case of perforation of the esophagus. It is bounded posteriorly by the spinal column and the prevertebral fascia and in front by the layer of fascia on the anterior side of the trachea. At the level of the bifurcation this latter fascia is connected with the bronchi, and here the downward diffusion of infections is to some degree prevented, a fact which is important with regard to treatment.

According to their cause, the esophageal perforations are divided into two main groups, one of which comprises the cases due to malignant tumors and the other, cases due to foreign bodies and injuries.

Cancer of the esophagus often leads to spontaneous perforation, but this usually develops gradually and does not so often give rise to extensive infection of the mediastinum. As it generally denotes a terminal stage of the disease, it is of minor interest from a therapeutic standpoint.

Perforations caused by foreign bodies are of greater practical importance. Most often, sharp bodies are present, but blunt objects may also perforate when they have been lying in the gullet for some time and decubital ulcers develop.

Three cases of mediastinitis due to perforation of the esophagus are described. All 3 patients had retained foreign bodies. Two of them had drunk lye when they were children and had since had symptoms of stricture. In one case the perforation occurred during an attempt to introduce a stomach

tube, in the 2 other cases it occurred during exploration with an esophagoscope.

In the first case there developed a large, but circumscribed, mediastinal abscess. This was at first drained by means of cervical mediastinotomy, but as it later descended to the level of the ninth thoracic vertebra and the drainage became unsatisfactory, a posterior mediastinotomy had to be performed afterward. The patient had also empyema on the right side, which yielded to puncture treatment and injections of penicillin.

The second patient had a large perforation and developed diffuse mediastinitis, which was drained by a posterior mediastinotomy with a good result.

The third patient had a small lesion on the wall of the esophagus and a circumscribed mediastinal abscess developed, this was drained from the left side of the neck. However, drainage was not satisfactory. The abscess descended and the evacuation proceeded slowly. Perforation to a bronchus occurred on the right side with symptoms of a fistula between the esophagus, the abscess cavity, and the bronchial tree. The fistula closed later.

Penicillin-sulfonamide treatment did not prevent the development of a mediastinal abscess in the first case or check the progress of a phlegmon in the second, however, in these cases there were large perforations causing extensive infections. In cases of such large perforations infective matter will be constantly conveyed to the mediastinum from the esophagus, and it is not reasonable to expect that the penicillin and sulfonamides alone will be able to master the infection. Surgical intervention with drainage will, therefore, be necessary.

The author's experiences have also confirmed the view already mentioned, that infections in the mediastinum which are descending deeper than the level of the fourth thoracic vertebra cannot be satisfactorily drained through an incision in the neck, but must be treated by posterior mediastinotomy.

After giving a brief survey of the clinical features, prognosis, and treatment of mediastinitis occurring after perforation of the esophagus, the author reports 3 cases of his own, which were treated by sulfonamides, penicillin, and mediastinotomy with good results. While the prognosis in mediastinitis was formerly very unfavorable, the case histories published in recent years seem to show that an essential improvement in this respect has taken place since the use of sulfonamides and penicillin has been adopted in the treatment. Meanwhile, it is not likely that these remedies will render surgical intervention superfluous.

JOHN E. KIRKPATRICK, M.D.

#### **MISCELLANEOUS**

**Comparison of Thymic Hyperplasia in Myasthenia Gravis and Exophthalmic Goiter** ALLEN L. BRYAN, JOHN R. McDONALD, and O. THERON CLAGETT *Arch Path*, Chic, 1948, 46: 212

The present article concerns 23 proved cases of myasthenia gravis, exclusive of thymoma, in which

thymectomy was done. In 4 patients extreme lymphoid hyperplasia, and in 2 patients, moderate lymphoid hyperplasia of the thymus were observed on microscopic examination. In the remainder, the glands either were normal or had been replaced by fat.

Twelve of the 17 normal glands in the myasthenia series showed areas of hyperplasia, but the percentage of glandular tissue was too low to permit their being considered hyperplastic, the average content of thymic parenchyma being only 29 per cent.

In none of the 20 cases of hyperthyroidism due to exophthalmic goiter did extreme hyperplasia of the thymus occur, and in only 1 case did moderate lymphoid hyperplasia occur.

Small areas of epithelial clustering occurred in 2 cases of the myasthenia series and in 3 cases of the hyperthyroid series, but the glands were essentially normal.

When the actual amount of glandular tissue in the thymus was determined and compared with Hammar's weights and with planimetrically determined percentages of thymic tissue in these glands, the weight of the parenchyma of 2 of 13 glands in the myasthenia series significantly exceeded the upper limit of normal, while the weight of the parenchyma of 7 of 9 glands in the hyperthyroid series exceeded the upper limit of normal.

There was apparently no correlation between the extent of hyperplasia determined microscopically and that which was observed when the actual weight of essential thymic elements exceeded significantly the expected upper limit of normal.

There was no correlation, on the basis of microscopic observations, between the extent of hyperplasia of one lymphoid organ and that of another in this study.

No correlation was found between the clinical and microscopic findings in myasthenia gravis, excluding the thymomas.

The term "thymoma" might be defined as a circumscribed tumor of the thymus composed of architecturally disarranged thymic elements, often with dense dividing trabeculae, and usually devoid of adult fat cells.

**Thymoma** HUGH REID and R. MARCUS *Brit J Surg*, 1949, 36 271

The subject of thymic tumors in general is reviewed from a historical standpoint by the authors, including the pathologic classification and the relation to myasthenia gravis. Some of this information is summarized in tabular form.

The authors observed 5 patients who were considered to have tumors of thymic origin. Three of these had myasthenia gravis. In 2 the tumor was removed surgically by a sternum-splitting approach. One of these died. In 1 case the chest was explored by means of a transpleural approach but the tumor could not be removed. In another instance the tumor, apparently invading the anterior chest wall, was subjected to biopsy examination only. Two patients were treated by roentgen therapy, as was the inoperable tumor.

The tumors were classified as reticulum cell carcinomas in 3 instances. In one case there was no histologic diagnosis and in the other the tumor consisted of large masses of lymphoid tissue without Hassall's corpuscles or lymphoid follicles. Reticulum cells were prominent and often packed into groups.

The article is illustrated by photomicrographs and roentgenograms. HIRAM T. LANGSTON, M.D.

**A Case of Thymolipoma** G. F. M. HALL. *Brit J Surg*, 1949, 36 321

This report concerns the occurrence of a benign asymptomatic mediastinal tumor composed of fat and thymic tissue, and believed to be comparable to one other found in the literature.

The tumor was found at autopsy in a 47 year old man in good health, who died promptly after severe trauma. It measured 22 by 16 by 6 cm and weighed 1100 gm; it was pear-shaped in outline and was found arising from the anterior mediastinum but lying almost entirely within the right pleural cavity. On cut section the mass appeared to consist of a fatty matrix with small scattered areas of firmer consistency. Histologic sections showed the main bulk of the tumor to consist of normal-appearing adipose tissue. The other areas had the appearance of thymic tissue, most of which was compatible with normal thymic structure. One such area, however, was different from the rest in that it was better encapsulated and suggested an adenoma of the thymic reticulum cells.

The tumor was believed to justify the name of thymolipoma because it was argued that both the adipose and the thymic portions were concerned in the production of the tumor.

The possibility that many intrathoracic "lipomas" may have an origin similar to that of this tumor and that under such circumstances the thymic elements may merely be overlooked is discussed. The article contains gross and microscopic illustrations.

HIRAM T. LANGSTON, M.D.

# SURGERY OF THE ABDOMEN

## ABDOMINAL WALL AND PERITONEUM

**Some Observations on the Functional Anatomy of Inguinal Hernia and Its Bearing on the Operative Treatment** DAVID H. PATEY *Brit J Surg*, 1949, 36 264

After operative exposure of both indirect and direct inguinal hernias, the author studied the functional anatomy of the surrounding structures by stimulating the conjoint internal oblique and transversalis muscles by faradic current. The following findings resulted:

### 1 Indirect inguinal hernia

a The pillars of the transversalis fascia, constituting the medial margin of the internal ring, are pulled laterally and upward as described by Lytle.

b The arched fibers of the internal oblique constituting the lateral margin of the internal ring move medially.

These two structures thus form a shutter closing the ring by operating in different planes. This protection is further supported in a minor way by (1) contraction of the cremaster fibers branching up the cord and tending to plug the ring, and by (2) the pull of the attachment of the internal oblique to the inguinal ligament, elevating the latter and so protecting the ring from below.

### 2 Direct inguinal hernia

a The transversalis fascia becomes tightened through the pull on its attachment to the deep surface of the transversalis muscle.

b By the contraction of the combined internal oblique and transversalis muscles immediately above the transversalis fascia, the upper limits of the direct inguinal hernia area are supported. The direction of movement is lateral, which tightens the medial tendinous part. This gives the effect of a hook rather than an arch. On contraction, there is a general movement of the whole structure laterally toward the muscular part, as well as the embracing and protective action of the internal ring of the muscular hook itself.

c The inguinal ligament becomes tightened by the pull of the internal oblique attachment to it and also by the contraction of the external oblique, so that the lower edge of the direct inguinal hernia area is supported.

The main support is therefore the transversalis fascia.

These findings suggested the following procedures:

### 1 Indirect inguinal hernia

The shutterlike action of the internal ring is reinforced by cutting a strip of fascia from the posterior lamella of the anterior rectus sheath and leaving its lateral edge attached. The strip is then brought through the internal oblique muscle immediately anterior to the medial edge of the ring. The strip is then passed through the upturned edge of the

inguinal ligament and sutured, thus embracing the medial margin of the ring closely. This tightens with each contraction of the attached muscles and further helps to close the ring.

### 2 Direct inguinal hernia

A continuous suture of fascia lata (Gallie) is used, being placed from below upward and laterally in an oblique direction, so that its loops get well tightened at each contraction and give maximal support to the underlying transversalis fascia. This is important since the shutterlike mechanism of the conjoint tendon, as postulated by Keith, does not exist, and the main protective agent for the direct inguinal area is a tightened transversalis fascia.

LEROY J. KLEINSASSER, M.D.

**Benign Paroxysmal Peritonitis. Second Series**  
SHEPPARD SEGAL. *Gastroenterology*, 1949, 12 234

The author reported his first series of cases of benign paroxysmal peritonitis in 1945, and an additional 6 cases are recorded in the present article. The disease is often confused with acute abdominal conditions requiring surgery, it is a disease of young people, is chronically disabling, and may last a lifetime. It may begin in childhood or, most often, in the second or third decade of life, and both sexes are affected. Recurrent paroxysms of abdominal pain and fever constitute the chief complaint. The attacks are usually of 2 or 3 days' duration, the hyperacute, febrile period lasting from 24 to 36 hours. The maximum temperature elevation varies from 100 to 105 degrees. Abdominal tenderness is invariable, and involuntary spasm of the abdominal wall is occasionally present. Constipation, vomiting, and leucocytosis are the rule. The pain is frequently localized in the right lower quadrant, thus simulating acute appendicitis. Chest pain of a pleuritic type is an occasional symptom. In most of the cases recorded in the literature the patients have been either Jewish or Armenian.

The etiology of the disease remains obscure, however, it apparently is closely related to the allergic disorders. Its onset in early life, its paroxysmal recurrence over many years without impairment of health, its basis in a reversible vascular reaction of hyperemia and edema are all consistent with this concept. Of 11 patients, 2 were atopic and 4 more had a definite family history of allergy, however, causative food allergens have not been demonstrated in any of 5 cases completely studied from this point of view. Eosinophilia has not been present in the author's patients during acute attacks, nor has adrenalin or the antihistamine drugs produced relief.

Three patients have been operated upon during an acute crisis. Hyperemia or edema of the peritoneum, with or without serous or serofibrinous exudate, comprise the operative findings. Interval explorations have been negative.

Treatment of the disease should include careful search for specific allergens and psychiatric evaluation. Surgical exploration is sometimes indicated if an intra-abdominal surgical lesion cannot be excluded. However, in 4 of 6 cases included in this report, appendectomy was done with no beneficial effect on the course of the patient's disease.

FREDERICK W. PRESTON, M.D.

### GASTROINTESTINAL TRACT

**Hematemesis** D. C. LEWIN and SIDNEY TRUELOVE  
*Brit. M. J.*, 1949, 1, 383

The present report covers 305 cases of hematemesis admitted to the Radcliffe Infirmary during the period from 1938 to 1947. The mortality was 19 per cent (58 deaths). A history of proved or probable chronic peptic ulcer was reported in 208 of the patients.

Age was the most important factor influencing prognosis, for the whole series as well as for the group with chronic peptic ulcer. The mortality rate rose steeply during the age period from 40 to 50 years.

In patients with chronic peptic ulcer, a long or short history of ulcer had little bearing on the immediate prognosis. This was true even in the older age group in whom one would normally expect to find a greater number of chronic ulcers.

The frequency of recurrent bleeding was about the same in old and young patients, and about the same proportion received massive blood transfusions.

The authors believe that general bodily changes occurring with advancing age are the principal causes for the higher mortality rate. The same is true of the other frequent complication of peptic ulcer—perforation.

Very few patients in this series were treated surgically, therefore, the authors have said nothing (as has been mentioned frequently in other articles) about the value of early decision and early surgery as a measure that tends to lower mortality in hematemesis in patients over 40 years of age.

FREDERICK C. HOEBEL, M.D.

**Argentaffine Tumors of the Gastrointestinal Tract**  
Report of 11 Cases. CHARLES H. BROWN, ROGER P. BISSENETTE, and HUGH H. STEELE. *Gastroenterology*, 1949, 12, 225

Eleven cases of argentaffine tumors are reported. Eight of these occurred in the appendix and 3 occurred elsewhere in the gastrointestinal tract. Of the 8 patients in whom the tumor was located in the appendix, 5 were operated upon for acute appendicitis. In several of these cases the tumor probably acted as a fecalith producing occlusion of the lumen and subsequent edema and inflammation. Three patients had no symptom of appendicitis, the appendix having been removed as a routine procedure during other abdominal operations. In none of these cases was metastases, mitotic figures, or invasion of the muscularis found. Patients were followed for

an average of  $5\frac{1}{2}$  years without evidence of recurrence. Although there are several reported cases of malignant argentaffine tumors of the appendix, those in the present series are benign. It is possible that argentaffine tumors of the appendix cause symptoms of appendicitis and are removed before they have a chance to become malignant.

Of the 3 tumors which occurred in the intestinal tract elsewhere than the appendix, one involved the cecum and two, the ileum. All 3 lesions were malignant and had metastatic glands. These patients were operated upon and the lesions resected. Two patients died within 16 months of surgery, and 1 was alive 8 years after surgery.

Argentaffine tumors arise from Kulchitsky cells which are found in all parts of the gastrointestinal tract and are most numerous in the crypts of Lieberkuhn in the terminal ileum and appendix. They constitute about 8 per cent of all observed neoplasms of the small intestine. They most frequently occur in the terminal ileum and appendix, but may occur anywhere in the gastrointestinal tract. Occasionally they are multiple.

The incidence of malignancy of argentaffinomas occurring outside the appendix varies from 22 to 38.3 per cent in different reported series. The authors conclude that since some become malignant, all must be treated as such.

FREDERICK W. PRESTON, M.D.

**Lymphosarcoma of the Gastrointestinal Tract, with a Report of 21 Cases** M. A. SPELLBERG and SIMON ZIVIN. *Arch. Int. M.*, 1949, 83, 135

The authors, in a review of their own material, found 1 case of lymphosarcoma to every 88 cases of gastric carcinoma in patients ranging from 26 to 57 years of age, and of an average age of 47 years. Emphasis is made that when a neoplasm is found in a younger patient, it is more likely to be a lymphosarcoma than a carcinoma.

By and large, the symptoms found with lymphosarcoma of the stomach tend to be nonspecific and somewhat ulcerlike, consisting of postprandial distress, belching, bloating, pain unrelieved by food, backache, and vomiting; weight loss was noted in 5 of 11 patients. Hematemesis or melena was noted in 6 of the 11 cases, and occult blood in the stool 7 times, frequently there was an associated anemia. It is believed that this bleeding feature has not been emphasized in the literature previously. In 5 cases an epigastric mass was palpable.

Röntgenography is of help diagnostically only infrequently. The usual diagnosis made is that of carcinoma, occasionally, the roentgen diagnosis is normal stomach or large rugal folds.

Gastroscopy is helpful but not infallible in cases of diffuse infiltration. The diagnostic difficulties are attributable to the morphology of the tumor, inasmuch as it so frequently produces a diffuse type of infiltration without the formation of localized defects.

Pathologically, the lesion is usually encountered on the greater curvature of the stomach. Involve-

ment of the perigastric lymph nodes was found in 8 of 11 cases, but no liver metastases were noted. Five of the lesions were the small cell type of malignant lymphoma, and 5 were the large cell or reticulum cell type. The prognosis was associated with the cell type of the lesion, the patients with the small cell type had an average survival of 44 months, whereas the 5 patients with the large celled, reticulum type had an average survival of only 7 months.

The opinion that there is a relatively favorable response to treatment of lymphosarcoma is not shared by all observers. In the literature the survival figures given vary from 6 6 months to 7 years. The authors state that their survival figures for lymphosarcoma are better than those for carcinoma of the stomach. They had a total of 3 "5 year cures" of lymphosarcoma.

Ten cases of localized intestinal lymphosarcoma were observed, 5 in the small intestine and 5 in the large intestine, giving an equal incidence in the small and large bowels for the series, although references can be found in the literature concerning the increased incidence of lymphosarcoma in the small intestine. About 1 lymphosarcoma was found to every 300 carcinomas in the large bowel and 1 lymphosarcoma was found to every 4 1 carcinomas in the small bowel.

The symptomatology of lymphosarcoma of the bowel varies with the location of the tumor, but it is stressed that an abdominal mass was palpated in 80 per cent of the cases, varying signs of obstruction were present but no blood in the stools was noted. No specific diagnosis was ever possible by means of roentgenography in these cases. As with gastric lymphosarcoma, there was absence of widespread metastases, however, intestinal lymphosarcoma appears to carry an extremely poor prognosis, as most of the patients died in less than 6 months.

JANE C. MACMILLAN, M D

#### The Vascularization of the Human Stomach. A Preliminary Note on the Shunting Effect of Trauma. A. E. BARCLAY and F. H. BENTLEY. *Gastroenterology*, 1949, 12 177

Using a technique of microarteriography described by Barclay in 1947, the authors studied the arterial circulation of the stomach wall in cadavers and in specimens of stomach resected for duodenal ulcer. In order to demonstrate the arteries and their branches down to the arterioles, a preparation of bismuth oxychloride was injected into one of the gastric or gastroepiploic arteries. The size of the particles in the preparation used was such that the capillaries were not outlined. In the submucous layer there is a plexus of arterioles so profuse that an injection through a single gastric or gastroepiploic artery suffices to fill the whole vascular plexus of both anterior and posterior gastric walls, and also the other gastric and gastroepiploic arteries by retrograde flow. To demonstrate small arterioles and capillaries a 10 per cent solution of colloidal silver iodide was used. By use of this material a second plexus of smaller ves-

sels close to the mucous membrane can be demonstrated. The capillaries which vascularize the mucous membrane arise from this plexus.

There was a striking difference between the microarteriographs obtained from cadaver specimens and in the resected specimens. In the former there was much more complete filling of the vessels of the mucosa. One stomach was obtained from a patient under high spinal anesthesia, and in this specimen the vessels of the mucosa also filled completely when microarteriography was done.

The authors conclude that arteriovenous anastomoses exist in the wall of the stomach in the region of the submucous plexus of vessels. The trauma incident to gastric resection causes these anastomoses to shunt blood away from the mucosa. However, the shunt mechanism is under the control of the sympathetic nervous system and when the sympathetic nerve pathways to the stomach are blocked the shunt remains closed.

Arteriovenous shunts similar to these demonstrated in the gastric wall have been demonstrated by Trueta in the kidney.

FREDERICK W. PRESTON, M D

#### Acute Perforations of the Stomach, and Small Bowel Ulcerations. CARLYLE AUGUST LUEHR SURGERY, 1949, 25 404

Between 1938 and 1948, 362 cases of acute, free perforations of gastrointestinal ulceration were seen at the St. Louis City Hospital. A detailed examination of their records forms the basis of this study. Many interesting points follow closely similar studies previously reported. Some statements of fact are particularly worthy of attention.

The operative mortality has gradually dropped from 1938 to 1948 and is possibly attributable to the use of sulfonamides and penicillin. However, it is particularly worthy of attention that the mortality climbed rapidly with the number of hours perforation was present before admission, thereby delaying surgical treatment.

From 0 to 6 hours the mortality was 10 6 per cent, from 6 to 12 hours, 25 4 per cent, from 12 to 24 hours, 52 0 per cent, and over 24 hours, 75 9 per cent. Thus the wisdom of early and good surgical management seems unchanged by the use of sulfonamides and antibiotics.

It is of interest that in 22 of the patients, perforation occurred while the patient was in the hospital, and all patients died. This is not an occurrence that is common only to this hospital, and the importance of careful and early evaluation of patients in the hospital who present acute abdominal symptoms is stressed.

The physical findings of a systolic blood pressure of 80 or lower, a low white count, subnormal temperature, and rapid respirations were ominous, followed by a high mortality.

Certain findings are important because of the high incidence of their occurrence in acute perforation. Pneumoperitoneum was demonstrated by roentgen



ogram in 63.5 per cent of cases in less than 6 hours and in 89.7 per cent in over 6 hours

"Boardlike" involuntary rigidity was present in 98.6 per cent of cases within 6 hours but was not so constant after the initial chemical peritonitis had subsided. Auscultation was done in two-thirds of the cases. Bowel sounds were absent in 79.2 per cent of patients and hypoactivity was observed in 13.8 per cent.

The conditions existing which were mistaken for acute perforations were, in order of incidence, appendicitis, acute cholecystitis, and acute pancreatitis. However, blood diastase levels were obtained in about two thirds of the cases of acute perforation and were normal in 97.5 per cent, the remainder were elevated between 600 and 800 units.

The author concludes that the duration of time from perforation to operation seemed to be the most important factor in influencing the prognosis. As time elapsed, increased soiling of the peritoneal cavity and bacterial infection occurred, and dehydration and electrolyte imbalance increased. Therefore, the most effective treatment consisted of correction or prevention of electrolyte imbalance, followed by surgery as soon as possible for closure of the perforation with an omental graft and closure of the incision without drainage.

FREDERICK C. HOEBEL, M.D.

**Diverticula of the Stomach. A Report of 30 Cases and a Review of the Literature.** CHARLES H. BROWN, ROGER P. BISSENETTE, and ROBERT D. ALBEE. *Gastroenterology*, 1949, 12: 10.

Studies were made of 30 cases of gastric diverticula. By far the most common location for gastric diverticula is in the cardia, and these are usually congenital in origin. Diverticula located outside of the cardia are frequently associated with other pathological lesions such as carcinoma, ulcer, aberrant pancreatic tissue, gall-bladder or pancreatic disease. There are no characteristic symptoms of the condition, and if symptoms are present they are usually caused by other conditions. In 7 of the 30 cases studied, the symptoms were thought to be due to the diverticula itself and consisted of ulcerlike distress. Gastric hemorrhages resulting from the diverticulum occurred in 2 cases. Conservative therapy utilizing an ulcer régime usually is sufficient to control the symptoms. Surgery was not necessary in any of the 30 reported cases. In cases coming to surgery (recorded in the literature), it is often very difficult to find the diverticulum. F. J. LESEMAN, JR., M.D.

**Surgical Treatment of Peptic Ulcer in the Region of the Cardia** (Zur chirurgischen Behandlung des cardianen Ulcus ventriculi). H. FINSTERER. *J. internal chir.*, Brux., 1949, 9: 1.

On the basis of an exceptionally wide experience in gastric surgery, the author, director of the surgical department of the University Hospital at Vienna, Austria, discusses the problems of peptic ulcer in the region of the cardia.

Ulcers near the cardia are not as rare as is generally assumed, among a series of 8,230 gastric resections for ulcer, the author observed 614 cases, i.e., about 20 per cent. This high percentage is partly explained by the difficulty of diagnosis and treatment. A number of interesting cases are described in which the ulcer was either mistaken for carcinoma or declared inoperable by other men, and in which surgery by the author resulted in complete cure.

Errors in diagnosis are frequent because the symptoms and signs are less characteristic than in pyloric ulcers. Frequently hypoacidity or anacidity are present rather than hyperacidity, and roentgen examination reveals less typical pictures. The ulcer is often mistaken for carcinoma, cardiospasm, or angina pectoris. Even at laparotomy, correct diagnosis is difficult when the ulcer is situated at the posterior wall, as it often penetrates into the lesser omentum or in the pancreas. Therefore, the author recommends in all cases in which an ulcer is diagnosed clinically but not found at operation, that a gastrotomy be made and the inside of the stomach explored with the bare finger, without rubber gloves. In this manner the ulcer is discovered easily, and no infection after digital exploration has ever occurred in the author's experience.

Resection of ulcers at the posterior wall should be done only if the ulcer is at least 1 to 2 cm. distant from the esophagus because sutures involving the esophageal wall are unsafe.

The author discusses in great detail the indications for, and techniques of, various operations. He rejects gastroenterostomy as valueless. The best results were achieved by pylorogastrectomy. In patients under 60 years with ulcers near the cardia, penetrating to the lesser omentum, the author performs the Billroth I operation with excellent results, he had no fatality in 109 patients treated by this method.

If an ulcer of the posterior wall involves the cardia, it is left in place and resection of the distal half of the stomach and the pylorus is performed after the method of Kelling-Madlener. If the length of the duodenum permits, a Billroth I operation or an anastomosis by the Hofmeister-Finsterer method is done.

This abstract can only give a perfunctory picture of this very interesting article which should be read in the original. WERNER M. SOLMITZ, M.D.

**Production of Gastric and Duodenal Ulcers by the Prolonged Administration of Mecholyl.** J. WENER, H. L. HOFF, and M. A. SIMON. *Gastroenterology*, 1948, 11: 904.

Mecholyl (acetyl- $\beta$ -methylcholine) is a choline ester which evokes an increased, more acid gastric secretion in dogs. When injected intramuscularly, in a beeswax and mineral oil mixture, it prolongs and increases continuous gastric secretion.

The observation that single injections of mecholyl in dogs produced a bloody diarrhea and postmortem findings of hemorrhages and erosions of the gastric



and duodenal mucosa, led the authors to investigate the effects of the drug. The effects of repeated injections of mecholyl were studied in two groups of dogs. In the first group, 29 dogs received daily injections of an aqueous solution of mecholyl subcutaneously. The dosage levels (determined by experience) were the maximum each dog could tolerate without collapsing or going into shock. Injections were made daily at 9 a.m., and the animals were not fed or given water until 4 p.m. The diet consisted of ground red beef and all animals were allowed free access to water after 4 p.m. Seven of the dogs were also given prostigmine along with mecholyl. All but one of the dogs died from the general effects of the drug.

In the second group of animals (19 dogs), the mecholyl was embedded in a beeswax and mineral oil mixture in order to prolong the effects of the drug. The drug was prepared according to the method devised by Code and Varco to prolong the action of histamine, it contained approximately 90 to 100 mgm of mecholyl per cubic centimeter. "Sub-shock" dosage levels were determined. The diet and feeding times were the same as for the first group. All but 4 of the dogs died from the general toxic effects of the drug, and the remaining dogs were sacrificed.

The experimental data are tabulated. Following the injections of mecholyl a sequence of pathological changes occurred which consisted of marked hyperemia and engorgement of vessels, interstitial mucosal hemorrhages with superficial necrosis, erosions, and acute or subacute ulcerations in the stomach and duodenum.

In nearly all instances, marked generalized parasympathetic responses accompanied every injection of mecholyl, and led to immediate collapse and death of the first few dogs, especially when prostigmine was injected together with the drug. This state of collapse was immediately relieved by the subcutaneous injection of atropine.

Mecholyl caused vomiting, frequently blood tinged, and occasionally massive hematemesis. It also caused increased gastrointestinal motility which, within 15 minutes, resulted in bloody diarrhea. This condition usually terminated in from 1 to 2 hours, and within 8 to 24 hours stools were formed, but tarry in color. In numerous instances gastrointestinal bleeding continued for 12 to 18 hours after injection, and finally such animals died as a result of extensive hemorrhages from the gastrointestinal tract.

Postmortem examination of the stomach usually revealed diffuse hyperemia, multiple mucosal hemorrhages, and areas of superficial necrosis and erosion. The hyperemic discoloration of the stomach was most severe in the fundic area, which was sharply demarcated from the paler, pyloric region. Beginning sharply at the most proximal end of the duodenum, the hemorrhagic involvement of the mucosa extended through the entire intestine with decreasing severity as the ileum was approached. Changes at

autopsy were most pronounced when death ensued shortly after an injection with mecholyl.

Histological examinations of the hemorrhagic areas of the stomach and duodenum showed marked dilation of the blood vessels, especially the capillaries, and the presence of acute diffuse interstitial hemorrhage into the mucous membrane, with necrosis of the most superficial layers of the mucosa. In a number of situations underlying a relatively intact mucous membrane in which interstitial hemorrhage had occurred, infiltration by acute inflammatory cells suggested a focal hemorrhagic gastritis or duodenitis.

The erosions were multiple, were usually confined to the fundic portion of the stomach, and were less often seen in the pylorus and duodenum. Most of the lesions were erosions, but a few dogs showed gastric or duodenal ulcers. Involvement of the deeper layers of the intestinal wall and the presence of an inflammatory ridge about the lesion were the criteria for ulcer.

Experimental data following the prolonged administration of mecholyl in beeswax are tabulated. The pathological changes in the stomach and duodenum were pronounced and lasted longer than in the dogs receiving mecholyl in an aqueous solution. No ulcers were found in the stomach or duodenum, although gastric or duodenal erosions were found in 8 of the 19 dogs injected.

Although the quantities of mecholyl injected with the beeswax were from 2 to 4 times greater than that given by subcutaneous injection of mecholyl in aqueous solution, the general parasympathetic responses to the drug were not as severe, and fewer dogs collapsed or died immediately after the injections than when aqueous mecholyl was given alone. Bloody diarrhea persisted much longer and led to the death of 7 of 19 dogs from severe gastrointestinal hemorrhages. The hemorrhagic appearance of the gastrointestinal mucosa was more extensive and more severe than in the first group of dogs given mecholyl alone.

The microscopic findings in the numerous sections taken from the gastrointestinal tract strongly suggest that vasodilatory action of mecholyl on blood vessels was the main factor in the pathogenesis of these lesions. It appears that the marked vascular engorgement and hyperemia gave rise to stasis, increased capillary permeability and tissue anoxia, which resulted in extravasations of red blood cells into the mucosa, and was followed by superficial necrosis of the mucous membrane erosions and eventually led to the formation of true ulcers. Additional factors, such as trauma, acidity, and malnutrition probably play a part in the genesis of the lesions observed in these experiments.

ERNEST D. BLOOMENTHAL, M.D.

**Total Gastrectomy** (Gastrectomia total) VOLTA BAPTISTA FRANCO *Rev. brasil. gastroenterol.*, 1949, 1, 7

Three total gastrectomies for cancer of the stomach were performed by the author.

## SURGERY OF THE ABDOMEN

The first patient succumbed to the operative shock, the second patient died on the eighth postoperative day from peritonitis caused by a dehiscence of the suture line connecting the esophagus with the jejunum. The last person operated upon is still alive, 18 months after operation. This patient was in excellent condition for a period of 15 months following the removal of his stomach, then he began to experience difficulty in swallowing food. Roentgenograms showed a tumor in the distal portion of the esophagus. The patient's condition necessitated performance of a jejunostomy. Preoperative measures have been taken for transthoracic esophagectomy.

JOSEPH K. NARAT, M.D.

### Malfunction of the Gastrojejunal Anastomosis during the Early Postoperative Period Following Gastrectomy (Les dysfonctionnements précoces de l'anastomose après gastrectomie) LUCIEN LEGER and JEAN LOYQUE *J. chir., Par*, 1949, 65: 116

This discussion is limited to the factors which prevent a good result from jejunostomy in the early postoperative course following the Pean type of gastric resection. These factors are classified under four headings: (1) inflammatory obstruction, (2) mechanical difficulty, (3) functional disturbances, and (4) nutritional difficulties.

A case is reported in which evidence of obstruction of the efferent loop became apparent on the fifth postoperative day following a gastric resection. Reoperation revealed a fibrous type of mesocolon had and dense adhesions posterior to the mesocolon had blocked the anastomosis. There was no leakage at the suture line or other apparent cause for the peritonitis. The authors cite several cases of other surgeries in which failure of the anastomosis to function was attributable to inflammatory adhesions.

Among the most frequent causes of mechanical obstruction is retrograde invagination of the jejunum into the stomach. Other causes include incarceration of a loop of small intestine in the opening in the mesocolon, obstruction of the anastomosis by a mucus plug, and kinking of the efferent loop by a short mesocolon.

Certain cases of gastric dilatation following gastric resection appear to be on a functional basis. The authors postulate a reflex mechanism of which the splanchnic nerves constitute the motor inhibitory pathway. Splanchnic block often will relieve the condition and permit normal function to become established.

Resection of the pylorus in itself has the effect of reducing gastric peristalsis, which may be a contributing factor to postoperative gastric atony in some cases.

Reflux of the gastric contents along the proximal loop of the jejunum with subsequent dilatation of the duodenum and the stomach was encountered in 2 cases described by the author.

The longitudinal incision in the jejunum may interrupt peristalsis along this segment of bowel and thus prevent function of the anastomosis.

Edema at the anastomotic stoma on the basis of hypoproteinemia is another condition which may interfere with the proper evacuation of the stomach. However, the authors do not attribute much importance to this factor because hypoproteinemia cannot be demonstrated in many patients with postoperative retention.

FREDERICK W. PRESTON, M.D.

### Intestinal Obstruction: Indications For Surgical Treatment (Oclusion intestinal. Indicaciones del tratamiento quirurgico) RAMÓN FLORES LÓPEZ and ANTONIO LUNA OLIVARES *Rev. gastroenter. Mexico*, 1949, 14: 1

Wangensteen's classification of intestinal obstruction is preferred by the authors to that of Ochsner, Calkins, and others.

Among other diagnostic measures the authors use peritoneal puncture. From the viewpoint of indication for surgical treatment, all patients with intestinal obstruction may be divided into 4 groups:

1. Patients who require immediate surgical intervention because of a strangulated external or internal hernia, mesenteric thrombosis or embolus, volvulus, acute intussusception, strangulation caused by intestinal atresia, imperforate anus, or congenital diaphragmatic hernia.

2. Patients in whom the operation may be postponed from 18 to 24 hours to allow improvement in the general condition and the institution of decompression of the intestines. To this group belong certain patients with strangulation of the colon, obstruction caused by adhesions, or acute episodes of chronic intestinal intussusception.

3. Patients in whom the operation may be postponed for several days while decompression is being employed. To this group belong patients with an obstruction of the gut by a stone or intestinal parasites, or with ileus caused by compression of the gut (by adhesions or bridges), peritoneal abscess, or by perivisceritis.

4. Patients with functional ileus, either spastic or paralytic. This group does not require any surgical intervention.

As a rule, the authors prefer spinal anesthesia, particularly the fractional method. For patients in a poor general condition and with marked hypotension, general anesthesia with a closed circuit is employed. If spinal anesthesia is used, it is important to administer oxygen through a nasal catheter. If the Levin tube is not inserted before the operation, gastric lavage is indicated preoperatively, to prevent aspiration of the gastric contents into the respiratory tract.

If an external strangulated hernia is present, the incision is made over it. In other cases the x-ray findings may furnish information as to the desirable site of incision. If the location of the lesion cannot be established before the operation, a right lower paramedian incision is made. If the obstruction is located in the lower portion of the small intestine, a right paramedian incision is made, one-third of it being located above, and two-thirds of it below, the

**umbilicus** If the obstruction is in the upper portion of the small intestine, a left paramedian incision is made, with two-thirds of it above, and one-third below, the umbilicus

A subcostal incision is employed for the treatment of a diaphragmatic hernia, the abdominal approach being used exclusively. Paramedian incisions are used for the treatment of obstructions of the large intestines

The authors do not recommend transverse incisions because they are more time-consuming and cause more bleeding. Longitudinal incisions are exposed to lesser tension, produce less postoperative pain, and are more reliable as far as prevention of postoperative disruption of the abdominal wall is concerned

The authors prefer a side-to-side anastomosis to a terminolateral or end-to-end anastomosis

Patients with volvulus of the intestines or a mesenteric infarct require a relatively large amount of blood for transfusion

The Mikulicz method is employed only in selected cases of ileus of the large intestines, such as volvulus of the sigmoid or of the cecum, with gangrene, or carcinoma of the colon with perforation or irreducible intussusception

If multiple strictures of the small intestines, caused by tuberculosis, mycotic processes, or nonspecific granuloma, are encountered, or if an extensive cancer or numerous postoperative adhesions are found, a short circuit is established by means of an intestinal anastomosis

Enterostomy is done only in patients with carcinoma or tuberculosis, if the general condition is grave. The procedure is useless in paralytic ileus

Colostomy is employed in patients with ileus of the large intestines caused by cancer, diverticulitis, granuloma, or constricting pericolicitis

Sulfanilamide in saline solution is used intraperitoneally before closure of the abdominal wall. Penicillin and streptomycin are given parenterally

The authors stress the value of the Wangenstein tube for the treatment of selected cases of intestinal obstruction

JOSEPH K. NARAT, M.D.

#### Primary Malignant Disease of the Small Bowel

DAVID STANLEY LIKELY, JAMES R. LISA, MELVIN H. STITCH, and H. D. STEIN. *Arch. Int. M.*, 1948, 82: 206

The authors give an excellent review of the literature concerning malignancies of the small bowel. In addition, they present 17 cases recently encountered, from which they draw the following conclusions

Carcinoma of the small bowel comprises about 3 per cent of the gastrointestinal carcinomas and is much less common than carcinoma of the large bowel. Not including this series, there have been reported only about 365 cases of carcinoid, or argentaffinoma tumors, of the small intestine. Lymphosarcoma, in contrast to carcinoma, is observed more commonly in the small than in the large bowel according to the literature. There are about 149

reported cases of lymphosarcoma of the small intestine including those of the authors

The prognosis is considered poor in carcinoma and lymphosarcoma, and good in carcinoid

Clinically, one of these rare tumors may be suspected in the presence of mild unexplained nausea, intermittent obstruction, and mild anemia

JANE C. MACMILLAN, M.D.

#### The Surgical Therapy of Duodenal Ulcer

JOHN H. GARLOCK and ALBERT S. LYONS. *Surgery*, 1949, 25: 352

The authors present a review of 187 cases of duodenal ulcer. All patients were subjected to partial gastrectomy in the private practice of the senior author. The usual indications for surgery formed the basis for selection of patients. These were failure of a medical regimen to control the disease, repeated hemorrhages, perforations, and obstruction due to scarring. The authors are of the opinion that the only indication for gastroenterostomy in duodenal ulcer is the presence of a benign obstruction accompanied by a low acidity in an elderly patient

Usually, two-thirds of the stomach are removed. It is emphasized that the greatest care must be taken to completely remove the pyloric antrum and pyloric ring and, in the vast majority of cases, this means that the ulcer-bearing portion of the duodenum must be removed. It is the authors' belief that with careful, meticulous dissection this can be accomplished in almost 100 per cent of the cases, and in this series only one exclusion operation of the Finsterer type was performed. This patient developed a gastrojejunocolic fistula 6 years later. If the surgeon is positive that he can remove the pyloric ring, and if the ulcer is located at the bed of the first portion of the duodenum or in the second portion, then there is no harm in leaving the ulcer behind provided a good closure of the stump can be made. The author favors a Hofmeister retrocolic type of anastomosis. If extensive retroperitoneal dissection has been done in the region of the duodenum or pancreas a drain is always inserted

The author believes that vagotomy should be performed as well as a partial gastrectomy in those cases in which there is a marked hyperacidity or recurrent hemorrhages. Vagotomy alone is of value in gastrojejunal ulcers following adequate partial gastrectomy

There were 4 deaths in this series of 137 patients, an operative mortality of 2.1 per cent. There have been only 4 cases of recurrent ulceration, in 3 of these an adequate partial gastrectomy had been performed, and in the fourth case an exclusion operation had been done

F. J. LESEMANN, JR., M.D.

#### Necrotic Jejunitis

K. A. FICK and A. P. WOLKEN. *Lancet*, Lond., 1949, 1: 519

The clinical features, diagnosis, treatment, and pathology of an endemic necrotic jejunitis are described. Two cases among 18 under observation are described in detail

Necrotic jejunitis is believed to be initiated by defects in the diet. The 18 cases occurred in 13 men and 5 women. Their average age was 61 years. Sixteen died with an average duration of 7 days of illness. Two patients in whom a wide resection of the jejunum was carried out lived.

Recent work suggests that the *Clostridium* "enterotoxigenus," or *Clostridium welchii*, type F, plays an important part in the causation of jejunitis.

RICHARD J. BENNETT, JR., M.D.

**Volvulus of the Cecum** EDUARD MELCHOIR. *Surgery*, 1949, 25: 251

Of 6 patients with volvulus of the cecum, 5 were treated by primary resection of the twisted bowel. All of these recovered, although in one patient the condition was complicated by gangrene and peritonitis. In a still more severe case the patient did not sustain the nonradical intervention. On the whole these results are better than those generally obtained in distortion, with or without cecostomy and/or cecopexy. Nonradical operations expose the patient to the danger of recurrence. Primary resection is, therefore, the preferred treatment in this emergency. The possible use of emetine as a supplement following operation should be considered.

CHARLES BARON, M.D.

**Volvulus of the Cecum, with a Review of 100 Cases in the Literature and a Report of 6 New Cases** J. L. DONHAUSER and S. ATWELL. *Arch Surg*, 1949, 58: 129

The previous literature reviewed by the authors revealed many pertinent facts. The incidence of volvulus of the cecum is about 1 per cent of the cases of intestinal obstruction in this country, but it is higher in Central Europe and in Russia.

Torsion or volvulus of the cecum has been defined as a condition in which there is torsion limited to the cecum, ascending colon, and adjacent portion of the small intestine. Hyperfixation of the hepatic flexure, ascending colon, or terminal end of the ileum, and hyperdescent of the cecum are contributing factors to torsion of the cecum, but the essential anomaly is hypofixation of the cecum. Torsion, when it occurs, is commonly from 180 to 360 degrees, but it may be as much as 720 degrees.

Dietary measures are probably contributory and are thought to explain the high incidence in Central Europe and Russia. The incidence is higher in those who have had previous peritoneal damage.

Roentgenologic interpretation is difficult except that it confirms an intestinal obstruction. A barium enema is of value when the column of barium cannot pass a certain point in the colon and thus the cecum is not defined although a large collection of gas appears at the site of the cecum.

A flat plate on admission and another after 24 hours of intestinal drainage by suction are significant if the last one looks the same as the first or if the localized gas collection is slightly larger than in the first one. It suggests closed loop obstruction.

The signs and symptoms are abdominal. The onset is usually slow but there is no definite sign or syndrome. The findings of intestinal obstruction are present some time after the onset of the symptoms.

The authors summarized 100 cases in the literature. Torsion in this group occurred at any age, but in 50 per cent of the cases it occurred between the ages of 20 and 45. Women and men were equally susceptible. The signs and symptoms usually were those of obstruction. There was considerable distention and a mass was often palpable.

Predisposing factors were pregnancy, previous operation, high roughage diet, strong catharsis, dietary indiscretions, and unusual exertion.

The mortality rate is high and is unaffected by the type of operation. However, early operation will definitely lower the mortality.

FREDERICK C. HOEBEL, M.D.

**Myenteric Plexus in Congenital Megacolon: Study of 11 Cases** FRANCIS R. WHITEHOUSE and JAMES W. KERNOHAN. *Arch Int M*, 1948, 82: 75

On the basis of theoretical and experimental observations, it was the feeling of the authors that one approach to the study of the etiology and pathogenesis of congenital megacolon would be the study of the myenteric plexus (plexus of Auerbach) of the colon in cases of congenital megacolon in which postmortem examination had been performed. The myenteric plexus apparently has as its main function in the colon the conduction of stimuli and the co-ordination of movements and, as a result of such function, would be of importance in any consideration of the pathogenesis of congenital megacolon.

The myenteric plexus was studied by the authors in 11 cases of congenital megacolon, a series of cases used as controls, and 5 cases of secondary megacolon.

The myenteric plexus was found to be absent in the most distal part of the colon in all cases of congenital megacolon. In 80 per cent of the cases the myenteric plexus was absent also in the "transitional region." In 60 per cent of the cases the myenteric plexus was also absent in the lower part of the sigmoid. In 20 per cent of the cases the absence of the myenteric plexus extended from the rectum into the upper part of the sigmoid and descending colon.

In all cases of congenital megacolon there were nerves present in the location of the myenteric plexus which were not seen in the control cases.

The strategic location of these changes, a review of previous theoretical concepts, experimental production, and certain physiologic and anatomic studies pointed toward the significance of the changes in the myenteric plexus in the pathogenesis of congenital megacolon.

**Surgical Treatment of Cancer of the Colon** (La terapia chirurgica del cancro del colon) CARLO SPANGARO and ANTONELLO FRANCHINI. *Arch Ital Chir*, 1949, 71: 17

The authors analyze their results in the treatment of cancer of the colon. They include 146 patients

seen from 1932 to 1946. There was a slight majority of males. The ages varied from 30 to 84 years, with the highest incidence in the sixth and seventh decades.

Radical treatment was used in 66 cases, or 45.2 per cent. In 50, or 34.2 per cent, palliative measures were employed. Thirty, or 15 per cent, of the cases were inoperable. The cecum and transverse colon were most often amenable to radical resection, while the sigmoid and hepatic flexure were least often amenable to this procedure.

A right hemicolectomy was performed on 23 patients with a mortality of 43 per cent. Mikulicz resection was performed on 37 with a mortality of 24 per cent, and intraperitoneal segmental resection was performed on 6 patients with 4 deaths, a mortality of 66 per cent.

Palliative measures consisted of 28 colostomies on the right side with 9 deaths, and 20 colostomies on the left side with 1 death.

The most frequent cause of death was peritonitis. Only 2 cases of shock were seen. The most frequent cause of peritonitis was failure of the suture line to hold.

Among the complications, obstruction was the most common, being seen in 68 per cent of the cases and most often on the left side. This complication is considered to be a manifestation of an advanced process.

A study of the results showed that hemicolectomy resulted in a definite cure in 49 per cent of the patients, with 8 per cent showing metastasis in 2 or 3 years. The Mikulicz procedure resulted in cure in 51 per cent of the patients with evidence of metastasis or recurrence in 25 per cent in 2 or 3 years. The authors believe that any patient who lives for 3 years after operation should be considered clinically cured.

LUCIAN J. FRONDOTI, M.D.

**Wounds of the Colon and Rectum—A Critical Analysis of Current Methods of Surgical Treatment with Emphasis on Details of Surgical Technique.** LEWIS S. PILCHER. *Mil. Surgeon*, 1949, 104: 188.

The author reviews the details of surgical technique which his extensive war experience demonstrated to be most effective in the treatment of wounds of the colon and rectum. While, in general, some form of exteriorization colostomy is the method of choice in the treatment of wounds of the colon, small single perforations of the colon may, on occasion, be closed by simple suture. Wounds of the rectosigmoid and rectum must be closed by suture, and a proximal diverting colostomy performed. For most wounds, tangential exteriorization or loop colostomy is the treatment of choice. Great care must be taken not to overlook a posterior or mesenteric perforation. Extensive injuries of the right colon are best treated by resection of the entire right colon with ilio-transverse colostomy. The author does not believe that under wartime conditions the Lahey-Mikulicz technique of a double-barreled ileo-

colostomy is a satisfactory procedure. In any type of exteriorization procedure, great care must be exercised to prevent the colostomy opening from retracting below the skin level.

Under wartime conditions the Mikulicz spur colostomy did not prove entirely satisfactory. Loop colostomies proved to be more satisfactory and their closure could be carried out either extraperitoneally or intraperitoneally. If closed extraperitoneally, great care had to be taken to completely free the bowel from the transversalis fascia in order to avoid deformity and angulation, if performed intraperitoneally, care must be exercised not to suture through edematous bowel. Open methods of suture were preferred to aseptic anastomoses.

Intraperitoneal wounds of the rectosigmoid should be treated by suture and proximal diverting colostomy. Wounds of the extraperitoneal rectum and anus should be similarly treated, and the author stresses the need for suture of such wounds.

F. J. LESEMAN, JR., M.D.

## LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

**Pseudoscirrhus Carcinosis of the Liver (Carcinosis pseudoscirrosa del hígado).** MARIO ALBERTO DINA. *Arch. ital. mal. app. diger.*, 1949, 15: 113.

The author describes 2 cases of cirrhosis of the liver with metastasis from an adenocarcinoma of the pancreas and from an adenocarcinoma of the ampulla of Vater. The clinical, and especially the anatomical characteristics of the disease present a peculiar picture which differentiates the condition from known neoplastic diseases involving the liver.

Macroscopically there was cirrhosis with major or minor reduction of the size, and with large fibro-lardaceous and variegated interstitial bands. Histologically, there were isolated neoplastic tubules or cords invading the fibrous connective tissue. These were found in lacunae with endothelial walls, with invasion of the pseudolobular parenchyma from the periphery and the center.

The author proposes the theory of an endolymphatic infiltration of a secondary neoplasm in a previously cirrhotic liver. This would explain the scirrhus nature of the neoplasm which was absent at the site of origin.

LUCIAN J. FRONDOTI, M.D.

**Parasitic Cholecystitis (Colecistitis parasitarias).** JOSÉ OVIEDO BUSTOS. *Prensa med. argent.*, 1949, 36: 33.

Bustos believes that in the presence of a cholecystitis, particularly in the absence of stones, and in cases in which there is an associated zooparasitosis, the latter must be ruled out before other biliary factors are considered. In over 40 cases the following organisms have been found as primary or secondary invaders of the gall bladder: *Lamblia* or *Giardia* intestinalis, *Fasciola hepatica*, *Ascaris lumbricoides*, *Endamoeba histolytica*, *hydatidosis*, *Taenia solium*, *Ankylostoma duodenale* or *Necator americanus*. Considerable speculation is recorded concerning the

pathogenesis and mechanics involved in the parasitic invasion of the bile reservoir, whether or not the entrance was effected by an ascending or descending route through the canalicular or biliary ducts, through the liver, peritoneum, blood, or lymphatic systems

Treatment primarily is directed against the parasites, and the specific for each type should be employed. If, during biliary surgery, the parasites are discovered, the antiparasitic drug should be introduced directly into the bile passages and into the duodenum

STEPHEN A. ZIEMAN, M.D.

**Cholecystitis Emphysematosa** EDWARD E. JEMERIN  
*Surgery*, 1949, 25: 237

Cholecystitis emphysematosa is an inflammation of the gall bladder with grossly discernible gas formation. It is a rare condition, although possibly not quite as rare as the small number of reported cases would indicate. Despite the fact that the first cases in which gas was found in the gall bladder were described by Stolz in 1901, only 14 additional cases have appeared in the literature since that time.

Pathologically, emphysematous cholecystitis is an acute, usually gangrenous, inflammation of the gall bladder wall with bacteria growing in the wall and producing gas. The wall crepitates and foamy fluid can be expressed from it. The lumen of the organ fills with infected fluid and gas accumulates there as well, replacing the fluid contents partially or entirely. Destruction of the wall with extension of infection outside the gall bladder is quite common, so gas-producing pericholecystitis is also to be expected.

The clinical picture is that of a severe acute cholecystitis, with pericholecystitis in a high percentage of the untreated cases. A characteristic shadow on the plain roentgen film of the abdomen makes the diagnosis. Usually, during the first 24 to 48 hours no gas can be seen. There then appears the dark, pear-shaped shadow of gas outlining the usually distended gall bladder with the wall of the organ demarcated by contained gas as a darker circumferential shadow. Stones may be visualized as positive or negative defects within the gas. A fluid level should not be uncommon in films taken in the upright position. Within a few days the gaseous collection within the wall may become broader and stratified, and streaks or blobs of gas may be seen in the surrounding tissues, indicating extension of the infection into the pericholecystic area. The biliary ducts and radicals are not customarily outlined by gas.

Treatment should be surgical, but not all authors are in agreement with this point of view. Whether surgery should be done in the acute phase or in the interval is a moot point in ordinary gall bladder surgery and cannot be decided conclusively for this variety of acute cholecystitis either. It would seem that if chemotherapy will control the acute infection it would be wise to wait until this has subsided. However, with evidence of beginning spread beyond the confines of the gall bladder, prompt surgical

intervention would seem to be the logical course to follow. Cholecystectomy is the operation of choice and should be performed whenever the general condition of the patient and the local findings will permit. Chemotherapy should, of course, be used in conjunction with surgery.

A case of cholecystitis emphysematosa is reported. This case of clinical acute cholecystitis with pericholecystitis showed the typical roentgen features of emphysematous infection. Gas was seen to fill the lumen of the gall bladder, to outline the wall, and to extend into the surrounding tissue. Because of uncontrolled diabetes and congestive heart failure, the immediate therapy was conservative. Apparent clinical subsidence of the acute phase was achieved. Operation was performed after 2 weeks, at which time the diabetes and cardiac status were well controlled, the patient was afebrile, and the abdominal signs had disappeared. Empyema of the gall bladder and pericholecystic abscess containing gas under tension were found. *Clostridium oedematiens* in pure culture was obtained from the pus. The gall bladder was necrotic and contained stones, one of which was impacted in the cystic duct. A right subphrenic collection was also found. The gall bladder was removed, and the subhepatic and subphrenic spaces drained. The postoperative course was entirely smooth for 10 days, the wound healing per primam and the operative site remaining soft and nontender. A chill with high fever occurred on the tenth day with a blood culture positive for *Bacillus coli*. Penicillin therapy was started immediately and within 2 days the temperature was normal. However, on the thirteenth day a severe cerebral accident occurred. The patient developed oliguria and lapsed into coma from which she never roused, and died on the twenty-fourth day after operation. Left ureteral obstruction with pyonephrosis was found at autopsy, and probably accounted for the transitory *Bacillus coli* bacteremia. The operative site was clean and death was attributed to the cerebral accident.

CHARLES BARON, M.D.

**Observations on the Technique of Subserosal Cholecystectomy** (Bedeutung der Technik der subserösen Cholezystektomie) R. DEMEL  
*Wien med Wschr*, 1949, 99: 23

The author recommends that the operation of cholecystectomy be performed in a retrograde fashion commencing at the junction of the cystic and common ducts and proceeding toward the fundus of the gall bladder. In this manner injury to the common duct or hepatic artery, as well as to the liver, is prevented. Also, hemostasis is secured by the control under direct vision of the several blood vessels bridging the space between the liver and the gall bladder.

Normal saline solution is injected beneath the serosa along either side of the gall bladder so that the subserosa is distended with fluid. The serous coat can then be incised without injury to either the gall bladder or the liver. The serosal cuffs, preserved by



the procedure, are sutured together to reperitonealize the gall bladder fossa. If the cuffs of serosa cannot be preserved the liver may be approximated over the raw gall bladder fossa with interrupted sutures.

The author insists upon the use of a simple rubber tube for drainage of the operative area. The tube usually is removed within 4 to 6 days.

The technique of subserosal retrograde cholecystectomy is applicable for both acute and chronic cholecystitis, with or without stones, as well as for empyema or perforation of the gall bladder.

ORVILLE F. GRIMES, M.D.

#### The Surgical Problem of Periapillary Cancer

GEORGE T. PACK and ROBERT J. BOOHER *Arch Surg*, 1948, 57: 71

The authors present their experiences in 5 cases of periampullary cancer in which the radical operation of pancreaticoduodenectomy was performed. They believe that the presence of neoplastic biliary obstruction necessitates surgical attack on the biliary duct system, the pancreas, and the duodenum. Metastasis occurs in less than 25 per cent of the cases of periampullary cancer, and death usually occurs as a result of interference with the flow of bile. Almost two-thirds of cancers of the duodenum are periampullary.

Suprapapillary and intrapapillary cancers of the duodenum do not cause early symptomatology, as do periampullary tumors, and therefore the rate of operability is not as great, and metastases are more likely to have developed by the time that patients come to surgery. The results of surgery are also better in periampullary tumors than in other carcinomas of the duodenum and of the pancreas.

The development of the radical operation of pancreaticoduodenal resection with choledochojunostomy, pancreaticojunostomy, and gastrojejunostomy by Whipple and others is described. A growing tendency toward standardization of the operation is apparent.

In the group of 5 patients whose cases are presented the symptoms were gradual in onset. The predominant symptom in 4 of the patients was painless jaundice and itching, and in the remaining case the early complaint was epigastric pain, which was followed by intermittent jaundice. This is in contrast to other reports of cases in which pain was an outstanding early symptom in many of the patients. All 5 of the authors' patients had insidious anorexia with loss of weight, and 2 patients had enlarged livers and distended gall bladders. All patients presented a distended gall bladder and common duct at operation, and this indicates the value of Courvoisier's law to the surgeon. Chills and fever occurred in one patient; this is not unusual. Melena occurred in 2 patients and severe secondary anemia in 3 patients (including the 2 with melena). This signified an ulcerating duodenal lesion which, when associated with obstructive jaundice, would indicate an ulcerated peripapillary tumor.

The diagnosis was difficult in the absence of jaundice, and particularly so when the carcinoma occurred in the pancreas. Awareness of the condition is therefore a necessary first step toward the diagnosis, as most cases begin with malaise, chills and fever, gastrointestinal symptoms, loss of weight, anorexia, and weakness. A palpable mass is an important physical finding. Roentgenologic studies were helpful in 2 of the 5 cases. Laboratory studies were not of great value in this series because of the variable stages at which the patients presented themselves.

When the diagnosis of obstructive jaundice is made, early surgery is indicated if a good resectability rate is to be attained with a long survival rate. The survival rate is very low for patients who have been ill for as long as 6 months before operation.

The difficulty of diagnosis at the operating table has been demonstrated by the fact that some patients in whom resection is done for carcinoma prove to have pancreatitis, and other patients with conditions diagnosed as pancreatitis are found at later operations to have carcinoma.

In the authors' cases the outstanding complication was pancreatic fistula, which occurred in 3 cases in spite of ligation of the pancreatic ducts and careful closure of the stumps. This indicates the wisdom of performing a pancreaticojejunostomy. Ascending cholangitis was prevented by placing the biliary gastrointestinal anastomosis at a good distance proximal to the gastroenterostomy.

The article is accompanied by roentgenograms, microscopic slides, and schematic drawings of the operations performed. Four radical pancreaticoduodenectomies and one local excision were performed. One patient survived for 3 years after operation and another, whose cancer was still resectable 2½ years after onset, is still living after 4 years. One death, 3½ months after operation, was the result of biliary and pancreatic fistula. One patient is alive and apparently well 1 year after operation, and 1 patient had recurrence 9 months after operation. ERNEST D. BLOOMENTHAL, M.D.

#### Chronic Recurrent Pancreatitis: Clinical and Laboratory Aspects. Serial Serum Diastase Levels Following Prostigmine Stimulation. WILLIAM A. KNIGHT, JR., R. O. MUETHER, and ANNE J. SOMMER *Gastroenterology*, 1949, 12: 24

The authors review 58 cases of chronic recurrent pancreatitis. The most common symptoms were upper abdominal pain, weight loss, malaise, nausea, vomiting, food intolerance, anorexia, constipation, and weakness. Occasionally a low grade fever lasting for months was the presenting symptom. Hematemesis or melena occurred in 23 per cent of the cases. Pain is an almost constant feature of chronic recurrent pancreatitis and may be epigastric in location, referred to the back, or to either upper quadrant. Physical findings were inconstant and minimal. Mild upper abdominal tenderness was usually present.

The most helpful laboratory test was the serum diastase level which was found to be elevated in 64 per cent of the cases. Extremely low serum diastase levels may be seen in far advanced pancreatic disease. The glucose tolerance test, serum cholesterol, and stool examinations are of little aid in the diagnosis of chronic recurring pancreatitis.

In an effort to devise a more accurate laboratory test for chronic recurrent pancreatitis, a study was made of the response of the serum diastase levels of patients with normal and diseased pancreas to prostigmine methylsulfate. In the control series the serum diastase values showed very little variation following the injection of prostigmine methylsulfate, however, in 41 cases with chronic pancreatic dysfunction serial serum diastase levels following injection of the drug demonstrated significant changes in the diastase levels.

In general, the variations in patients with this disease may be classified into four types: in the first type a high fasting diastase level was present and following injection of the drug there was a progressive fall in the level, the second type of response was an initial rise followed by a progressive fall, the third type of response was a progressive rise following prostigmine stimulation, and the fourth type of response was in those patients who initially had a low diastase level, and in whom there was but little change following the prostigmine stimulation. The authors believe that the response of the serum diastase levels to prostigmine stimulation is a worthwhile test in patients with chronic pancreatic disease.

F. J. LESEMANN, JR., M.D.

#### Carcinoma of the Pancreas HOWARD K. GRAY *Arch Surg*, 1948, 57: 763

In the preface of his exhaustive work on the surgery of pancreatic tumors, Brunschwig has stated that the pancreas has been regarded as the "hermit organ" from the surgeon's standpoint because of the rarity with which operations have been performed on it and because surgeons have been reluctant to undertake such procedures, often fearing the development of acute pancreatitis as a complication of the operation itself. The complexion of this dismal situation has changed rapidly, however, in the last 15 years, owing to the abundant information that has accumulated relating to diagnosis, preoperative and postoperative care, and surgical technique. Not the least factor has been a willingness on the part of many surgeons to challenge and to conquer this natural aversion to direct surgical attack on the pancreas and, by so doing, to demonstrate that partial, and even total, pancreatectomy can be done without imposing undue risk.

It has been stated that two main types of pancreatic carcinoma are observed: (1) cylindric cell carcinoma, arising from the ducts, and (2) carcinoma simplex, arising from the parenchyma.

It is ironical that carcinoma of the head of the pancreas should become manifest in many instances when the lesion is small enough to permit complete

surgical excision, and yet be so placed that it may be extremely difficult, if not impossible, to make a positive diagnosis. This refers in particular to small carcinomas of the head of the pancreas that produce extrinsic pressure against the terminal portion of the common bile duct and produce obstructive jaundice. The terminal portion of the common bile duct descends along the posteroinferior aspect of the bend joining the first and second parts of the duodenum and then along the inner side of the second part, where it is surrounded more or less by the head of the pancreas. Because of this anatomic arrangement, any attempt to obtain tissue for microscopic examination will entail a rather extensive surgical procedure unless the surgeon is fortunate enough to withdraw sufficient malignant tissue by exploring the common duct from within. It is rare that a specimen of the desired tissue can be obtained for biopsy in this manner in the early stages of obstruction because infiltration of the walls of the common bile duct by cancer will not have occurred, and the examining scoop or tissue extractor will encounter only a duct that is compressed from external pressure. It is also ironical that carcinoma of the body or tail of the pancreas (where surgical removal could be accomplished with the least difficulty and risk) should become manifest in many instances when the lesion is so extensive that complete surgical excision is not possible.

Although there is no method whereby the surgeon can accurately recognize the presence of a malignant lesion of the pancreas, much valuable information can be obtained from a carefully taken history and from the results of physical and laboratory examinations.

Pain of some character has been noted by practically all observers in the majority of cases.

When the lesion involves the head of the pancreas (approximately 75 per cent of cases), jaundice will be present in practically all cases. The nature of this jaundice may give an invaluable lead as to the underlying pathologic condition, for it is usually marked and constant. The remissions that are seen so commonly associated with stone in the common bile duct are absent, and because of the depth of the jaundice (occasionally as much as 60 or 70 mgm. of bilirubin may be observed in 100 cc. of serum) pruritus is marked and many factitial areas may be seen on the skin.

The presence of jaundice and a distended gall bladder may suggest obstructive jaundice due to carcinoma of the head of the pancreas or of the bile ducts below the orifice of the cystic duct, but this combination is by no means pathognomonic. The presence of deep, persistent jaundice, continuous acholia and a distended gall bladder may be considered a more reliable diagnostic complex.

Cachexia and loss of weight usually are symptoms of advanced carcinoma and in most instances will be present in a patient in whom the malignant condition has progressed to the point at which surgical excision of the lesion is no longer possible.



Laboratory data are of inestimable value, particularly in the presence of jaundice

Appreciable elevation of the content of lipase in the serum was noted in about 37 per cent of a series of cases of pancreatic cancer. Because this phenomenon probably was due to obstruction of the pancreatic ducts and/or associated pancreatic inflammation, it was thought to be significant in the diagnosis of cancer of the pancreas.

Studies of hepatic function show no remarkable deviation from that seen in obstructive jaundice arising from other causes, except perhaps in degree, for alteration of hepatic function is dependent on damage to the parenchyma of the liver.

The recognition of carcinoma of the islands of the pancreas may present an insoluble diagnostic problem, for it is well known that even though surgical exploration of the pancreas is carried out, an adenoma or carcinoma of the islet cells is not always demonstrable and definitely incriminated as the cause of a patient's spontaneous hyperinsulinism and associated hypoglycemia.

Although occasional instances of hypoglycemia undoubtedly are hepatogenic, the minimal reduction of sugar in the blood in itself rarely causes symptoms, and therefore the spontaneous occurrence of the clinical syndrome ascribed to hypoglycemia should make the physician acutely aware of the possibility of a benign or malignant islet cell tumor.

In review of the records of patients suffering from this unusual disease, it is interesting to note that an appreciable number of patients will be familiar with the fact that sugar will abort an attack, and have become accustomed to carrying candy or sugar with them at all times. The attack of hypoglycemic coma may be mistaken for drunkenness by the average layman, and it has not been an unusual experience to find that a patient has been discharged from his position on the mistaken assumption by his employer that he had been imbibing too freely.

Surgical treatment would seem to be indicated in practically all cases in which the presence of a carcinoma of the pancreas has been recognized, if for no other reason than to offer palliative relief from a condition that is unbearable. In view of the fact that the majority (60 to 70 per cent) of malignant tumors of the pancreas are situated in the head, and that most of these produce complete and persistent jaundice, the surgeon is justified in attempting to restore the flow of bile into the stomach or intestine if it is seen that radical removal cannot be effected.

Should there be any uncertainty as to the diagnosis, a period of observation may be indicated in order to permit determination of the general course of the disease.

The patient who is suffering from the hepatogenous type of jaundice is more likely to be harmed than benefited by operation.

In the absence of jaundice, the diagnosis of carcinoma of the pancreas is extremely difficult to make, and therefore the indications for surgical intervention are obscure. The decision to explore will

have to be made when other diagnoses have been discarded through a careful process of elimination. It is probable that more patients should undergo exploratory operations than are being operated on at present, for by such a course it will be possible to attack the disease when it is still amenable to surgical removal.

The author discusses preoperative preparation, and operative and postoperative treatment.

**Role of Splenectomy in Thrombopenic Purpura**  
GEORGE BOGARDUS, J. GARROTT ALLEN, LEON O. JACOBSON, and CHARLES L. SPURR. *Arch Surg*, 1949, 58, 16.

Clinical data based on 20 cases of idiopathic thrombopenic purpura are presented. Ten of the patients in this group were treated medically, and 10 were subjected to splenectomy. Seven of the 10 patients treated medically were known to have had no recurrence for a period of from 6 months to 2 years. Five of the 10 splenectomized patients had a recurrence, in 2 of these it was severe. Of the patients who had a recurrence, 3 had the acute disease and 2 had chronic disease. Opinions concerned with the pathologic processes in thrombopenic purpura are discussed. The importance of the capillary abnormality, as well as the low platelet count, is emphasized. It is possible that the condition of the entire reticuloendothelial system, and not of the spleen alone, determines the course of the disease.

BENJAMIN GOLDMAN, M.D.

**Fever Following Splenectomy** (*La febbre degli splenectomizzati*) LUIGI TORRACA *Gior ital chir*, 1948, 4, 675.

The author discusses fever following splenectomy. In certain cases a mild fever, which cannot be explained on the basis of infection or absorption, is present for several weeks. He analyzes 8 cases following splenectomies which he performed. Two patients had fever for more than 2 weeks. This represents 25 per cent, comparable to the 27 per cent reported by Saarenmaa of the Helsinki Clinic.

Among the theories which are discussed as to the cause of the fever are the following: (1) ligation of the tail of the pancreas, (2) formation of exudate in the operative area, and (3) collection of blood in the splenic bed. Other theories are mentioned.

The author concludes that all these theories are merely hypotheses which do not adequately explain the cause of the fever. He agrees with Tansini in considering it a problem which is still to be solved.

LUCIAN J. FRONDOTI, M.D.

## MISCELLANEOUS

**The Coexistence of Intra-Abdominal Lesions in Patients with Epigastric Hernia** JOHN M. HOFFMAN and GREGG D. WOOD. *Surgery*, 1949, 25, 566.

In a tabulated review of 76 patients admitted to the Portland (Oregon) Veterans' Hospital, the

authors found 24 cases of associated epigastric hernia and upper abdominal disease

The symptoms of epigastric hernia are characterized as (1) a sharp finger-point lancinating pain on straining, well localized to the hernial ring where filaments of the lower intercostal nerves are impinged, and (2) the deep, boring, aching pain aggravated by eating or bending backward, produced by a drag on the greater omentum, greater curvature of the stomach, or falciform ligament of the liver. Pain is relieved on reduction of the mass, or on lying down, and is aggravated by straining, bending backward, or eating a full meal. Thirty of the 76 patients entered the hospital with these symptoms.

Patients with added vague ulcer or digestive symptoms should be thoroughly investigated and even given a trial medical regimen, to rule out coexisting visceral disease, before simple hernioplasty is done. Careful preoperative roentgenograms of the stomach for evidence of gastritis or ulcer, of the gall bladder for disease, and of the colon for disease or malposition, are considered essential, inasmuch as these diseases were predominantly coexistent.

JANE C. MACMILLAN, M.D.

**Abdominal Lymphadenitis, Study of 40 Observations** (La lymphadénite abdominale, d'après l'étude de 40 observations) JOEL MEGNIN *Rev chir*, Par, 1949, 68 12

The affection which, in the United States, is known as mesenteric lymphadenitis is a syndrome rather than a pathogenetic entity. It occurs most frequently in the second decade of life.

The author differentiates three clinical forms: acute, subacute, and chronic. The pathologic anatomy is not very characteristic except for an enormous swelling of the mesenteric lymph nodes, especially in the ileocecal area. The lymph nodes, which normally are the size of a hemp seed, are increased to lentil or bean size, they are smooth, gray, or pink, and of a special translucent aspect. Although the ileocecal location predominates, enlarged lymph nodes are often found disseminated over the entire abdominal cavity. Histologically they present diffuse hyperplasia, especially of the reticular and endothelial elements.

The etiology of the condition is still an open question, and various writers differ considerably in their opinions. In 1921, Brenneman, in America, suggested that the affection accompanies or follows tonsillitis or other streptococcal infections of the throat. Streptococci were found in a vast majority of cases on throat culture. The author doubts this

theory of the "Brenneman syndrome." Probably a multitude of factors may lead to mesenteric lymphadenitis. Systemic infections such as influenza, pneumonia, measles, scarlet fever, and even poliomyelitis and osteomyelitis are mentioned by the author. On the other hand, intestinal disturbances such as parasites, appendicitis (acute and chronic), and terminal ileitis may play a causative role.

The author discusses 40 personal cases. Of these, 21 patients were operated upon. He includes in his statistics cases of acute purulent appendicitis on the one hand, and abdominal tuberculosis on the other (Abstractor's note. This is surprising, since these conditions should be separated from the syndrome of mesenteric lymphadenitis as it is understood in the United States). WERNER M. SOLMITZ, M.D.

**Subphrenic Abscess** R. S. HUNT *Brit J Surg*, 1948, 36 185

The present report is based upon 12 cases of subphrenic abscess. Each case is described separately and the anatomy of the subphrenic spaces is briefly discussed.

One patient was found to have a single abscess on the left side secondary to a perforated peptic ulcer, another had abscesses on both left and right sides, secondary to a carbuncle of the left kidney. In all other cases abscesses were on the right, most of them being right posterior, and in general the etiologic factors were either appendicitis or perforated ulcer. However, in 3 cases the condition was secondary to amebic dysentery and in 1 case the abscess was of unknown etiology.

The following conclusions were drawn:

The recognition and early treatment of any predisposing condition, such as appendicitis or peptic ulcer, is of prophylactic value. The predisposing causes must be treated "thoroughly" in order to obtain the best results and prevent relapses. Early drainage is indicated as soon as the diagnosis is made. Diagnostic aspiration or "needling" should be avoided in order to prevent spread of infection or damage to other intra-abdominal organs. The extraperitoneal approach should always be employed. Extreme caution should be observed in order to avoid the splenic flexure in rare left-sided cases. Because of the varied organisms found on culture, both penicillin and sulfonamides should be used. Finally, the infection seldom corresponds to the anatomical boundaries of a subphrenic space, as it sometimes occupies part of a space and frequently is present in more than one location.

SAMUEL J. FOGELSON, M.D.

# GYNECOLOGY

## UTERUS

**Visualization and Photography of the Uterine Canal** W B NORMENT *North Carolina M J*, 1948, 9 619

As a result of many years of attempting to visualize and study the uterine canal, an instrument was devised which consists essentially of a metallic sheath similar to a urethroscope and containing a metal obturator. After the sheath is inserted through the cervix into the uterine canal, the obturator is removed. A second metallic sheath containing the optical system and closed at the end with a transparent window is then inserted through the first sheath. The two sheaths that cover the optical system are air tight and the insertion of the second closed sheath carries a column of air into the uterine canal which causes a slight dilatation which is advantageous for study. This investigation may be done under pentothal sodium or a low spinal anesthetic. It is thus possible to inspect the inside of the uterus and, for the purpose of further study, photographs may also be taken by a camera attached to the optical system. This instrument is an aid in intrauterine diagnosis and is especially valuable for guidance to the exact site where diagnostic curettage should be made. SAMUEL J FOGELSON, M D

**Clinical Signs of Adenocarcinoma of the Cervix Uteri** (Zur Klinik des Adenokarzinoms der Cervix uteri) H. DRESCHER *Geburth & Frauenh*, 1949, 9 31

Seventy-nine patients with adenocarcinoma of the cervix were treated by the author. In suitable cases an operation, namely, an abdominal or vaginal total hysterectomy, or Wertheim's operation, was done and supplemented by preoperative and postoperative x-ray treatments. In 50 per cent of the operable cases a cure was obtained. In the remaining cases fractional x-ray treatment was combined with applications of radium.

Forty-three patients, or 54.4 per cent of the entire group, were operable and a 5 year cure was obtained in 24 per cent of the entire material.

Cylindrical cell carcinoma is less radiosensitive than flat cell cancer, contrary to the flat cell carcinoma of the cervix and the adenocarcinoma of the corpus uteri. The adenocarcinoma of the cervix spreads to the parametria in its early stages. While the squamous cell cancer advances in a wide front, the adenocarcinoma forms clusters of cells separated by normal tissue. This type of advance is much faster than that of the squamous cell cancer.

Unlike cancer of the body of the uterus, cancer of the cervix occurs much more frequently in multiparas than in nulliparas. However, in the author's material the number of nulliparas was twice as large as would be expected.

The author concludes from his study that the results of irradiation in adenocarcinoma of the cervix, with or without operation, are nearly as good as those in cancer of the cervix in general.

JOSEPH K. NARAT, M D

**Fibromyxochondrosarcoma of the Cervix Uteri** (Fibromyxochondrosarcoma del cuello uterino) JOSÉ M. CUBO and JOSÉ L. BOVERI *Obst gín lat amer*, 1948, 6 554

The authors present an exhaustive case study of a rare uterine tumor. The patient, a 24 year old tripara, had been operated upon for a benign cervical polyp 1½ years previous to her present admission. Metrorrhagia recurred and 10 months later she submitted to a cervical amputation. After a period of 6 months there was recurrence of vaginal bleeding, and on examination at this time a fungating mass which bled freely on the least manipulation was seen attached to the left cervical wall. Microsections revealed a mixed sarcoma. Considerable speculation with regard to the histogenesis of the tumor brought out several theories regarding the formation of these tumors. The possible sequence appears to be as follows:

Because of constant association of the tissues which constituted the tumors, the existence of this link is regarded as sequential and not accidental. The formation of a precartilaginous blastema and the production of a benign cervical chondroma is conceivable. Malignant sarcomatous alteration of this chondroma and its mesenchyma matrix is the next step, with regression of the cartilaginous components due to local factors. The disembryoplastic origin of the tumor suggests the existence of aberrant embryonal germinants since the neoplasm did not show any characteristics of the region involved.

STEPHEN A. ZIEMAN, M D

**The Role of Surgery in the Treatment of Carcinoma of the Cervix** CHARLES D. READ *Edinburgh M J*, 1948, 55 675

In any discussion on the subject of the treatment of carcinoma of the cervix, division of opinion invariably centers around the relative merits of radiation and radical surgery. This generally applies only to cases coming within the category of stages 2 and 3. In many clinics the Wertheim operation was abandoned when radiotherapy became generally established, but at the author's hospital the radical surgical operation has been practiced continuously, but lately in rather carefully selected cases only.

In his "all out" surgical attack on carcinoma of the cervix, Victor Bonney, between the years 1907 and 1936, performed 500 consecutive Wertheim operations. His operability rate was 63 per cent of all cases seen and his series included stage 1, 2, and 3 growths. His operative mortality was 14 per cent.

In these 500 operations, there was malignant involvement of the regional glands in 200 patients, while in 300 patients the glands were free of growth. The 5 year cure rate in the gland-free cases was 53 per cent, and the corresponding cure rate in the gland-involved cases was 22 per cent. A further analysis of Bonney's results, taking into consideration the 37 per cent of patients not subjected to surgery, shows an absolute cure rate of 25 per cent.

The results of radiotherapy are quoted and compared more than favorably with those of surgery, but in spite of either method of treatment, a considerable number of patients die from the disease.

Since 1936 at the Chelsea Hospital for Women, 14 per cent of the patients with carcinoma of the cervix have been subjected to the Wertheim operation. The operative mortality was 8.3 per cent. With a more careful selection of cases, it is fair to assume that the operative mortality would have dropped to about 4 or 5 per cent as a result of the improved anesthesia, blood and plasma transfusions, penicillin, the sulfa drugs, and good nursing.

The selection of cases for the radical operation today is largely confined to those presenting the following: (1) radioresistant growths, (2) columnar-celled (adeno) carcinoma of the cervix, (3) stenosis of the vaginal vault, (4) large fibroids, ovarian tumor, or salpingitis, (5) refusal of radiation by the patient, and (6) pregnancy complicating cervical cancer.

During the years from 1936 to 1941, 54 radical operations were performed on stage 1 and 2 growths. The uncorrected 5 year survival rate was 44 per cent, the corrected rate was 50 per cent.

The author has performed the radical operation following radiotherapy on 42 occasions. Previous radiation does magnify the technical difficulties of the operation to some extent, but provided the growth still conforms to Stage 1 or 2, it is always removable.

So far as can be assessed, the rate of carcinomatous gland involvement is approximately as follows:

Stage 1	from 20 to 25 per cent
Stage 2	from 30 to 35 per cent
Stage 3	from 40 to 50 per cent
Stage 4	over 60 per cent

The author suggests that radiation may not successfully sterilize the pelvic lymphatic field of carcinomatous deposits, as is illustrated by histological examination of excised nodes following a full course of treatment by radium and deep x-ray therapy. He believes that there is a place for lymphadenectomy in selected Stage 3 cases which have been cured locally by radium, and that such a procedure could well be extended to Stage 2 cases and selected cases of Stage 1.

As for the operation, lymphadenectomy is performed early in the operation immediately after it is ascertained that the bladder can be satisfactorily displaced downward. At least the upper half and preferably the upper two thirds of the vagina are

removed. The ureters and bladder are treated with the greatest gentleness. Over the past 12 years the incidence of postoperative urinary fistula has been 3.1 per cent. GEORGE BLINICK, M.D.

**Discussion of Certain Findings at Autopsies of Patients with Cancer of the Uterus** (Considerazioni su alcuni reperti di autopsie di pazienti affette da cancro dell'utero) F. MARCHESI *Quad. clin. ostet. ginec.*, 1948, 3: 675

Among 11,693 autopsies there were 82 cases of cancer of the uterus, but 24 of these had to be excluded from the review because the autopsies were incomplete.

In 53 cases of the remaining 58 the cancer was primary and in 5 it was secondary. In 37 cases the cervix was the primary site of the cancer and in 16 the fundus was the primary site.

The author attempted to establish the cause of death in each instance. He divided the causative factors into three groups: (1) direct, namely neoplastic invasion of the lesser pelvis, peritoneal carcinosis, or metastases in the liver or brain, (2) indirect, such as cachexia or renal insufficiency, and (3) intercurrent, such as infectious peritonitis or decompensation of the heart.

Cancer of the cervix caused the formation of fistulas and the infiltration of adjoining organs more frequently than cancer of the fundus.

The frequency of brown atrophy of the liver was greater and that of fatty degeneration of the liver less in cases of cervical cancer than in cases of cancer of the fundus.

Atrophy of the spleen was recorded in 32.4 per cent of the cases of cervical cancer, while septic tumefaction of the same organ was found in 31.2 per cent of the cases of cancer of the fundus.

In 29.1 per cent of the cases of cervical cancer there was hydronephrosis with atrophy of the renal parenchyma, in 24.3 per cent, fatty degeneration, and in 32 per cent, dilatation of the ureters. On the other hand, the frequency of renal lesions in cases of cancer of the fundus was of no practical importance.

The vesical wall was invaded in 24.3 per cent of the cervical cancers and in 6.2 per cent of cancers of the fundus.

The author concludes from his review that the greatest effort should be made to avoid secondary infections and to maintain the anatomic and functional integrity of the urinary apparatus, especially in cases of cervical cancer.

JOSEPH K. NARAT, M.D.

#### ADNEXAL AND PERIUTERINE CONDITIONS

**Surgical Indication of Hysterectomy with Castration in Hydatidiform Mole** (Indication chirurgicale de l'hystérectomie avec castration dans la mole hydatiforme proliférante) CH. FLAMAND *Acta chir. belg.*, 1948, No. 8: 483

The author reports a case of hydatidiform mole with very rapid development and a poor general con-

dition of the patient. At 3 months of pregnancy the uterine fundus was at the level of the umbilicus, continuous small hemorrhages had been present for 4 weeks, the patient complained of continuous dull abdominal pains, the hemoglobin was 55 per cent, and the gonadotropic hormone in the urine was 40,000 units. According to Aschheim and Zondek the last finding is a classical sign of hydatidiform mole, the titer in normal pregnancy being between 500 and 4,500 units. In view of the rapid growth, the extreme softness of the uterus, the probability of incomplete evacuation by curettage, and the poor general condition of the patient, the author decided on hysterectomy. As, at laparotomy, the ovaries appeared enormously enlarged (of more than fist size), hyperemic, and polycystic, they were removed with the uterus.

The author discusses in detail the indications for hysterectomy in hydatidiform mole. He believes that the operation is indicated only in such extreme cases as the one reported. In the individual case the decision will depend not only on the rapidity of uterine growth and the general condition but also on the parity of the patient.

In the light of recent researches, not too much value can be ascribed to the gonadotropic titer. It has been shown that abnormally high titers sometimes also occur in normal pregnancies as well as in hyperemesis gravidarum. WERNER M. SOLMITZ, M.D.

### MISCELLANEOUS

**Irradiation of Spleen (Die Milzbestrahlung)** RICHARD KURT KEPP *Geburish & Frauenh.*, 1949, 9: 24

The mechanism of the effect of irradiation of the spleen remains obscure. Probably products of decomposition of cells under the influence of x-rays are responsible for the rise of coagulability of the blood.

In many instances, irradiation of the spleen not only causes cessation of the uterine bleeding, but also re-establishes the normal cycle. This effect is possibly attributable to hormonal relations between the spleen and the ovaries. The author irradiates from a distance of 40 cm, with the use of 110 roentgens, 180 to 200 kilovolts, and a copper filter 0.5 cm thick.

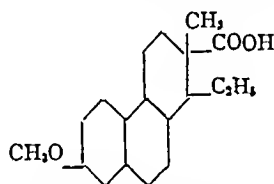
At the University of Goettingen, irradiation of the spleen in the treatment of juvenile menorrhagias, functional hemorrhages of women, preclimacteric uterine bleeding, and hemorrhages due to inflammatory processes of the adnexa, or essential thrombopenia, has been followed by good results.

A cessation of juvenile bleeding was recorded in two-thirds of all cases, and in one-half of them a normal menstrual cycle was re-established. Seventy-five per cent of all patients with uterine bleeding caused by an inflammation of the adnexa reacted favorably.

If the proper technique is employed, the method is considered harmless. JOSEPH K. NARAT, M.D.

**Clinical Study of 1 Methyl Bisdehydrodolsynolic Acid** A New Synthetic Estrogen (Etude clinique de l'acide 1-méthyl bisdehydrodolsynolique. Un nouvel oestrogène de synthèse) ALBERT NETTER, MICHEL JAMES, and G. MATHÉ. *C. rend. Soc. fr. gyn.*, 1948, 18: 272

This compound, 1-methyl bisdehydrodolsynolic acid, of strong estrogenic activity, has been prepared by Miescher who gave it this name in honor of the American author, Doisy. The formula is



The authors studied this new drug in a series of 33 patients, 18 of whom were in the menopause, 12 had had castrations, and 3 had amenorrhea. The substance is given by mouth only. Doses of from 20 to 30 mgm. re-establish normal vaginal cytology in castrated women. In 2 cases of ovariectomized but not hysterectomized patients, doses of from 20 to 30 mgm. produced uterine hemorrhage. Pruritus vulvae was relieved in 2 women in the menopause. The clinical effect on hot flashes, headaches, palpitations, and angiospasm of the extremities was much less marked than that of estradiol.

WERNER M. SOLMITZ, M.D.

# OBSTETRICS

## LABOR AND ITS COMPLICATIONS

**Medical Treatment of Uterine Inertia** (Sul trattamento medico dell'inerzia uterina) ROBERTO PICCOLI *Arch ostet gsn*, 1948, 53 276

The efficacy of the association of estrogen with the posterior lobe hormone, and that of sparteine sulfate alone or associated with spasmolytic substances have been studied in 53 cases of uterine inertia. Of 19 patients with simple inertia and early rupture of the membranes, 16 were treated by the oral administration of 4 mgm of diethylstilbene and the intramuscular injection of 3 units of extract of the posterior lobe 4 hours later, in the other 3 patients, 3 mgm of the synthetic estrogen were injected intramuscularly. Before the institution of treatment in all of the cases, the complete absence of uterine contractions was constantly verified by palpation for at least 2 hours. In 13 patients the pregnancy was at term, in 3 it was in the seventh month, and in 3 it was in the eighth month. The presentation was podalic in 2 cases and normal in the others.

In 11 patients uterine contractions started about 3 hours after the administration of estrogen, and in the others within 30 minutes of the administration of the posterior lobe hormone. In 16 patients labor proceeded regularly and spontaneous delivery occurred without complications in an average of 11 hours and 10 minutes. In 2 patients the estrogen treatment started the contractions, but they were of little use and came at rather long intervals even after administration of the posterior lobe hormone. Delivery was obtained after 22 hours by the application of forceps in the first case and in the second case it occurred spontaneously after 33 hours. In the remaining patient, a multipara in the seventh month of pregnancy with ruptured membranes for more than 24 hours and a podalic presentation, the treatment was ineffective in that it caused only weak contractions for 3 hours, and delivery was obtained only after a foot was brought down and traction applied.

Of 34 patients with secondary inertia of the dilatation and expulsion period, 22 were given sparteine sulfate alone in doses ranging from 9 to 20 cgm, while 12 were given 20 cgm of the drug with 3 cgm of paverine.

In the first group, sparteine failed in 2 patients and was effective in the others (90.9 per cent). In from 10 to 20 minutes it caused good contractions which resulted in spontaneous delivery in 65 per cent of the patients, and in more advantageous conditions for operative delivery in the remainder. The contractions caused by sparteine usually last from 30 to 40 seconds and occur at intervals of 3 to 5 minutes. The best results are obtained with doses over 15 cgm. The duration of the action of the drug varies from 2 to 4 hours, but it is seldom necessary to repeat the dose.

In the second group, which consisted of primiparas with simple inertia in whom the borders of the incompletely dilated cervix appeared to be rigid, or in whom the uterus was hypertonic or strongly applied to the fetal body, sparteine associated with papaverine caused spontaneous delivery within a short time in 7 instances and facilitated operative delivery under favorable conditions in 3, but it failed in 2 instances. The association of spasmolytic substances with sparteine does not interfere in any way with the oxytocic action of the latter. RICHARD KEMEL, M D

**Dystocia in Face Presentation** (Dystocia en la presentación de cara) DIEGO TAYLOR GOROSTIAGA and ROBERTO E LEDE *Prensa méd argent*, 1949, 36 143

The authors, in an elaborate article generously illustrated, discuss the various possible positions of fetal face presentation and the necessity for precise diagnosis of the condition. Every aid should be utilized for this purpose and the criteria for accurate diagnosis are given.

The management of this condition is presented. This includes expectant therapy or manipulation when some disproportion exists. The details of reduction and orientation are enumerated.

The causes for face presentation are given as twofold and listed as primary and secondary, whereas factors which limit expectant therapy and contribute to the high fetal mortality (from 12 to 50 per cent) involve the maternal organs, their pathophysiologic processes (dystocias), and malformation of the fetus. Considerable judgment and experience are required to decide upon the precise time for surgical intervention as well as to choose the type of surgery suited for the particular case at hand. This is usually determined by the presentation, whether high or low, and the relationship of the maternal and fetal parts.

The various manipulation schemes are discussed, they include rotation, the use of forceps, internal version, symphysiotomy, and cranioclasia.

STEPHEN A. ZIEMAN, M D

**Dystocia Due to Obstructing Tumors** (Dystocia por tumores previos) A WOLFF NETTO *An Fac med*, S Paulo, 1948, 2 23

Obstructing tumors may be genital (uterine malformations, ovarian, uterine, vaginal, and vulvar neoplasms) or extragenital (originating in organs close to the uterus, such as the pelvis, rectum, bladder). They make the normal course of parturition impossible by preventing dilatation of the cervix, or engagement and progression of the fetus through the pelvic canal, or by producing abnormal fetal positions and presentations. Sometimes the dystocia is only apparent and during the course of labor the tumors spontaneously leave their obstructing position and present no further impediments to parturi-

tion When this does not occur, the obstructing tumor requires the intervention of the obstetrician

Tumors obstructing the pelvis are not exceptional complications of labor Neoplasms of the uterus, and, especially, myomas of the cervix and the lower segment in aging primiparas and in pluriparas with few births or long intervals between them, are the most frequent In decreasing order of frequency the tumors are ovarian neoplasms (dermoid, pseudomucinous and serous cysts, carcinoma, and sarcoma) and tumors originating in the tissues and walls of the pelvis Obstructing tumors of the vagina and vulva or those constituted by a pelvic ectopic kidney, fecalomas, vesical calculus, and malignancy of the rectum and bladder are extremely rare The diagnosis is not always easy and is based on the origin of the tumor, its aspect, consistency, localization, fixation, or mobility Parturition by the natural route may occur because of the softness or small volume of the tumor, its ascension, or its artificial or spontaneous rupture If the pelvic obstruction is such as to prevent birth by the natural route and this fact is not recognized, the patient ends by dying from infection or uterine rupture The treatment of this dystocia must be surgical, it depends on the nature of the tumor but has cesarean section as its basis, which procedure can nowadays be considered rather safe When it is impossible to displace the tumor manually and to obtain descent of the fetus, this operation becomes imperative and, with or without extirpation of the tumor, solves the problem with decreased maternal and fetal mortality

The author classifies and discusses the genital and extragenital obstructing tumors, and emphasizes the role played by uterine myomas and cystic tumors of the ovary He reports 2 cases In the first, the dystocia was due to a uterine myoma which at first was thought to be a low insertion of the placenta, although there was no hemorrhage After careful examination the diagnosis of obstructing submucosal myoma was made and it was realized that the localization of the tumor made its extirpation easy The cervical dilatation was completed and the myoma was removed by torsion of its pedicle The membranes were then artificially ruptured and the fetal head became engaged Birth occurred normally 3 hours later In the second case the dystocia was due to a vulvar tumor and the entire perineal region was occupied by a giant papilloma which obliterated the vaginal orifice nearly completely and made examination impossible Segmental cesarean section was performed and the tumor was removed by thermocautery 3 months later

RICHARD KEMEL M D

**Cesarean Section in Contaminated Cases—A Résumé of 1,138 Observations** (La cesárea en el caso impuro [A través de 1,138 observaciones]) JULIO BAZÁN, FRANCISCO A URANGA IMAZ, and CARLOS D SCHIAVO *Bol Soc obst gin B Air*, 1948, 1948 571

This is a critical comparative study of the treatment of cesarean section in contaminated cases with-

out and with chemotherapy and antibiotics It extends from 1928 to 1948 With the low section technique and drains, the mortality from peritonitis and infection for 172 cases was 4.06 per cent (from 1928 to 1933) Surprisingly, this figure remained about the same up to 1943 despite variations in operative procedures and care In 1943 when sulfonamides were employed the rate dropped to half (2.13 per cent) Significantly enough, with improved bacteriologic studies, correct identification of the invading organism, and the employment of specific sulfa-antibiotic combinations, the mortality rate from 1945 to 1948 was reduced to zero in 195 contaminated cases

Emphasis is placed on culturing of the organism, the skillful operative technique without trauma, and the maintenance of high sulfa-antibiotic concentrations of the blood by local and parenteral means

STEPHEN A ZIEMAN, M D

**Obstetrical Uterine Rupture in Finland During the Years 1936 to 1943, Especially from the Point of View of Preventive and Clinical Treatment** (Ueber die obstetrischen Uterusrupturen in Finnland während der Jahre 1936-1943, insbesondere vom Gesichtspunkt der Präventiven und Klinischen Behandlung aus betrachtet) P O PÄRNÄNEN *Acta obst gyn scand*, 1949, 28 Supp 6

The author analyzes all cases of obstetric uterine rupture occurring in Finland during the years 1936 to 1943 He reports a total of 103 ruptures among 593,251 deliveries (0.17%) The maternal mortality was 53.4 per cent and the fetal mortality, 93.3 per cent The ratio of multiparas to primiparas was 96 to 13

So-called violent or traumatic rupture accounted for 17 cases (16.5 per cent of the total) The majority of these followed forceps application and version In a few cases rupture occurred following craniotomy and embryotomy

Spontaneous ruptures (86 cases, or 83.5%) were divided as follows (1) those caused by rupture of a scar (45.4%), (2) mechanical obstruction to delivery (38.4%), (3) pathologic changes of the uterine wall, e.g., neoplasm (9.3%), (4) miscellaneous factors, e.g., pendulous abdomen (2.3%), and (5) undetermined factors (4.6%)

Ruptures of a uterine scar presented the best maternal prognosis (25%) The most usual mechanical obstruction was a narrow pelvis Two of the 33 cases in this latter group were precipitated by the administration of oxytocics

The symptoms varied Classical symptoms of an imminent uterine rupture were frequently absent At times signs of internal hemorrhage suddenly appeared It was a common feature for ruptures of scars to be preceded by pain in the region of the scar, perhaps even several weeks beforehand Nearly 80 per cent of all ruptures occurred within 1 week of term, and four-fifths of these should have been considered early in pregnancy as definite hospital deliveries



The prognosis seemed to depend primarily on the degree of shock, the severity of hemorrhage, the presence of infection and duration of the rupture before treatment was instituted. Of secondary importance was the general condition of the patient, mode of transportation of the patient to the hospital, and the skill of clinical care.

The author proposes certain principles of management after instituting therapy for hemorrhage and/or shock, definite treatment should preferably consist of wound toilet, and then, if circumstances permit, suture of the rupture, otherwise supravaginal hysterectomy rather than complete hysterectomy should be done. Packing is ill-advised. In patients with persistent hemorrhage the uterine cavity should be emptied either vaginally or by the abdominal route. An empty, retracting uterus is the best security for the control of hemorrhage. It is significant that the mortality among women attended by general practitioners was 77.3 per cent, among those under the supervision of specialists the mortality was only 24.3 per cent.

WARREN R. LANG, M.D.

### MISCELLANEOUS

**Roentgenologic Study of the Pelvic Viscera in the Pregnant Woman** (Etude radiologique des visceres pelviens chez la gestante) M. FOURNIER. *C. rend. Soc. fr. gyn.*, 1948, 18, 202.

Five normal pregnant women, at or approaching term, were studied roentgenologically. Three of these were primiparas and 2 had had a childbirth previously. A sixth woman who clinically presented symptoms suggesting placenta praevia in the sixth month of gestation was later, on Cesarean section, found to have a placenta praevia centralis.

The technique consisted in partially filling the bladder with a shadow medium (tenebryl B). A small barium enema was given by rectum and the vagina was rendered visible by mere inunction of the walls and plications with a thin layer of opaque substance. The roentgen rays were centered between the greater trochanters so that the two shadow contours coincided for the exposures in profiles, and from the middle of the symphysis to the middle of the promontory.

From the experience in these 6 cases it is concluded that cystography will often show a much greater thickening of the inferior uterine segment than vaginal examination with the fingers would lead one to suspect. Although the exact location of the placenta cannot always be found, even when it occupies the lower uterine segment, without a careful study of the relationships also offered by the rectum and the uterus, nevertheless the method is peculiarly susceptible for confirming the clinical diagnosis of placenta praevia. On the other hand, in the absence of the signs of abnormal distance between the bladder and the presenting part, and between the rectum and the presenting part, a clinical diagnosis of placenta praevia can be discounted.

The author reasons that the method might also apply to other forms of forelying obstructions of the birth canal, such as tumors, fibromas, or cysts.

The roentgenographs show the close relationship between the upper end of the vagina to the rectum in the normal woman at term and explains the frequent injuries to the rectum in vaginal tears. They also show how closely the bladder is molded over the foregoing part contained within the lower uterine segment and the ease of injury to the bladder in tears of this segment.

JOHN W. BRENNAN, M.D.

**Abortions, Premature Births, and Weight of the Newly Born During the War Period** (Aborti, parti prematuri e peso dei neonati in periodo di guerra) PIERO MUTTI. *Ann. ostet. ginec.*, 1948, 20, 750.

The contradictory reports of various authors who had studied the subject of newborn infants in the two world wars led Mutti to make his own investigation, using the material observed at the Obstetric and Gynecologic Clinic of the University of Cagliari during three periods—the prewar period from 1939 to 1940, the war period from 1941 to 1944, and the postwar period from 1945 to 1946.

He found that the average incidence of abortions had remained nearly uniform, in the neighborhood of 19 per cent, during the three periods. However, the slight increase in premature births to 16.5 per cent during the war period, as compared to 15.6 per cent during the postwar period, was lower than the 17.35 per cent average of the prewar period, and especially the 20.08 per cent of 1939 which constituted the highest point of the curve.

On the basis of 2,614 clinical records referring without doubt to births at term, the average weights of the newborn were 3,291 gm. for the prewar period, 3,316 gm. for the war period, and 3,308 gm. for the postwar period. Consequently, instead of the expected decrease in weight during the war period, there was a very slight increase. Various factors may have contributed to this stability of the weight of the newborn in Sardinia. The war period on this island was shorter than in Northern Italy where the problem has been studied particularly. The island is principally an agricultural region and it is probable that the dietary deficiencies which are capable of profoundly altering the general condition of the mother did not occur here as they did in the other parts of Italy. Pluriparity, in which the weight of the newborn tends to increase with each successive pregnancy, reached its highest point on the island during the war. As a result of the transfer to the island of numerous families of soldiers, many children considered as islanders were really of continental origin, and their average weight at birth was generally higher than that of children belonging to the region. With the influx of continental elements and the intermarriage with island girls, there must also have been some influence on the average weight of the newborn in the direction of an increase.

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tion When this does not occur, the obstructing tumor requires the intervention of the obstetrician

Tumors obstructing the pelvis are not exceptional complications of labor Neoplasms of the uterus, and, especially, myomas of the cervix and the lower segment in aging primiparas and in pluriparas with few births or long intervals between them, are the most frequent In decreasing order of frequency the tumors are ovarian neoplasms (dermoid, pseudomucinous and serous cysts, carcinoma, and sarcoma) and tumors originating in the tissues and walls of the pelvis Obstructing tumors of the vagina and vulva or those constituted by a pelvic ectopic kidney, fecalomas, vesical calculus, and malignancy of the rectum and bladder are extremely rare The diagnosis is not always easy and is based on the origin of the tumor, its aspect, consistency, localization, fixation, or mobility Parturition by the natural route may occur because of the softness or small volume of the tumor, its ascension, or its artificial or spontaneous rupture If the pelvic obstruction is such as to prevent birth by the natural route and this fact is not recognized, the patient ends by dying from infection or uterine rupture The treatment of this dystocia must be surgical, it depends on the nature of the tumor but has cesarean section as its basis, which procedure can nowadays be considered rather safe When it is impossible to displace the tumor manually and to obtain descent of the fetus, this operation becomes imperative and, with or without extirpation of the tumor, solves the problem with decreased maternal and fetal mortality

The author classifies and discusses the genital and extragenital obstructing tumors, and emphasizes the role played by uterine myomas and cystic tumors of the ovary He reports 2 cases In the first, the dystocia was due to a uterine myoma which at first was thought to be a low insertion of the placenta, although there was no hemorrhage After careful examination the diagnosis of obstructing submucosal myoma was made and it was realized that the localization of the tumor made its extirpation easy The cervical dilatation was completed and the myoma was removed by torsion of its pedicle The membranes were then artificially ruptured and the fetal head became engaged Birth occurred normally 3 hours later In the second case the dystocia was due to a vulvar tumor and the entire perineal region was occupied by a giant papilloma which obliterated the vaginal orifice nearly completely and made examination impossible Segmental cesarean section was performed and the tumor was removed by thermocautery 3 months later

RICHARD KEXEL M D

**Cesarean Section in Contaminated Cases—A Résumé of 1,138 Observations** (La cesárea en el caso impuro [A través de 1,138 observaciones]) JULIO BAZÁN, FRANCISCO A URANGA IBAZ, and CARLOS D SCHIANO *Bol Soc obst gin B Am*, 1948, 1948 571

This is a critical comparative study of the treatment of cesarean section in contaminated cases with-

out and with chemotherapy and antibiotics It extends from 1928 to 1948 With the low section technique and drains, the mortality from peritonitis and infection for 172 cases was 4.06 per cent (from 1928 to 1933) Surprisingly, this figure remained about the same up to 1943 despite variations in operative procedures and care In 1943 when sulfonamides were employed the rate dropped to half (2.13 per cent) Significantly enough, with improved bacteriologic studies, correct identification of the invading organism, and the employment of specific sulfa-antibiotic combinations, the mortality rate from 1945 to 1948 was reduced to zero in 195 contaminated cases

Emphasis is placed on culturing of the organism, the skillful operative technique without trauma, and the maintenance of high sulfa antibiotic concentrations of the blood by local and parenteral means

STEPHEN A ZIEMAN, M D

**Obstetrical Uterine Rupture in Finland During the Years 1936 to 1943, Especially from the Point of View of Preventive and Clinical Treatment** (Ueber die obstetrischen Uterusrupturen in Finnland waehrend der Jahre 1936-1943, insbesondere vom Gesichtspunkt der Praeventiven und Klinischen Behandlung aus betrachtet) P O PÄRÄNEN *Acta obst gyn scand*, 1949, 28 Supp 6

The author analyzes all cases of obstetric uterine rupture occurring in Finland during the years 1936 to 1943 He reports a total of 103 ruptures among 593,251 deliveries (0.17%) The maternal mortality was 53.4 per cent and the fetal mortality, 93.3 per cent The ratio of multiparas to primiparas was 96 to 13

So-called violent or traumatic rupture accounted for 17 cases (16.5 per cent of the total) The majority of these followed forceps application and version In a few cases rupture occurred following craniotomy and embryotomy

Spontaneous ruptures (86 cases, or 83.5%) were divided as follows (1) those caused by rupture of a scar (45.4%), (2) mechanical obstruction to delivery (38.4%), (3) pathologic changes of the uterine wall, e g, neoplasm (9.3%), (4) miscellaneous factors, e g, pendulous abdomen (2.3%), and (5) undetermined factors (4.6%)

Ruptures of a uterine scar presented the best maternal prognosis (25%) The most usual mechanical obstruction was a narrow pelvis Two of the 33 cases in this latter group were precipitated by the administration of oxytocics

The symptoms varied Classical symptoms of an imminent uterine rupture were frequently absent At times signs of internal hemorrhage suddenly appeared It was a common feature for ruptures of scars to be preceded by pain in the region of the scar, perhaps even several weeks beforehand Nearly 80 per cent of all ruptures occurred within 1 week of term, and four-fifths of these should have been considered early in pregnancy as definite hospital deliveries

The prognosis seemed to depend primarily on the degree of shock, the severity of hemorrhage, the presence of infection and duration of the rupture before treatment was instituted. Of secondary importance was the general condition of the patient, mode of transportation of the patient to the hospital, and the skill of clinical care.

The author proposes certain principles of management after instituting therapy for hemorrhage and/or shock, definite treatment should preferably consist of wound toilet, and then, if circumstances permit, suture of the rupture, otherwise supravaginal hysterectomy rather than complete hysterectomy should be done. Packing is ill-advised. In patients with persistent hemorrhage the uterine cavity should be emptied either vaginally or by the abdominal route. An empty, retracting uterus is the best security for the control of hemorrhage. It is significant that the mortality among women attended by general practitioners was 77.3 per cent, among those under the supervision of specialists the mortality was only 24.3 per cent.

WARREN R. LANG, M.D.

### MISCELLANEOUS

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Mutti also found an increase in the average weight of the newly born offspring of women who were in

tients with arterial disease, 100 per cent of those with surgical hypertension, and 73 per cent of those with vascular sclerosis

It was not possible to decide from the material studied what produced the hyperfunction of the suprarenal gland in the cases of permanent arterial hypertension, nor was it possible to determine what caused the disappearance of the glomerulosa, and the hypertrophy of the spongiosocyte layer with pigmentary changes in the reticular layer and medulla. This study suggested to the authors the advisability of suprarenalectomy for the treatment of certain hypertensive patients and of certain vascular syndromes

In résumé, the authors studied the histological lesions found in 32 cases in which the suprarenal glands were surgically removed for permanent arterial hypertension. In this group of cases they noted the disappearance of the glomerular zone, hyperplasia of the spongiosa and an increase in the number of islets of lymphocytes. They concluded that these histopathological changes had distinctive characteristics not found in any other disease entity

CONRAD A. KUEHN, M.D.

#### Instrumental Visualization of the Renal Pelvis

HARRY R. TRATTNER, *J. Urol.*, Balt., 1948, 60, 817

Renal exploration for lesions which cannot be accurately identified by pyelography leaves much to be desired. If the lesion is not apparent in the exposed cortex of the kidney, intrarenal exploration by means of various types of incisions often fails to reveal a "hidden lesion," causes considerable renal damage, and presents problems in hemostasis.

To overcome this shortcoming in renal examination, the author presented a "nephroscope" (a modified cystoscope) by means of which the interior of the renal pelvis and calices may be visualized when the kidney is exposed surgically. The nephroscope is composed of a 24 F straight sheath equipped with 3 telescopes, namely, right angle, fore-oblique, and forward. Grasping forceps can be used with any of the telescopes. A "renal pelvis valve adaptor" is devised to be secured in the incision by a purse-string suture, through this adaptor the sheath of the instrument can be introduced. This device is for the purpose of reducing trauma to the renal pelvis.

The author calls attention to the fact that the kidney must be well exposed (by means of rib resection when necessary), and that the renal pedicle must be of sufficient length and elasticity to allow sufficient mobilization of the kidney for examination. Various types of renal pelvis and calices were discussed from the standpoint of the facility with which examination might be carried out by means of the nephroscope. The author presented drawings to illustrate the various appearances of infundibula, minor calices and pyramids. It is possible by use of this instrument to visualize epithelial tumors, stones, and other pathologic conditions which might otherwise be missed. It is obviously impossible, however, to

visualize all of the ramifications of the calices, except in a minority of cases.

Among the contraindications for the use of this instrument which the author mentioned are (1) conditions which do not permit sufficient mobilization of the kidney with safety, (2) inaccessibility of the renal pelvis because of its type or pathologic involvement, (3) conditions in which it is thought that introduction, injection, or aspiration of fluid into and from the renal pelvis is likely to result in extension or dissemination of an infective process, as in the majority of acute inflammatory conditions and in known cases of renal tuberculosis.

JOHN L. EMMETT, M.D.

#### Perirenal Abscess OLA OBRANT *Acta chir. scand.*, 1949, 97, 338

In order to establish the results of incision and drainage of perirenal abscesses, investigate the sequelae of the disease, and consider possible alterations in treatment, the author undertook a study of 32 cases of perirenal abscesses in patients previously operated upon during the period between 1920 and 1945. The 32 cases were divided into two groups. The first group comprised 18 cases in which perirenal abscess was secondary to staphylococcal infection of the kidney parenchyma (pyonephritis), and the second group comprised 14 cases in which the etiology was pyelonephritis (infection in the renal pelvis and parenchyma).

In evaluating the statistical data, it was noted that abscesses occurred somewhat more frequently on the right side than on the left. Etiologically, staphylococci were the only organisms isolated in the first group, while various strains were found in the second group. The abscesses were located most commonly inferior to the kidney. None were reported medial to the kidney.

Pain in the renal area, lumbar region, and abdomen was common, however, pain in the legs, joints, and buttocks occurred also in some patients. Anterior abscesses often simulate appendicitis and cholecystitis. Urinary symptoms occurred in 1 patient in Group 1, and in 3 patients in Group 2, with pyuria in the latter group but only bacteria in the former. Leucocytosis was variable, with normal counts occasionally encountered. Fever and an elevated sedimentation rate were rather constant findings. Palpable resistance in the loin was a frequent important finding, but only occasionally was it associated with fluctuation in either group. Roentgenological examination is of paramount importance in the diagnosis. Roentgenograms frequently showed obliteration of the psoas shadow, kidney shadow, a visible mass in the loin, fixation of the kidney on respiration, and calculi, which occurred in 6 cases.

Treatment consisted primarily of incision and drainage. Only 2 patients received chemotherapeutic agents, while none received antibiotics. Of the original number of 32 patients, 18 are living and adequate follow-up examinations were made on 16. The renal shadow on the diseased side was visible in all but 2 patients. In 6 patients in Group 1, relative

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fixation of the earlier diseased kidney was noted, in Group 2, only one patient revealed this finding, and in 6 cases the findings were relatively normal. Blood pressure findings were inconsequential.

Of the 18 patients in the first group, 14 are living and well, death of 2 patients was due to disease unrelated to the perirenal abscess. In Group 2, only 4 patients are living, and 2 of these have fistulas. Six patients in Group 2 died as a direct result of perirenal abscess and 4 died as a result of the operation.

The author states that generally it is not satisfactory to treat perirenal abscesses (pyelonephritis) by incision and drainage. In nearly all cases there has been some serious disease in the kidney or urinary system, such as concretions, pyonephrosis, infected hydronephrosis, etc. Treatment must be directed against the associated disease as well as the perirenal abscess.

PETER L. SCARDINO, M.D.

### Treatment of Papillary Tumors of Ureter

VINCENT J. O'CONNOR, *J Urol*, Balt., 1949, 61: 488

The author believes that the prognosis in papillary tumors of the renal pelvis and ureter has been spectacularly improved by earlier diagnosis and application of complete nephroureterectomy. This contrasts with the prognosis for cortical renal tumors in which modern surgery has made little progress toward the prolongation of life.

There is at present a lack of definite knowledge as to the etiology of papillary carcinoma of the renal pelvis and ureter, aside from the fact that these lesions are often associated with the presence of stones and chronic infection. There is a generally accepted idea that there must be some irritant to the urinary epithelium by a carcinogenic agent of local origin or one which has been carried to this epithelium by the blood or lymph. Fagerstrom considers epithelial crypts and buds to be bizarre expressions of epithelial hyperplasia and he does not support the theory of cell rests as proposed by Von Brunn. He was unable to develop any evidence that solid epithelial buds are directly associated with the origin of solid tumors of the urinary epithelium.

The author deems it unwise to regard any tumor of the renal pelvis or ureter as being anything but potentially malignant. Incomplete measures such as local excision or destruction are not to be condoned except in unusual circumstances, such as absence or inadequacy of the other kidney. The treatment of choice in dealing with these primary tumors is complete nephroureterectomy with removal of a cuff of the bladder. Incomplete ureterectomy is often followed by recurrence or subsequent tumor development in the ureteral stump, the intramural portion of the ureter, or in the bladder mucosa. These secondary tumors are usually more extensive and less amenable to destruction than the primary tumor.

In support of these conclusions a series of 482 nephrectomies was reviewed. Seventy operations were done for renal or ureteral tumor. There were

14 (2 squamous, 12 papillary) primary renal tumors with secondary implants in the ureter and bladder. Complete procedures were done in 9. In 6 of these the patients are alive for periods ranging from 4 to 22 years. Two cases with incomplete nephrectomy were followed to ultimate death within 8 years and the other within 12 years. Several other cases in which an incomplete nephrectomy was done, including a case in which intramural portion of the ureter was treated by electrocoagulation from without, are listed as showing metastasis in the bladder and pelvis. Of 6 patients operated on elsewhere for papillary tumors of the renal pelvis, 4 died of the primary disease. There were 2 patients seen after being subjected to complete operations for tumors of the ureter, both of whom had recurrences in the stump of the ureter with small papillary tumors of the bladder.

ALLAN K. SWERSIE, M.D.

### Carcinoma of the Ureter

JOHN HERMAN LONG, *J Urol*, Balt., 1949, 61: 23

A case of primary carcinoma of the ureter is discussed, and a brief review of the literature is submitted, as well as an analysis of pertinent data relative to this entity. Primary ureteral neoplasm occurs either as an epidermoid or as a papillary carcinoma. The condition is observed twice as frequently in males as in females, and occurs in the sixth and seventh decades of life. The lesion occurs twice as often in the right ureter as in the left, and in the lower third of the ureter twice as frequently as in the upper two-thirds. Hematuria, pain, and an enlarged kidney occur secondary to obstruction by the tumor, ureteral tumor is palpable abdominally, rectally, or vaginally, and lymph nodes may be enlarged. Cystoscopic and roentgenological examinations aid in the diagnosis.

The treatment of choice is extraperitoneal nephroureterectomy with segmental resection of the bladder. Metastases are said to occur in 34 per cent of the reported cases, with spread to the retroperitoneal lymph nodes, liver, bones, and lungs. A mortality of 25 per cent is recorded, but no patient living more than 4 years after operation died of metastases. The author recommends periodic follow-up examinations at 3 month intervals during the first year, at 6 month intervals during the second, third, and fourth years, and yearly thereafter.

PETER L. SCARDINO, M.D.

### Transureteropyelostomy and Transureteroureterostomy

THOMAS D. MOORE, *J Urol*, Balt., 1948, 60: 859

In selected cases in which pathologic conditions affect the lower part of only one ureter, it may be desirable to preserve the kidney rather than to perform nephrectomy. Among the conservative operations which have been employed toward this end are reimplantation of the ureter into the bladder, implantation into the bowel, and anastomosis to the normal ureter of the opposite side.

The author reports 1 case of anastomosis of one ureter into the ureter on the opposite side, and 1 case of transureteropelvic anastomosis (anastomosis of a ureter to the pelvis of the opposite kidney) which to his knowledge is the first to be reported in the medical literature. The latter case was that of a woman 30 years of age, who had bilateral ectopic (pelvic) kidneys and backward flow of urine up the left ureter, this caused periodic pain, infection, chills, and fever. The left ureter was isolated, severed from the bladder, brought down through a tunnel under the posterior parietal peritoneum, and implanted into the right renal pelvis, with successful results.

Among the indications for these two types of operative procedure, the author lists unilateral ureteral reflux, surgical ureteral trauma, sloughing of the ureter subsequent to its extensive mobilization and interference with the blood supply, pathologic conditions, either neoplastic or inflammatory, which extensively involved the lower ureter, primary ureteral tumors, either benign or of low grade malignancy, and intractable ureteral strictures.

An account of the author's preliminary operations on animals to determine the feasibility of transplanting a ureter to the opposite renal pelvis is presented. The author calls attention to the fact that, as yet, the successful implantation of a ureter to the opposite renal pelvis of a normally situated kidney in a human being has not been reported. Such a procedure has been performed on cadavers and he is confident that it can be done successfully.

JOHN L. EMMETT, M D

### BLADDER, URETHRA, AND PENIS

**Cystectomy in the Male. The Significance of the Combined Prostatoseminal Vesiculocystectomy with Special Reference to the Sexual Function.** RAGNAR ROMANUS. *Acta chir scand*, 1949, 97: 389.

The author comments on the various reports which have been made in the literature concerning the operation of cystectomy. He has found (with but one exception) that publications say nothing concerning the sexual function in men after cystectomy.

The author's material consists of 49 cystectomies performed on male patients during the years 1940 through 1947. This operation was performed on 8 patients with extensive papillomatosis of the bladder, 3 patients with severe chronic cystitis with contracted bladder, and 38 patients with vesical cancer and malignant papilloma. Among these 49 patients the prostate was extirpated in 29 cases, and in 28 of these the seminal vesicles were also removed. In 4 of the 20 other cases the prostate was cut approximately in the middle, while in 16 cases it was left largely intact, in 5 of the 16 it was left untouched, and in the remaining 11 cases the division was made through the upper part of the prostate, or the first part of the urethra was cauterized.

During the first years of the period covered by this report, the prostate and the seminal vesicles

were routinely left intact in cystectomy. They were removed only if pronounced adhesions were found with fixation of the bladder to the vesicles, and an extravescical extension was suspected. As a rule, the prostate was removed in cases of tumor in the neck of the bladder with extension to the prostate, and in cases in which changes giving rise to the suspicion of malignancy were observed in the prostate before or during the operation. Of late years, the indications for removal have not been so strictly limited and often are taken out chiefly for technical reasons.

An analysis of the radicality of the operations performed revealed that one argument for removal of the prostate and vesicles was the finding in 6 cases of cancer of the prostate, some of which were unsuspected.

A number of complications have occurred in more or less definite relation to the type of operation performed. There is a tendency for the clamp to slip, owing to division through the prostate instead of distal to the apex.

On 2 occasions fistulas or cavities have arisen which were possibly connected with necrosis of remaining prostatic tissue.

It was the author's impression that urethral drainage was of value in the prevention of retropublic cavities. Epididymitis was found in 3 cases. In 1 instance rectal injury was occasioned when dividing the membranous part of the urethra with diathermy.

Data concerning the sexual function before and after extirpation of the bladder was obtained from 21 patients, comprising 10 in whom the prostate and the seminal vesicles were left, 4 in whom the seminal vesicles were left while the prostate was partially removed, and 7 in whom the prostate and the seminal vesicles were completely removed. In the 10 who had intact prostate and seminal vesicles, 7 enjoyed unchanged sexual function after the operation. There was, however, a temporary impairment in at least 2 cases. In the remaining 3 patients the function has been impaired in 2, in direct relation to the operation and in one secondarily through a subsequently occurring prostatovesiculitis about 5 years postoperatively. In 4 patients the prostate was partially removed, the vesicles being left intact, 2 of these had unchanged sexual functions after the operation but the amount of semen was small.

The last group comprises 7 patients in whom both the seminal vesicles and the prostate were removed. Two of these had unchanged or only slightly impaired sexual function after the operation (apart from the fact that there has been no ejaculation), 1 patient had at first a normal erection but soon died of another disease, 3 patients had inhibited functions after the operation which, in at least 2 cases, may be ascribed to the primary disease and its complications without direct relation to the type of surgery, 1 patient had for a period following the operation a normal libido but was impotent, presumably a consequence of the operation.

In view of these findings the author believes that the disturbances of sexual function which have been

described in connection with operations on the prostate and seminal vesicles must not be ascribed solely to the removal of these organs. Similar changes appear after abdominoperineal extirpation of the rectum and after operations upon the sympathetic nervous systems. These disturbances should therefore more probably be ascribed to nerve injuries sustained in connection with the operation than to the loss of the organs themselves. In an uncomplicated abdominal cystectomy, with removal of the prostate and the seminal vesicles, the dissection of the organs is chiefly made bluntly in the prevesical space and its continuation. Thus, the main nerve plexuses are left undamaged.

On the basis of the present material it is not possible to judge whether the risk of sexual disturbance after cystectomy is greater in connection with removal of the prostate and the vesicles than it is if these organs are left intact. The material is not extensive enough, and it has been selected on the principle that chiefly the most severe cases have been subjected to prostatovesiculectomy and, as a whole, those subjected to this procedure have had a comparatively poor general condition and impaired renal function.

The author's experiences with these 21 patients show that despite the removal of both the prostate and the seminal vesicles, the sexual potential may be normal, i.e., the erection normal, the course of the coitus normal, ending in a normal orgasm but of course without ejaculation. As secondary complications may arise from apparently normal seminal vesicles and prostate left behind at operation, these organs should, on principle, be removed in all cases of malignant vesical tumor, and only in cases of clearly benign changes in patients for whom it is particularly desirable to retain fertility should the preservation of the prostate and the seminal vesicles be considered.

ROBERT O. BEADLES, M.D.

#### Artificial Urinary Bladder SEYMOUR W. RUBIN *J. Urol.*, Balt., 1948, 60: 874

In this article (awarded first prize by the Committee on Scientific Research of the American Urological Association), the author stated that the important problem to be solved in cases of total cystectomy is not the removal of the bladder, but rather the successful disposition of the ureters. A complete review of the literature concerning uretero-intestinal anastomosis and experimental attempts to form an artificial urinary bladder is given. A complete bibliography is appended.

Because of the frequency of ascending renal infection and ureteral obstruction after transplantation of ureters to the bowel, the author has sought another method for disposing of the ureters when cystectomy is necessary. He presented a review of his work on dogs, in the formation of an artificial bladder from an isolated portion of the sigmoid colon. The operative technique is presented in detail. Briefly, it consists of isolating a 6 to 10 cm. loop of sigmoid and re-establishing the continuity of the

bowel by end-to-end anastomosis. The isolated loop of sigmoid, with its intact musculature, is displaced to the right and its proximal end is closed with sutures. The ureters next are severed from the bladder and anastomosed to the sigmoid loop over ureteral catheters. The bladder is then removed, and the distal end of the isolated loop is anastomosed to the proximal end of the severed urethra.

The operation was successfully performed in 7 of 11 dogs. The dogs were continent, and habits of micturition were almost normal.

The important observation was that postoperative studies did not reveal evidence of pyelocaliectasis or ascending renal infection. The length of postoperative observation varied from a few weeks to 7½ months. At the time of the report there had been some infection in the artificial bladder, but it had been easily controlled with urinary antiseptics. The author stated that there is no reason why this procedure should not be tried on human beings.

JOHN L. EMMETT, M.D.

#### MISCELLANEOUS

##### Barge-Bourgain's Reaction in Genitourinary Tuberculosis O. SIEVERS and TH. BERGLIN *Acta chir. scand.*, 1949, 97: 283

In 1946 Pirot, Barge, and Bourgain reported on the results of a reaction previously found by Barge and Bourgain with sera from patients suffering from tuberculosis. This reaction is produced by the injection of fresh active patient serum around the lymphatic glands of guinea pigs infected with tuberculosis. Barge and Bourgain consider the formation of a rash in the lymphatic region 8 to 12 hours after the injection to be a positive reaction. The intensity of the reaction is indicated as from 1 to 4 plus.

The original investigators contend that the reaction is positive in patients suffering from tuberculous infections, and they believe the reaction to be of direct diagnostic significance in tuberculous epididymitis, adenitis, and abscesses.

As an explanation of the reaction, Barge and Bourgain assume the escape of various products or toxins from the tuberculous process into the blood stream. They assert that the reaction these products are capable of bringing about in guinea pigs is not identical with the tuberculin reaction, inasmuch as the Barge-Bourgain reaction may sometimes be positive and may at other times be negative in one and the same patient, depending upon the stage of the tuberculous process. If the process is in the healing stage or so encapsulated as to inhibit the escape of such products into the blood stream, the reaction would be negative, or if the tuberculous process is giving off the products in question which are then liable to enter the circulatory system, a positive reaction would be expected. If the reaction is positive, the authors consider the disease to be in a labile stage and they believe that a tuberculous patient ought not to be operated on as long as the Barge-Bourgain reaction is 2 plus or stronger. This con-



clusion is made concerning, above all, genitourinary tuberculosis

The authors examined the sera of 19 different patients with pulmonary tuberculosis, all of whom had been hospitalized on the preceding day on account of deterioration in their tuberculous condition. Sera from 9 of these patients gave a Barge-Bourgain reaction of 3 plus, 4 others gave a plus reaction, 3 were negative, and in 3 cases the control-examined animal exhibited local reddening, for which reason the reaction could not be evaluated. The negative cases were patients with recently diagnosed tuberculosis with short histories.

The authors carried out a number of experiments to try to determine the specificity of the reaction, and his examinations show that it is possible, with the use of material containing the decomposed substances of tuberculosis bacteria, to obtain a reaction similar to that shown by Barge and Bourgain in guinea pigs infected with tuberculosis and injected with serum from tuberculous patients. In these experiments the authors used substrates on which tuberculosis cultures had been grown and tuberculosis cultures which had been carefully pounded. Living tuberculosis cultures suspended in physiological salt solution will not produce such a reaction in the animal. No evidence was produced to show that it was the same substance that appears in the serum of some patients when the guinea pig tests are positive, in Barge and Bourgain's conception of the term. It could, however, be stated that the reactions in both cases exhibit similar pictures and that it is not incredible that the two substances are identical. If such is the case, this must be accepted as a sign that Barge and Bourgain's reaction really is a specific reaction.

#### CLINICAL EXPERIENCE WITH BARGE-BOURGAIN'S REACTION

Berglin examined material consisting of 111 cases, among which there were 17 cases of nontuberculous disease of the urogenital system and 25 cases of other nontuberculous diseases, the remainder were tuberculous.

Of 60 patients with clearly diagnosed tuberculous diseases, a negative test was observed in 23 cases, or 38 per cent. Of the 41 patients who primarily reacted positively, 34 were clearly tuberculous from the beginning or were later found to be so. Six cases, 5 of which were epididymitis and 1 aseptic pyuria, had been strongly suspected of tuberculosis clinically. In only 1 of the 41 cases with a positive Barge-Bourgain reaction was tuberculosis really doubtful. This case was one of the very first, and had been recorded as weakly positive, so it is possible that the reaction may not have been positive. The Barge-Bourgain reaction in all of the 17 controls, consisting of nontuberculous cases of urinary tract infection, were negative. Likewise, the 23 judgeable

controls consisting of nonurogenital cases were clearly negative.

On the basis of these findings the author considers that the examinations argue for Barge-Bourgain's contention that the reaction is specific from a diagnostic point of view. It must be pointed out, however, that only a positive reaction is of diagnostic value.

The reaction was of special value in the early diagnosis of obscure cases of tuberculosis of the urinary tract. In a number of cases of renal tuberculosis the reaction was immediately suggestive of a specific diagnosis which could not be confirmed by the bacterial examination until much later.

The possible value of the test in determination of the developmental phase and possible activity of tuberculous infection was indicated in the study when 14 of 15 cases of primary (positive) urogenital disease showed signs of activity or revealed activity in the later course of the disease.

The 13 cases of pulmonary tuberculosis with positive reaction were all in a clinically active stage. The 2 cases located elsewhere were both in an active stage. Thus, of 30 primarily positive cases there was but one case that did not show any signs of activity. These findings warrant the following conclusions.

If the Barge-Bourgain reaction is positive, a tuberculous process in the active state is strongly indicated.

The value of the reaction as an indicator of the activity of a tuberculous infection was conspicuous in those cases in which a positive Barge-Bourgain reaction was not accompanied by clinical signs of activity, but in which the later course of the disease revealed a distinct activity of the process.

In contradistinction, a negative reaction does not exclude the existence of an active tuberculous process.

As an indicator of the activity, the Barge-Bourgain reaction is expected to be of greatest importance from a surgical point of view. By operating during the most favorable phase of the disease a direct spread of the process may be avoided. In the author's experience, and that of others, the patient should not be operated on as long as the reaction is positive. Follow-up examinations of these cases revealed that the reaction became negative much more rapidly on patients who were hospitalized than on those who had been released with a positive reaction. The authors believe that patients in whom the reaction is positive and in whom the disease is, in all probability, in the active stage, should be considered acutely ill and therefore confined to bed.

The authors' findings corroborate those of previous workers and furnish some valuable clinical information on a reaction which will, in all probability, be of great significance in the diagnosis as well as in the treatment of tuberculosis.

ROBERT O. BEADLES, M.D.

# SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

## CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC

**Paralytic Equinovarus Deformities of the Foot** J  
LEONARD GOLDNER and C E IRWIN *South M J*,  
1949, 42 83

The authors herein discuss two types of feet, both of which are classed as paralytic equinovarus deformities (1) equinovarus foot with contracted Achilles tendon, cavus, contracted plantar fascia, depressed first metatarsal head, and claw toes, and (2) the rigid recurrent equinovarus foot

Abnormal physiology and etiology are discussed in an orderly and lucid manner. Some of the points made are that muscle imbalance predisposes to fixed deformity. Contracture of the plantar fascia ensues. Relaxed subastragal and midtarsal joints magnify the deformity. Abnormal distribution of body weight increases the varus once it is present.

A standard method of recording the functional strength of muscles is described. This together with analysis of bone age and architecture of the foot is a prerequisite to treatment.

Nonsurgical measures are outlined for children under 9 years of age, who are still in the period when muscle strength is returning or who are too young for surgery. Lengthening of the Achilles tendon may be required occasionally. Tendon transplants alone, without stabilization, are usually not indicated. The importance of the posterior tibial muscle has frequently been overlooked.

Operative treatment of patients more than 9 years of age is designed to (1) stabilize and align the foot, (2) remove deforming factors, (3) eliminate joint pains, calluses, and limp, (4) obviate leg braces, and (5) restore normalcy in appearance.

Surgical procedures for adults include

- 1 Plantar fasciotomy
- 2 Triple arthrodesis (after the method of Hoke, in such a way that the dorsum of the foot is shortened in ratio to the strength of the extensor muscles, the plantar surface is elongated, and the varus of the forefoot and heel is corrected)
- 3 Wedging of the forefoot upward after from 7 to 10 days
- 4 Tendon surgery 4 weeks after stabilization
- 5 Correction of external torsion of the tibia by a high greenstick rotation osteotomy at the same time the tendon work is done

In the case of the rigid recurrent equinovarus, the surgery is as indicated for relapsed clubfoot.

Charts showing combinations and procedures applicable in performing tendon transplants after arthrodesis are submitted in concluding this article. The drawing and the photographs are excellent and further serve to illustrate the well written text.

KENNETH E SHERMAN, M D

## SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC

**Surgical Treatment of Osteoarticular Tuberculosis**  
(Tratamiento quirúrgico de la tuberculosis osteoarticular) ALBERTO INCLÁN, JR. *Cir ortop traumat*, Habana, 1948, 14 75

Forty-three cases of bone or joint tuberculosis treated surgically are reviewed by the author. Among the recent additions to the surgical armamentarium in the treatment of this disease the author mentions the following: the use of the Haynes splint for immobilization of the knee joint following arthrodesis, the use of streptomycin after excision of the diseased tissue in 3 cases of tenosynovitis, and the employment of the Brittain technique for extra-articular arthrodesis of the hip and shoulder.

Articular resection is employed now only in exceptional cases, such as tuberculosis of the elbow in adults, certain lesions of the wrist, and certain types of hip disease.

The introduction of antibiotics which are able to control secondary infections has limited the indications for amputation greatly. As a rule, arthrodesis constitutes the method of choice in the treatment of osteoarticular tuberculosis. The effect of this operation may be compared with that of thoracoplasty in the treatment of pulmonary tuberculosis, i.e., it provides immobilization of the involved region.

Extra-articular arthrodesis is preferable to the intra-articular type in the treatment of articular tuberculosis because it avoids entering the articular capsule and reactivating or disseminating the specific infection.

Tuberculous abscesses should be treated by repeated aspiration and not by incision and drainage. Only Pott's abscess, which produces compression of the spinal cord, may require drainage. Another exception is the retropharyngeal abscess which should be drained if it causes dyspnea or dysphagia.

Of 205 cases of osteoarticular tuberculosis, 43 have been treated surgically, among them being 15 cases of Pott's disease and 17 cases of disease of the hip.

JOSEPH K. NARAT, M D

**Delayed Autogenous Bone Graft in the Treatment of Congenital Pseudarthrosis** JOHN ROYAL MOORE *J Bone Surg*, 1949, 31-A 23

A discussion of the theories of the etiology of congenital pseudarthrosis and of various methods of treatment is presented. The histopathological characteristics of the lesion have been generally accepted as conforming to those of acquired pseudarthrosis. Inert, sclerosed, pointed, atrophic bone ends surrounded by a sleeve of dense connective tissue and developing ultimately the characteristics of a nearthrosis including the cartilage and joint cavity are the principal findings in the mobile type. The author



theorizes that the end product of osteogenesis (laminated bone) in the pseudarthrosis area is defective in quality, in that it is not only incapable of withstanding the physiological stresses, but is equally incapable of repair

He classifies the lesion into two principal types (1) prepseudarthrosis, the stage in which the long bone is bowed or bowing, the apex of the bow is narrow, the medullary cavity becomes obliterated, and spontaneous or induced fracture occurs, followed by pseudarthrosis, and (2) pseudarthrosis, which may be fibrous to frank nearthrosis

With this hypothesis the delayed autogenous bone graft is presented, it is an excellent means of producing osteogenesis. The delayed graft is one which is completely freed of all attachments at the donor site of the tibia, fibula, or ilium. It is replaced in the original site and the wound closed. In from 18 to 21 days it is carefully removed with its new-bone components and implanted in the fragments comprising the pseudarthrosis

Careful attention is paid at operation to removal of the pseudarthrosis and preparation of the bed for the graft. For immobilization during operation in tibial sites the author uses the Abbott bone-lengthening apparatus with four steel wires in the tibia and an intramedullary wire in the fibula. The tibial fragments are split to the nearest wire and the tibial bone graft is wedged in. He also recommends grafting the fibula at the same time. He approaches both bones through the anterior compartment through one incision. The wound is closed in layers. Routine light dressings are covered by a plaster cylinder (including pins) which extends from the toes to the groin. In cases in which lengthening is required, the delayed graft must not be started until the lengthening is completed and the operative wound has healed. For a pseudarthrosis of the ulna, femur, or clavicle, delayed onlay grafts are used with secure internal fixation as well as external immobilization.

The pins and plaster are maintained until the medullary cavity appears in the graft, which requires an average of 4 to 6 months. Then, in the case of the tibia, a double-bar caliper brace, extending from the ankle to the groin, is applied. This brace has a pelvic band and a full length tibial leather cuff. This is worn for 2 years. Roentgenograms are taken bi-monthly during this period.

Successful osteosynthesis has been accomplished in 8 cases of congenital pseudarthrosis. In 6 cases the deformity was in the leg, and in one case each, in the ulna and femur. In 2 cases, three delayed grafts were required, and in 1 case an additional bone graft was required for reinforcement to prevent possible fracture. In 2 cases spontaneous fracture occurred, and traumatic fracture occurred once in each of 3 cases, which necessitated the extra grafting mentioned previously.

Illustrative roentgenographic reproductions accompany the text. Photomicrographs of immediate and delayed bone graft histology, as well as that of pseudarthroses are shown.

The author concludes that the delayed autogenous bone graft is capable of stimulating osteogenesis. The extra supply of alkaline phosphatase and the attached newly formed bone may contribute to osteogenesis. Bony union has occurred in each instance. The principal problem is one of meticulously nurturing the young bone until it can withstand the physiological forces and, later, the functional demand. Reinforcement of the newly formed tibia at its weak point, as evidenced by narrowing or incipient bowing, is imperative. Continuation of primary immobilization until the medullary cavity is formed is emphasized.

KENATH H. SPONSEL, M D

**Transfer of a Metacarpal** G L HYROOP *Plast Reconstr Surg*, 1949, 4 45

The first transfer of a metacarpal with the attached digit was reported by Bunnell in 1931. This was a transfer of a second metacarpal with partial amputation of the index finger.

The aim in any type of reconstructive surgery is to restore or to improve function, sensation and cosmetic appearance. Loss of the thumb, for example, with the first metacarpal, produces a serious disability of the hand.

Under special circumstances it may be well to repair the skin, nerves, bones, and tendons before the metacarpal is transplanted to determine the sensation and the amount of function that is to be expected in the digit. If a tendon pulley is required the deficiency should be corrected before transfer of the digit is undertaken. Adductor contractures between the thumb and index fingers and other scarring may have to be repaired. Exposed bone and soft tissues must be covered. Surgery may not be performed for from 6 months to a year following the healing of osteomyelitis. When there is amputation of the thumb, or of the long or ring fingers because of tumor, transfer may be carried out immediately or later, in accordance with the type of lesion present.

A brief discussion of operative technique is included. Indications for the operation with reference to the thumb and also the other fingers are given. Illustrative drawings, photographs of roentgenograms of the hands as well as illustrations of the hands are shown. The article is based upon the author's experience with 34 cases. The advantages of metacarpal transfer are that recovery following surgery is quite rapid, and that the nerve and vascular supply are retained. KENNETH SHERMAN, M D

**Results of Intertrochanteric Osteotomy in Pseudarthrosis of the Femoral Neck** (Risultati di osteomie intertrocanteriche per pseudoartrosi del collo femorale) G DE LUCCHI and A NURRA. *Chir org movim*, 1948, 32 421

The authors report on 42 cases treated by intertrochanteric osteotomy at the Istituto Rizzoli of Bologna, Italy, from January 1, 1940 to December 31, 1945. This was performed for nonunion of fractures of the femoral neck.

A stable hip, with some shortening (not exceeding 4 cm), some limitation of hip motion, with no pain and a perceptible limp is considered a good result.

The authors quote Putti as saying that it is impossible to expect a perfectly functioning articulation following this procedure. They stress that it is important that the thrust force be exerted directly under the head in weight bearing. This frequently results in a solid bony union between the head, the intertrochanteric osteotomy area, and the greater trochanter. In the authors' experience, a not uncommon cause of failure in this procedure has been the inaccurate placing of the femoral shaft under the head.

Immobilization of the osteotomy site for from 5 to 6 months is recommended. A long leg abduction cast is replaced by a short leg abduction cast at the end of 10 or 12 weeks.

In the 42 cases reported the results are evaluated as good (21) fair (7), and bad (8). The remaining 6 cases did not have adequate follow-up.

The Pauwel classification of hip fractures is discussed.

CARLO SCUDERI, M D

#### Arthroplasty of the Knee Joint J EDUARD SAMSON *J Bone Surg*, 1949, 31-B 50

The author bases his findings on 72 patients who were operated on between 1924 and 1941. In 4 of these patients an arthroplasty was performed in both knees. The femoral and tibial condyles were removed freely. A central ridge was left on the tibial plateau to correspond with the intercondylar notch of the femur. A free fascial flap measuring 15 by 10 cm was used to cover the bony surfaces.

Early motion was encouraged. The author infiltrated the knee joint with novocain to enable his patients to move the knee freely. Bilateral arthroplasty of the knee was discarded because it was found that the development of a second knee arthritis was usually beyond the capacity of the patient. The lower age limit was set at 20 years. In 52 per cent of the author's patients a stable and painless joint was obtained. Poor results were found in 48 per cent.

GEORGE I. REISS, M D

#### Arthroplasty of the Knee J S SPEED and PHILIP C TROUT *J Bone Surg*, 1949, 31-B 53

The residual effects of acute infective arthritis of hematogenous origin, of suppurative arthritis of external origin, and the results of incomplete painful ankylosis or complete ankylosis of the knee joint were found to be the only indication for arthroplasty. Multiple rheumatoid arthritis, tuberculosis, osteomyelitis, obesity and osteoporosis were considered as contraindications for arthroplasty of the knee joint.

The operation consisted of building a simple type of hinge joint. The extensor apparatus was not disturbed. A sufficient amount of bone was removed from the posterior femoral condyles to allow the tibia to slide into the popliteal space. If only one-half of the knee joint was ankylosed no arthroplasty was performed because it failed in all instances. It

was found that fascial covering of the condyle was not necessary but that it helped until fibrocartilage was formed. The cruciate ligaments had to be sacrificed.

The most sufficient range of motion was between 180 and 110 degrees. Motion beyond the 90 degree angle may produce instability. Pain was observed in a few patients. The author stated that in 45 per cent of the cases the results were classified as good and in 20 per cent they were failures.

Watson Jones opposed arthroplasty of the knee because he felt that the patient could not depend upon his knee. He stated that an arthrodesis was not too great a handicap and that arthroplasty was indicated only if there was ankylosis of both knees or of the hip and knee of the same side. Freiberg presented a patient operated on in 1935 who had a very good result. Cleveland pointed out that the author reported only one-third of all the knee joints operated on and discarded two-thirds because of various reasons. Less than 50 per cent of the patients were classified as having a good result. He pointed out that this left a very small number of good results and advocated extreme caution in the selection of cases for arthroplasty.

GEORGE I. REISS, M D

#### On Arthrodesis of the Ankle Joint in Posttraumatic Conditions A KARLÉN *Acta orthop scand*, 1948, 18 175

The author reports the results of 24 cases of tibio-tarsal arthrodesis for post-traumatic conditions. Bony ankylosis was obtained in all cases. Twenty-one patients are fully able to work, 2 are doing light work, and 1 is still under treatment (supplementary subastragalar arthrodesis). Three patients have secondary osteoarthritis of the neighboring joints.

These procedures were performed during the period from 1936 to 1946 at the Orthopedic Clinic of the Karolinska Institute in Stockholm. The majority of operations were performed for fractures of both malleoli or for trimalleolar fractures. Exclusive intra-articular arthrodesis has been practiced as the earliest operative procedure. Gradually, insertion of one, and later of two transarticular bone grafts completed the surgical interference.

When all reported cases are considered, the argument that ankylosis of the talocrural joint is difficult to obtain seems to be refuted by the average duration of the ankylosing phase, amounting to 31 months. Fusion occurred most readily after intra-articular arthrodesis combined with fixation of two grafts across the articulation.

Immobilization of the ankle joint imposes increased strain, particularly on Chopart's joint. Evidence of this condition is given by an increased range of movement (to 30 degrees) that subsequently appears in that joint. Also the subtalar joints may be considered as being exposed to increased, abnormal strain which is due either to a decreased rate of pronation and supination, or, at least, to a certain elasticity in the ankle joint. Secondary

arthrosis deformans involving the exposed joints may be expected and referable to these increased strains

In order to avoid such discomfort the author advocated a panastragalar arthrodesis and this procedure was carried out in 10 cases. No pain arose from the midfoot postoperatively in 8 of these cases. Hallgrimson has reported on 15 cases of poliomyelitis which were followed up after panastragalar arthrodesis. In 6 of them, there was a more or less increased range of movement in Lisfranc's joint, this movement, however, never exceeded 20 degrees. Two patients complained of subsequent slight pain.

Nevertheless, the author did not think that panastragalar arthrodesis should become a generally used procedure in preference to talocrural fusion because of the greater duration of the operative procedure in the injuries sustained by the soft tissues, necrosis of the skin, etc. Tibiotarsal arthrodesis combined initially with subastragalar (tri-articular) arthrodesis is confined to cases which have already (before operation) developed osteoarthritis in the subastragalar and midtarsal joints.

C. FRED GOERINGER, M.D.

## FRACTURES AND DISLOCATIONS

**Avascular Necrosis of Large Segmental Fracture Fragments of the Long Bones** EDWARD L. COMPERE. *J. Bone Surg.*, 1949, 31-A 47

Five cases are presented in detail in which there was avascular necrosis of large segmental fracture fragments of the long bones. In these cases it may be predicted that there will be a marked delay in union of the large segmental fracture of the midshaft or ends of a major long bone. The larger the fragment, the poorer the prognosis, from the standpoint of viability of that fragment. If most of the cells die in the fragment it will become necrotic, although massive sequestration does not occur. Union may be delayed for many months. With good fixation, healing of the fracture will take place. If the nutrient artery remains uninjured, aseptic necrosis may not occur.

RICHARD J. BENNETT, JR., M.D.

**Traumatic Posterior (Retroglenoid) Dislocation of the Humerus** JOHN C. WILSON and FRANCIS M. MCKEEVER. *J. Bone Surg.*, 1949, 31-A 160

Posterior dislocation of the humeral head is relatively uncommon, but it is also frequently unrecognized until weeks after its occurrence when treatment is difficult and the prognosis uncertain.

Eleven males, presenting a total of 12 posteriorly dislocated shoulders, were studied. Four dislocations, including the bilateral ones, resulted from epileptic convulsions, and the rest from violent external trauma.

Concomitant fracture of varying degrees occurred in 8 of the shoulders and contributed to failure of early diagnosis of the dislocation in more than half of the cases.

Review of the pathological findings in the patients operated upon shows that the type and extent of damage depends upon the degree of violence producing the original dislocation. Nerve damage is rarely encountered. Clinical recognition of the posterior dislocation is easy before swelling obliterates the landmarks and in old untreated cases. Adequate roentgenograms are imperative, especially lateral views, which can be interpreted without unusual difficulty.

In the first hours after injury, reduction is readily accomplished under anesthesia, but it is not easily maintained. The necessary position of marked internal rotation is most uncomfortable for a period of time. In 3 dislocations, the reduction was safely and comfortably held by fixing the head to the acromion process with cruciate wires. These may be inserted and then removed after 3 weeks without open operation. Only a sling is needed for support, and the early motion that is possible allows good recovery of function.

The results of late treatment are poor because of gross joint changes and fibrosis.

FRANCES E. BRENNKE, M.D.

**Indication for Operative Treatment of Fractures of the Proximal Portion of the Upper Arm** (Zur Indikation der operativen Behandlung von Frakturen im koerpernahen Abschnitt des Oberarmes) HERMANN KARCHER. *Chirurg*, 1948, 19 553

Conservative treatment of fractures of the proximal portion of the upper arm is advocated by the author because it furnishes good functional results. In dislocation fractures an operative treatment is indicated only if (in exceptional cases) conservative measures fail.

The author is not in favor of operative procedures because

1 There is no danger of pseudarthrosis in this region.

2 An open reduction inhibits callus formation, delays consolidation, and frequently irritates the articular capsule.

3 The open articular capsule is easily subject to infection and the proximity of the nail to the articulation frequently causes effusions.

4 The hospitalization period is not shortened but rather prolonged after an open reduction, furthermore, a readmission is necessary for removal of the nail.

5 Periodic examinations show that the results of open reduction are poorer than those of conservative treatment.

An impacted fracture of the surgical neck is immobilized in a sling or by a Desault dressing.

A thoracic abduction cast is applied in case of a nonimpacted fracture, with good apposition of the fragments.

Malposition of the fragments is corrected by closed reduction under local or general anesthesia. If the reduction is unsuccessful, a wire extension is applied.

The same method is employed in the treatment of subcapital fractures and dislocations

JOSEPH K. NARAT, M.D.

**Follow-Up Results of Surgical Treatment for Non-union of the Carpal Scaphoid Bone** Report of 19 Cases C. FRED GOERINGER, *Arch Surg*, 1949, 58: 291

Twenty operations were performed on 19 patients with nonunion of the carpal scaphoid. The bone graft was taken from the tibia. One case of nonunion persisted following the bone grafting.

In 8 of the 16 cases supplementary drilling was carried out, and it is believed that the follow-up indicates that this procedure would be of value in selected cases. A large chart is included giving voluminous details about each case. Six roentgenograms are included.

In 2 instances the proximal fragment was removed, and in 1 instance, the distal fragment. These patients are said to have pain and limitation of motion in the wrist postoperatively.

The author suggests that arthrodesis of the wrist is preferable to excision of one or more of the carpal bones.

RICHARD J. BENNETT, JR., M.D.

**Management of Intracapsular Hip Fractures** ROBERT T. McELVENNY *Surg Clin N America*, 1949, 29: 31

The author states that an intracapsular fracture of a femoral neck in an elderly patient is no surgical emergency but may well be a medical emergency. The patient is put to bed with boards under the mattress and 5 pounds of Russell traction. Proper padding is placed beneath the buttocks and above the rubber sheet. The patient is encouraged to use the hand attachments of the overhead frame, and to sit up and move about. He is turned from side to side frequently. Small doses of morphine, codeine, and aspirin may be prescribed. A complete medical survey is made, and surgery is postponed until medical balance is obtained, which averages from 7 to 10 days. The patient is typed for transfusion. Postoperatively the patient is again placed in moderate traction and only one hypodermic of  $\frac{1}{12}$  grain of morphine is given. Thereafter codeine by hypodermic injection or codeine and aspirin are given orally for pain. Penicillin is given routinely. Deep breathing exercises are given, but the patient is not out of bed for from 10 to 21 days. Meanwhile exercises of the extremities are encouraged. The patient is then placed in a wheel chair, and later is taught to use crutches, but weight-bearing is not permitted until 4 to 6 months postoperatively.

The operative procedure as described by the author takes from 1 to 2 hours. He prefers anesthesia by pentothal induction followed by the inhalation of 50 per cent nitrous oxide and 50 per cent oxygen, sometimes supplemented by small additional injections of pentothal. After anesthesia the patient is placed upon the cassette holder with a narrow perineal post. Traction is applied to both extremities.

The reduction is accomplished and checked with anteroposterior and lateral views. No surgical preparation or draping is done until completely satisfactory reduction is shown by adequate roentgenograms in both planes. Routine exposure and insertion of the guide wire through a quarter inch drill hole is described. Placement and depth are checked with roentgenograms and the length of the cannulated nail is determined. A starter is used and then the nail is driven in. Roentgenograms in both planes check the position of the nail.

The author attempts to differentiate between aseptic necrosis, a rare complication in his series, and delayed union, a common complication. Following 65 hip operations for fracture there were 11 failures (16.78%). The failures consisted of 1 case of aseptic necrosis, 2 cases of nonunion, 2 of non-reduction (immediate osteotomy), 5 of delayed union, and 1 death. There were no serious infections. The excellent results obtained were attributed to the efficient reduction, so that the roentgenograms in both planes showed the neck fragment under and medial to the head fragment in a true valgus position.

DANIEL H. LEVINTHAL, M.D.

**Comminuted and Segmental Fractures of the Leg** KELLOGG SPEED *Surg Clin N America*, 1949, 29: 1

Comminuted fracture of the leg, simple or compound, often presents problems not successfully treated by any uniform routine method, however, the purposes of treatment should be carefully noted: (1) restoration of limb length, (2) restoration of the axial relationship of the knee and ankle, (3) maintenance of the integrity of the soft parts by gentle handling and consideration of the nerves and vessels, and (4) maintenance of reduction until adequate callus can hold the fragments.

An injured leg should be splinted and the patient put at rest. The circulatory status of the limb should be noted, as well as muscle function. X-ray study of the limb in anteroposterior and lateral views should be made. With careful handling of the leg the tissue should be prepared with a soap and water scrub, any open wounds being covered with sterile sponge. Hair should be shaved off. Then the preparation is continued with 70 per cent alcohol and a dye antiseptic if desired. The surgeon may elect the closed or open method of treatment, according to the circumstances of the injury, the type of fracture, and his operative experience and training. The fracture dislocation is reduced on the fracture table by fixed or manual traction, and the leg is securely encased in a padded plaster cast from the upper thigh to the toes. The cast may be incompletely bivalved in anticipation of swelling, and the limb is elevated on pillows. In some cases continuous traction is preferred by means of insertion of a Steinmann pin through the calcaneus and suspension of the limb in balanced traction, with the Thomas splint. Distraction is to be avoided by x-ray follow-up. Transfixion pins and outside bars are not a generally accepted method of treatment.

A satisfactory method of treatment is the use of the Steinmann pin through the calcaneus for traction in reduction, then another pin is placed transversely through the tibial tubercle and the whole limb is encased in plaster for about 8 to 12 weeks. It is then removed and followed by a walking boot cast, if healing has been satisfactory and sufficient callus and bone are noted in the roentgenogram. The use of the walking iron stirrup, unless carefully planned, is dangerous.

DANIEL H. LEVINTHAL, M.D.

**Treatment of Malleolar Fractures According to Lauge Hansen's Method Preliminary Results**  
T. BAEK KRISTENSEN *Acta chir scand*, 1949, 97, 362

On the basis of 200 cases of ankle fracture treated according to Lauge Hansen's method, the system of classification, manners of production, and mechanisms of reduction are reviewed.

**Supination-eversion fractures** The supinated foot is everted, i.e., the tip of the foot is turned outward around a vertical axis. The characteristic feature of this type is the oblique spiral fracture involving the lateral malleolus and the adjacent part of the fibula.

**Supination-adduction fractures** The foot is supinated and adducted at the talocrural joint, thereby causing an avulsion fracture of the lateral malleolus (or lesion of the ligamentum calcaneofibulare). The characteristic feature of this type of fracture is the transverse fracture of the lateral malleolus on a level with, or distal to, the articular surface of the ankle joint.

**Pronation-eversion fractures** When the foot is pronated, the deltoid ligament is tightened. The characteristic feature of this type of fracture is the high fracture of the fibula.

**Pronation-abduction fractures** When the foot is maximally pronated, the deltoid ligament is tight-

ened. The characteristic feature of this type of fracture is the bending fracture of the fibula at a point a little above the ankle joint.

**Pronation-dorsiflexion fractures** By forced dorsiflexion of the pronated foot, pressure is exerted by the talus on the tibia and medial malleolus. The characteristic feature of this type of fracture is the large fracture of the anterior lip of the tibia.

The material reported here comprises all the cases of ankle fracture treated in the Surgical Department from November 1, 1942 to November 1, 1946. The follow-up examination took place at least 12 months after the accident. Among 200 patients, there were 116 men and 84 women, a distribution roughly corresponding to that found in other reports. Cases of epiphyseal separation have not been included.

In 120 of the 200 patients studied, it was necessary to reduce the fractures, 115 were reduced at once. In 106 cases the result was good, in 8 the result was fair, and in 1 case the result was poor. Open reduction, osteosynthesis, and wire extension were not employed. If the control roentgenograms showed good position, a rubber-covered wooden block, serving as a heel, was incorporated 2 or 3 days later, and usually the patients were allowed to get out of bed and were discharged after another couple of days. The time in bed after the application of the plaster cast averaged 42 days for patients with uncomplicated fractures.

In the classification and end results, the author adopted various criteria which seemed to be acceptable. An analysis of the causes of the poor results was made in the various types of fractures. The pronation-abduction fractures have given the greatest percentage of poor results, whereas no poor results were found among the supination abduction fractures subjected to follow-up examination.

C. FRED GOERINGER, M.D.



A satisfactory method of treatment is the use of the Steinmann pin through the calcaneus for traction in reduction, then another pin is placed transversely through the tibial tubercle and the whole limb is encased in plaster for about 8 to 12 weeks. It is then removed and followed by a walking boot cast, if healing has been satisfactory and sufficient callus and bone are noted in the roentgenogram. The use of the walking iron stirrup, unless carefully planned, is dangerous.

DANIEL H. LEVINTHAL, M.D.

#### Treatment of Malleolar Fractures According to Lauge Hansen's Method Preliminary Results

T. BAEK KRISTENSEN *Acta chir scand*, 1949, 97: 362

On the basis of 200 cases of ankle fracture treated according to Lauge Hansen's method, the system of classification, manners of production, and mechanisms of reduction are reviewed.

**Supination-eversion fractures** The supinated foot is everted, i.e., the tip of the foot is turned outward around a vertical axis. The characteristic feature of this type is the oblique spiral fracture involving the lateral malleolus and the adjacent part of the fibula.

**Supination-adduction fractures** The foot is supinated and adducted at the talocrural joint, thereby causing an avulsion fracture of the lateral malleolus (or lesion of the ligamentum calcaneofibulare). The characteristic feature of this type of fracture is the transverse fracture of the lateral malleolus on a level with, or distal to, the articular surface of the ankle joint.

**Pronation-eversion fractures** When the foot is pronated, the deltoid ligament is tightened. The characteristic feature of this type of fracture is the high fracture of the fibula.

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In 120 of the 200 patients studied, it was necessary to reduce the fractures, 115 were reduced at once. In 106 cases the result was good, in 8 the result was fair, and in 1 case the result was poor. Open reduction, osteosynthesis, and wire extension were not employed. If the control roentgenograms showed good position, a rubber covered wooden block, serving as a heel, was incorporated 2 or 3 days later, and usually the patients were allowed to get out of bed and were discharged after another couple of days. The time in bed after the application of the plaster cast averaged 4.2 days for patients with uncomplicated fractures.

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C. FRED GOERINGER, M.D.

bility of the blood and a strong tendency to bleed, especially following trauma. It is always present for life. Transmission is always through the female to the second generation, the genes being sex-linked and recessive. The coagulation defect is observed in vitro as a prolongation of the whole blood clotting time from a normal of 6 to 12 minutes to many hours. Most of the patients in the authors' series have clotting times of 1 to 2 hours. It is generally agreed that the fibrinogen, prothrombin, calcium, and the *number* of platelets are all normal.

The authors report the cases of 40 patients aged 12 years or over who have been followed during the last 10 years. All were males. Seventy per cent of these had a family history of hemophilia. There were 5 deaths, 3 were caused by conditions unrelated to hemophilia, and none occurred as the result of acute hemorrhage. Bleeding into joints is the most frequent hemorrhagic episode of adult hemophiliacs. It is recurrent, so that eventually many joints acquire some degree of permanent damage, the knees and elbows being most frequently involved. In only 2 of the series was there no evidence of *chronic* hemophilic arthritis, and the authors state that one would hesitate to make the diagnosis of hemophilia without the presence of joint deformity unless the diagnosis could be otherwise conclusively established. Purpura is not the characteristic finding here that it is in purpura hemorrhagica. Bleeding into muscle almost always follows severe trauma and may spread so dangerously as to result in shock. Attacks of hematuria are one of the most frequent hemorrhagic episodes, almost 90 per cent of this series having suffered one or more such episodes. Hematuria may be painless unless clots are passed. It may last a day or so, or may be prolonged for several weeks, no known factor or form of treatment apparently affecting the duration. Other less common bleeding phenomena are hemophilic pseudo bone tumor, pharyngeal hematomas, pulmonary and

pleural bleeding episodes, and the abdominal and retroperitoneal bleeding episodes which may mimic acute surgical conditions of the abdomen. Intracranial hemorrhage is rare.

Transfusions of whole fresh blood or plasma separated soon after phlebotomy are effective in correcting the coagulation defect, although bleeding may continue in spite of the coagulation time having been brought to normal. Whole blood may be given in amounts necessary to replace that lost or, if blood is not necessary, plasma in amounts of 100 to 250 cc may be given. The correction of the coagulation time may persist for 6 to 12 hours. Thus, for continued bleeding, blood or its derivatives should be given once or twice daily during the period of active bleeding. Blood plasma fractionation has led to the production of Fraction I, a preparation of human fibrinogen which contains antihemophilic properties and which can be conveniently and quickly given. Its limitations are its production in limited amounts and the probable transmission of hepatitis, which occurred in 2 cases in this series.

For local bleeding, thrombin (held in place with some form of pressure dressing) is preferred as a coagulant. Major surgery is hazardous and the estimate of Friedrich of a mortality of 35 per cent is probably conservative. Free use of preoperative and postoperative blood transfusions and thrombin, wherever possible, are the only important additions to a careful surgical technique. A detailed plan of treatment for the many types of bleeding disabilities to which hemophiliacs are heir is presented, with emphasis upon the suitable management of dental extractions and dental hygiene.

The authors conclude with the statement that the physician must not slight the social, economic, and psychiatric implications of the disease in his efforts to aid the patient to learn to live with his disease.

ALLAN D. CALLOW, M.D.



Incompetency of the valves is treated by exposure of the deep veins in Hunter's canal and ligation of the superficial femoral vein. Perivenous cicatrization is treated by removing the fibrous tissue mantle from about the vein. Ulceration is treated by sympathectomy with ligation of the superficial femoral vein and subfascial ligation of the communicating veins.

Recurrent streptococcal infections are avoided by careful hygienic care of the legs and feet. Acute attacks are treated by immediate rest in bed and prompt institution of antibiotic therapy.

ELY ELLIOTT LAZARUS, M D

**Tissue-Culture Evaluation of the Viability of Blood Vessels Stored by Refrigeration** E CONVERSE PEIRCE, II, ROBERT E GROSS, ALEXANDER H BILL, JR, and KEITH MERRILL, JR *Ann Surg*, 1949, 129 333

After the authors had studied various methods of preservation they used tissue culture techniques to demonstrate viability of the blood vessels, and concluded that storage of the vessels in the 10 per cent homologous serum and balanced salt solution (Ringer's solution) at temperatures slightly above freezing gave uniformly viable vessels. Of six methods studied, this was the most successful, the frozen vessels showing growth on tissue culture in only 2 of 34 experiments. Small pieces of tissue stored alone gave poor results, but their viability could be maintained by adding a large piece of tissue to the substrate.

The authors report that vessels so stored have been safely used in dogs and humans for homoplastic grafts.

JOHN H KAY, M D

## BLOOD, TRANSFUSION

**The Rh Blood Groups and Their Clinical Effects** P L MOLLISON, A E MOURANT, and R. R. RACE *Med Res Council, Lond*, 1948, No 19

In England the Medical Research Council, realizing that there is an urgent need for an authoritative summary of the present knowledge on the subject of the Rh blood groups and their clinical effects, has prepared a most welcome memorandum on this subject. It seems inevitable that a discovery which is so intellectually satisfying and so practically effective should, of course, gather around it a very bulky literature and one that seems to grow as the research in this field progresses.

First of all the division and classification of the Rh groups are discussed. Second, the clinical considerations and importance of the Rh groups, and, third, Rh testing are discussed.

The discovery of the Rh factor in human blood and the recognition that human beings can be clas-

hemolytic disease of the newborn, and hemolytic reactions that occasionally follow transfusions even when a reliable and blood type was used.

The brilliant discoveries by Levine in 1939 of an atypical immune agglutinin in the blood of a woman after a stillbirth was the first of rapid developments which led up to the concept of the Rh blood groups and their clinical manifestations. In 1940 Landsteiner and Wiener reported finding the Rh antigen. Most research investigations were actively pursued by Taylor, Mollison, Race, Wiener, and Fisher.

It soon became apparent that Rh testing should be made a routine before the administration of any type of blood. Even now, however, there is a tendency to ignore the need for such tests and to report findings in order to emphasize the two main dangers avoided by using the Rh test. First, the transfusion of Rh-positive blood to Rh-negative persons has been sensitized by either a pregnancy or a blood transfusion may kill them. Second, the transfusion of Rh-positive blood to an Rh-negative person sensitizes her to the Rh antigen, so that a subsequent child subsequently born to her may be diseased or even stillborn. The injection of a small amount of Rh-positive blood may cause life-long sensitization.

In discussing the clinical considerations the authors mention that many tragedies have been averted by routine Rh testing and by the transfusion of Rh-positive blood to an Rh-negative person. This simple measure alone it has been estimated that about 20 or 25 per cent of all cases of hemolytic disease could be prevented, as well as a large number of fatal transfusion reactions. The direct comparison of the donor's and the recipient's blood is a valuable safeguard against fatal transfusions from Rh as well as from the blood group compatibility, but it is no safeguard against the possibility that a transfusion may sensitize and thus lead to a future hemolytic disease. Therefore, in circumstances in which Rh testing cannot be performed, persons who have not passed the child-bearing period certainly receive Rh-negative blood if it is obtained.

Rh testing during pregnancy is desirable but has not at present the same importance as testing before transfusion, since no means of sensitization of an Rh-negative mother prior to positive fetus are known.

The present state of our knowledge of the blood groups and their clinical effects is completely summarized in this excellent memorandum.

EDWARD F LEWIS

The second case was that of a patient who, 10 days after an electric shock, developed attacks of dyspnea, precordial pain, and severe palpitations. Examination of the heart and vascular system were negative, an electrocardiogram was not done. Four infiltrations of the left stellate ganglion resulted in complete cure.

In view of these spectacular successes, the author discusses the advisability of performing infiltration of the regional sympathetic ganglia routinely after all electric injuries in order to prevent secondary vasomotor disturbances.

WERNER M. SOLMITZ, M.D.

**Wounds of the Extremities.** SIR THOMAS FAIRBANK, F. A. R. STAMMERS, R. J. FURLONG, J. M. P. CLARE, and Others. *Brit J Surg*, 1949, War Surg Supp 2.

This summary of the principles of military surgery is based on the experience of surgeons of the British Armed Forces in World War II. In wounds of the extremities, which formed such a large proportion of the total, the results generally were definitely better than those in the First World War. In both wars, the treatment of the wounded in the later campaigns reached a standard which, for various reasons, was impossible in the earlier. The rate at which the number of cases of unhealed wounds has diminished since the end of the war speaks for itself, when we recall that after the First World War thousands of similar cases required repeated admission to the hospital over a period of many years.

Some of the numerous factors which contributed to the improved results were the better organization of the medical services and mobile surgical units prepared to function anywhere, but particularly as close to the front line as circumstances permitted; these units brought operative surgery to the more severely wounded at the earliest possible moment, which fact is rightly regarded as being of paramount importance.

In Britain, the mistakes of the First World War were avoided, much greater care being taken in the selection of suitable hospitals for the reception of convoys, and in ensuring that patients in need of specialized treatment were transferred to suitable units without delay. There were far more specialists available to handle cases of exceptional difficulty. Resuscitation teams were at hand wherever the surgeon went, saving innumerable lives, and in desperate cases transfusion was started as far forward as the Aid Post and continued in the ambulance as it traveled to the surgeon.

The actual surgical treatment was performed along the same lines as in the earlier war in wounds of the extremities but with modifications as a result of further experience, discoveries, and new ancillary treatment. Pains were taken to train the young uninitiated surgeons, for it was soon recognized that the most single important factor in the treatment of all wounds was the skill and efficiency with which the primary surgical treatment was carried out. With regard to muscle damage in particular, the truth of

this is generally accepted. The sulfonamides and antibiotics cannot replace surgery entirely in the treatment of wounds. Modern surgical treatment employs many adjuncts to the operative techniques, that are of great value. Chemotherapy, fluid replacement, transfusion of whole blood and the various fractions of blood employed as substitutes, potent anesthetic agents, and narcotics properly administered are of inestimable value in treating the wounded.

The ever present necessity for evacuation to the rear divided the technical surgical management into first aid measures, initial wound surgery, secondary wound surgery at the base as definitive or reparative, and reconstructive and rehabilitation measures. The phases of surgical treatment as listed above in general with the military echelons, just as the placement of the various types of hospitals and, consequently, the provision of facilities for surgical treatment were determined by the geographic deployment of a military force. The essential feature about organization in the forward areas is that it should be elastic, and from the surgical point of view, the establishment of field surgical units, and field transfusion units, together with casualty clearing stations and new field dressing stations, made this possible. The most important advances affecting the medical services during the Second World War were (a) the well organized service by which blood and other intravenous fluids, including plasma, were readily available in adequate quantities, (b) the development of highly mobile surgical units—the Field Surgical Unit, (c) chemotherapy, particularly penicillin, and (d) better means of communication, since the fate of casualties depends upon them in great measure, to these should be added the Bailey Bridge, the bulldozer, and the jeep.

In forward areas specialist teams were tried but they were not a success since in most instances casualties could not be held long enough postoperatively for adequate observation. It was found best, because of improved and more rapid evacuation and transport, to place specialist teams at the Base or on lines of communication farther back where there were special units for fractured femurs and other complicated fractures, the chest, the head, burns, vascular injuries, and peripheral nerve injuries. The only exceptions to placing specialist teams at Base were the placing of neurosurgical and maxillofacial units along the lines of communication in the Army Area.

The first surgical intervention then, in everything except neurosurgical and maxillofacial lesions, was made by general surgeons in the forward areas, and there was no question of segregation of special types of cases until the Base was reached. These forward surgeons were picked, experienced surgeons, able to tackle anything, and their real task was to eliminate factors that were of immediate danger to life and limb, and to prepare the patient for later reconstructive procedures to be undertaken on the lines of communication or at the Base.

# SURGICAL TECHNIQUE

## OPERATIVE SURGERY AND TECHNIQUE, POSTOPERATIVE TREATMENT

**Blood Supply of Cross Leg Pedicle Flaps** R. B. STARR *Plast Reconstr Surg*, 1948, 3 694

The cross leg pedicle flap is an expedient for the transplantation of whole thickness skin and subcutaneous tissue to a defect of the foot or leg. From the point of view of the comfort of the patient, the medial aspect of the calf and the anterior aspect of the thigh offer the best donor sites upon which to construct pedicled flaps. The posterior aspect of the calf and the medial aspect of the thigh also have been used as donor sites for either open or tubed pedicles. The relative vascularization of the soft tissues of the various areas of the lower extremity cannot be determined by reference to standard texts of anatomy.

Several methods were used to gain information concerning the location of macroscopic arteries of the various surface areas, the size of the arteries, and their relative, quantitative vascular beds. Cadavers from the anatomical laboratory were used. After withdrawal of the embalming fluid from the arteries, commercial umbrathor (colloidal thorium dioxide, from 24 to 26%) was injected into the arterial tree through a cannula in the femoral artery. The degree of filling was determined by x-ray examination of the extremity. Once filling had been accomplished, circumferential flaps of whole thickness skin and subcutaneous tissue were cut from the extremity, just above and just below the knee. They were removed completely from the extremity, the line of dissection being accurately placed at the junction of the subcutaneous tissue and the fascia. The upper margin of the circumferential flap of the leg was at the level of the medial condyle of the tibia and the head of the fibula with its vertical incision along the crest of the tibia. The size of the usual pedicled flap allows only three possible donor areas in the leg: the medial, posterior, and lateral. The thigh affords four possible donor areas: the anterior, medial, posterior, and lateral. In an endeavor to determine the relative vascularity of the three available donor sites of the leg, the circumferential band of whole thickness skin and subcutaneous tissue was divided by lead markers into equal medial, posterior, and lateral thirds. The same procedure was used upon the flap from the thigh where four possible donor sites were demarcated equally. Roentgenographs were taken of these circumferential flaps. Inspection of the films showed that the arteries which reach the tissues of the surface were accurately outlined by the opaque medium.

In the second method of study a refrigerated unembalmed cadaver was used. The vascular tree of the right lower extremity was washed out with physiological saline solution. Liquid latex rubber

was injected into the arterial tree. After the body had been refrigerated for approximately a month, a circumferential flap was cut below the knee as outlined previously. The flap was subdivided by an incision into three equal donor areas. Each rectangular block of tissue was placed into a separate basin where all of the soft tissues were digested by a solution of sodium hypochlorite, according to Danforth's method. The tissue digestion left the unaffected latex vascular casts. Since the latex filled only the arterial tree, the casts represented molds of the arteries of the skin and subcutaneous tissue. These molds were carefully weighed.

The observations reported herein indicate that the medial aspect of the calf and the anterior aspect of the thigh are donor sites of choice since it has been shown that arteries are most abundant in these areas. The posterior aspect of the calf and the posterior aspect of the thigh show the fewest arteries. It is known that pedicles from the posterior third of the calf may be used with success if cautiously delayed, but this area is not the donor site of choice, and its indiscriminate use may occasionally lead to failure. The lateral third of the calf has an arterial supply second to that of the medial third of the calf but it is usually difficult to base a pedicle upon that surface. The medial aspect of the thigh has somewhat fewer arteries than has the anterior aspect of the thigh but the difference is not great. Clinically this area has been used principally for tubed pedicles with success.

FRANK F. KANTHAK, M.D.

## ANTISEPTIC SURGERY, TREATMENT OF WOUNDS AND INFECTIONS

**Sequelae of Electrocution and Infiltration of the Stellate Ganglia** (Séquelles d'électrocution et infiltration stellaire) PIERRE OURY and RAYMOND DENNIEL. *Presse méd*, 1949, 57 147

The authors report 2 most interesting cases in which the late sequelae of electrocution were cured rapidly by novocain infiltration of the stellate ganglia.

The first patient presented the picture of severe vasomotoric disturbances of both hands 2½ months after an electric shock. The hands up to the wrists were of bright red color, "like lobster claws," extremely edematous, and quite limited in movement. The patient complained of diffuse dull pains and was unable to do any work. Ten infiltrations of the stellate ganglia, four on the right side and six on the left, brought about complete cure.

The author discusses the probable mechanism of this spectacular cure. It is interesting that infiltration of the sympathetic ganglia has a beneficial effect not only on spasms of the blood vessels as in Raynaud's disease but also in extreme dilatation as in the present case.

## SURGICAL TECHNIQUE

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WERNER M. SOLMITZ, M.D.

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Some of the numerous factors which contributed to the improved results were the better organization of the medical services and mobile surgical units prepared to function anywhere, but particularly as close to the front line as circumstances permitted, these units brought operative surgery to the more severely wounded at the earliest possible moment, which fact is rightly regarded as being of paramount importance.

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The principles involved in the care of wounds of the extremities and the parietes do not differ from those applicable to all wounds. Primary considerations are (1) arrest of hemorrhage and treatment of shock, (2) prevention of additional contamination and trauma, (3) diagnosis of the extent of the injury, (4) conversion of a contaminated wound into a clean wound if the time interval permits, (5) removal of foreign material and devitalized tissue, (6) repair of injured structures, (7) purposeful splinting and dressing to provide rest and an adequate circulation for the injured tissues, whether bone or soft tissues, and (8) clean surgical care until healing is complete.

*First aid, resuscitation and transport.* Every man carried on him a first aid dressing, and when wounded either he or some comrade applied it to the injured part. If ambulatory, he would make his own way to the regimental aid post or to some other collecting post, otherwise he was rescued by stretcher bearers readily, larger dressings (shell dressings) and splints such as the Thomas splint would be applied for femur injuries. Then he was taken by ambulance to the advanced dressing station where a medical officer made any necessary adjustments to the dressings and to splints, administered antitetanus serum, morphine when necessary, and 2.5 gm of sulfonamide by mouth, which was to be continued throughout the journey. Blood, plasma, and glucose-saline solution were available at Advanced Dressing Station and full resuscitation could be given. For extensive muscle injuries gas gangrene antitoxin was administered. It was a rule that no wound should be exposed unless the patient was in severe pain or showed a rising pulse and temperature.

*Loss of blood.* It has been demonstrated by hematocrit, blood volume, and clinical studies that in major muscle wounds the loss of blood is usually great. It soon became appreciated that plasma and glucose-saline solution were of value, but that replacement of blood by blood was the best treatment. Excessive transfusion was harmful and in some cases was followed by anuria and uremia.

*Dehydration.* Most wounded men were in a state of dehydration. Heat in warm regions, sweating, and diminished fluid intake during combat increased the body temperature sometimes to 103 or 104 degrees. After hemorrhage, dehydration, together with the outpouring of serum into bruised tissues, often led to hemoconcentration and accounted for an erythrocyte count of 6,000,000 and the hemoglobin at 112 per cent. Glucose-saline solution given intravenously in adequate amounts (from 5 to 7 or 8 pints daily with sodium chloride not to exceed from 10 to 12 gm daily) corrected dehydration. The daily output of urine should be over 1,000 cc and must be not less than 500 cc.

*Infections and other results of injury.* Gas gangrene is a specific disease of devitalized muscle and its genesis is the whole environment of war, for the circumstances under which a fighting force lives, works, and is wounded are such as to encourage it. The incidence may be as high as 5 per cent with a

mortality of 50 per cent, but with increasing experience these figures were reduced to about 1 per cent and 20 per cent, respectively, and after penicillin became available the mortality was reduced to about 10 per cent. It cannot be emphasized too strongly that no crushed or lacerated muscle is free from the danger of gas gangrene and all crushed, torn, and devascularized muscle must be excised to eliminate the nidus most favored by the clostridia. The fundamental factor in the disease is damage to the blood supply, and anything that embarrasses the circulation of the limb, such as tourniquets, tight bandaging, badly applied splints, and the trauma of ambulance journeys, encourages it, the more general factors of severe hemorrhage, exposure, starvation, and absorption of toxic products of infection and muscle necrosis render the victim more susceptible. Various color changes are observed in and about the wound, the muscle being plum-colored, salmon-red, greenish-black, or black with a general tendency toward dryness, such discharge as there is being foul-smelling serum which may or may not contain bubbles of gas. Occasionally the diseased muscle is yellow and friable. An outstanding feature is that the involved muscles neither bleed nor contract when cut. The skin is affected late, but as tension increases it becomes pale, and later becomes mottled from hemolysis. With gas-forming organisms it is tympanitic. Of great importance is the intense necrosis that results in the liver and kidney cells which accounts for the common terminal symptoms of scanty blood-stained urine or anuria.

The symptoms may declare themselves as early as 5 or 6 hours, but usually appear from 24 to 48 hours, after wounding with sudden onset and rapid advance. The victim becomes pale, livid, anxious, afraid, or euphoric, but is mentally alert. His pulse quickens and becomes feeble, dicrotic, and running, the blood pressure is low, the extremities are cold, blue, and clammy. The temperature varies from some rise to subnormal and is not significant. These facts emphasize the crucial difference between contamination and infection, the most important fact in the established case is the profound toxemia. The picture is one of peripheral vascular failure, and mimics three other conditions, namely, advanced peritonitis, major muscle wounds of 3 or 4 hours' standing, and acute hypoproteinemia. Such patients are utterly prostrated, and unless immediate and vigorous surgical measures are applied death is imminent. Gas, when present, can be demonstrated by roentgenographs. Errors arise by the attempt to diagnose the condition by its odor, many contaminated wounds are by necessity malodorous but in the absence of severe prostration this does not point to gas gangrene. Penetrating wounds may permit the entrance of air into the soft tissues which may give a sensation of surgical emphysema.

Treatment is essentially prophylactic from the moment of wounding. It is assumed that first aid is properly executed—adequate splinting, bandaging that is adequate and not too tight, strict adherence

to the rules regarding the application of tourniquets, correct application of the Thomas splint, keeping the patient warm, relief of pain, administration of antitetanic and gas gangrene antitoxin, control of shock, and transportation to the nearest surgical center with dispatch

The proper surgical treatment of all wounds is a requisite, but for the established case blood transfusion, antitoxin, and penicillin are essentials. All affected muscle must be excised and this may be done best by removing the entire muscle from origin to insertion and remembering that the blood vessels of the muscles run within the bellies longitudinally, which explains why the infection tends to spread longitudinally. Large muscles like the adductor magnus may demand only partial resection, but it may be necessary to sacrifice the entire gluteal group. All discolored muscle and any that does not bleed or contract must be excised. A limb may be so disorganized that amputation is the only solution. A heavy penicillin frosting is applied to the wound and 100,000 units of gas gangrene antitoxin are given intravenously. Penicillin, blood transfusions, fluids, and plasma are administered postoperatively.

**Tetanus** Every soldier was protected by tetanus toxoid before going abroad and, if wounded, was further treated by antitetanic serum. The experience of the Americans and the French indicates that tetanus toxoid is sufficient. The incidence of tetanus was exceedingly low and, as in the case of sepsis generally and for clostridial infections in particular, adequate surgery with dispatch is the best safeguard against the disease.

**Trauma and malaria** In malarious areas trauma might precipitate acute clinical malaria even though it were controlled hitherto by suppressive antimalarial agents. High fever and malaise were indications to examine a blood film. The cerebral type was confusing in the presence of a head wound or in cases of fat metabolism from limb injuries.

**Anuria** This dysfunction was associated with crushed limbs, major muscle wounds, gas gangrene, abdominal wounds, transfusions of excessive amounts of blood or of incompatible blood, and large doses of sulfonamides, which precipitated acetylated derivatives with blockage of the tubules, ureters, and pelvis, in addition, transfusions, either excessive in quantity or of incompatible blood, lead to choking of the glomeruli and tubules by agglutinated and disintegrated red corpuscles. In extensive burns, severe dehydration and hypoproteinemias lead to hemoconcentration and oliguria and because of delayed treatment may progress to anuria. Since the war, Trueta and his coworkers have proved by experimental crushing of limbs that the main arteries in the lower limbs pass into spasm which ascends the vascular tree until the renal arteries are reached and are similarly affected. It has also been postulated that lacerated muscle was absorbed into the circulation which led to a prolonged fall in the blood pressure, as a result of which irreversible degenerative changes took place in the renal cells from ischemia.

The onset of anuria is heralded when the urine becomes dark and scanty and finally suppressed, the tongue and skin are dry and the blood urea rises to uremic levels (300-400 mgm per cent). Patients developing oliguria may recover or may develop anuria, dying between the sixth and eighth days. Anuria resulting from large doses of sulfonamide is treated by pressing fluids and trying to dislodge the deposits in the ureters by ureteric catheterization. For the remainder, alkalization and fluids form the mainstay of treatment. Since the war, peritoneal dialysis, artificial kidney, and the injection of novocain around the celiac ganglia to abolish renal vessel spasm have been advocated.

**Fat embolism and the effect of blast** It was not an uncommon experience to find a patient with a limb injury who became drowsy from 24 to 36 hours postoperatively, then lapsed into coma, and died with cerebral manifestations 2 to 4 days later. Papilledema was never present, and retinal hemorrhages were found rarely. Neck rigidity occasionally evolved, reflexes were usually exaggerated, and signs of a pyramidal tract lesion, such as extensor plantar response, sometimes appeared. When lumbar puncture was performed there was no finding grossly. The brain at autopsy showed the same changes in both groups of cases—generalized petechial hemorrhages throughout the white matter. When lung complications were also present, the bubble of air beneath the pleura suggested that the whole condition resulted from blast. It seemed probable that when the cerebral signs were present from the beginning the condition was one of blast, but when they were delayed they resulted from fat embolism. Some of the specimens at the Base showed fat globules in the kidneys, urine, and brain. There was no effective treatment for either.

**The surgical treatment of wounds** The influence of time, terrain, climate, and type of missile is fundamental. In active, moving warfare in which it is not possible to hold any but the seriously wounded men in the Forward Areas, there is no place for primary suture. This is because the majority of casualties will be subjected to the trauma of long ambulance journeys of unpredictable duration over bad roads, during which time they will not be under constant observation of a surgeon who might detect impending complications.

Infection remains relatively superficial for the first 8 hours after wounding, and is less severe in a dry climate than in a cold, wet one. It is, therefore, easier to render a wound surgically clean if treated within 8 hours of wounding, and units should be deployed accordingly. The heaviest contamination of wounds occurs in cold, wet weather when fighting is in the liquid mud of highly cultivated soil. Such wounds require thorough excision at the earliest possible moment, and anything less carries the grave risk of spreading cellulitis, septicemia, and gas gangrene, and, in any case, a wound unfit for early suture. Penicillin and sulfonamides are not substitutes for surgery—they are valuable adjuncts.



Nothing less than excision of contamination is safe, but this does not mean block excision. A wide area of skin around the wound was washed with soap and water and shaved, and usually some spiritous solution was applied. Because of the value and the viability of skin, the practice of removing a rim of about one-eighth of an inch was abandoned, only the frayed edge was removed. In order to inspect the depths of the wound it was extended sufficiently to permit the insertion of retractors down to the bottom. This necessitated generous longitudinal incisions of the deep fascia, which had the added advantage of decompressing edematous, congested tissues and reducing the incidence of vascular spasm, for the same reason transverse incisions also were sometimes employed. There was no fear of making incisions too long since they were to be sutured at the lines of communication, or at the Base in a few days. Tags of fat or fascia, or any soiled area of either, were removed. All muscle that did not bleed or contract when cut was excised. Imperfect removal carries with it the danger of sepsis which would nullify the general policy of delayed primary suture. Search was made for pieces of indriven clothing and other foreign bodies, and these, together with any readily accessible fragments of metal, were removed. All spaces that might harbor pus were laid open. Until the last year of the war, pieces of bone wholly detached from periosteum were removed, but, as already recorded, it was discovered that in the presence of adequate penicillin this was no longer necessary. The operation was completed by insufflating penicillin-sulfonamide powder until there was a heavy frosting. The wound was not picked. Vaseline gauze with 5 per cent sulfonamide was popular at first, but once conditions were suitable for a general policy of delayed suture, under which regime the first dressing was performed at operation, the vaseline pack was replaced by a dry gauze dressing. In relatively superficial through-and-through wounds the practice was to lay open the tract, but when the penetration was deep it was the custom to treat each wound separately. Quite apart from fractures, every wound involving muscle was found to require splinting, and this had to include the joint below the wound. Finally, following surgery, no inspection of the wound was made until the patient reached the operating room where the delayed suture was to be performed. In the absence of pain or toxemia any exposure of the wound prior to this was meddlesome and led to superimposed infection.

These principles of treatment applied equally to all soft tissue wounds, whether of the limbs (with or without fractures), chest wall, back, axilla, or belly wall, although when it was essential to hold certain cases for from 8 to 10 days in the forward areas for medical reasons, as for instance abdominal cases, primary suture of such wounds was employed. The basis of the rule is the fact that stitched wounds and ambulance journeys are incompatible.

The whole plan of the policy of delayed suture was aimed at the suture of wounds within 3 to 5 days

after the original excision, and treatment in forward areas became so efficient that suture could be accomplished safely in over 90 per cent of the cases, with complete healing by first intention in from 83 to 93 per cent. Experience showed that this time factor was essential, for when casualties could not be delivered for delayed closure in less than 8 or 10 days after the first operation, the proportion of successes fell from 5 per cent to 10 per cent lower. In one theater of war, during the quietude of the winter of 1944 to 1945, an experiment in primary suture in the forward area was carried out. The criteria for selection were that wounds should be not more than 12 hours old and that they should be essentially superficial, that is, although the muscle might be involved, every part of the wound was exposed and therefore no nooks and crannies were present. Such wounds were usually tangential, although several were from 6 to 8 inches long and about 2 inches in depth. Two surgeons were selected to do this work and the cases were carefully observed. The usual excision technique was employed but the wounds were sutured at the end of the operation. Altogether, 140 patients, representing 180 wounds, were treated. Of these, over 90 per cent healed perfectly after 8 or 10 days and 70 per cent returned to duty within 17 days. There were no serious failures. The 10 per cent that were not healed when stitches were removed were either moist or there was a stitch abscess and part of the wound broke down. Since the patients were under constant supervision no untoward results followed. Two of the wounds which broke down were situated over bone, and this location came to be regarded as a contraindication to primary suture. The conclusion was that primary suture should be used only in specially selected cases when it can be assured that the patients can be held for 8 or 10 days until the stitches have been removed. It is, therefore, restricted to periods of inactivity. One of the great achievements of the policy of delayed suture was that scar tissue was reduced to a minimum, with primary suture it was eliminated.

There was no doubt that in penicillin we possessed an agent that no other bacteriostatic or antiseptic equalled. When penicillin became plentiful, wounds behaved in a manner hitherto unknown. The mortality rate from gas gangrene dropped to about 10 per cent. Almost all wounds were suitable for treatment by delayed primary suture, with an expectation of healing by first intention in well over 90 per cent. Gunshot wounds of bones were converted into closed fractures within a few days, it was no longer necessary to remove pieces of bone detached from the periosteum, they became incorporated into the developing callus. The incidence of empyema in the last 200 chest cases was only 2.5 per cent. Penicillin made possible these triumphs.

*Vascular injuries.* Of 36 ligations of the popliteal artery, 26 required amputation above the knee joint, and of 31 ligations of the femoral artery, 21 required amputation above the knee. Given a wound in the lower third of the thigh, the popliteal space

being full and tense, and the condition of the limb below the knee pointing to vascular embarrassment manifested by coldness, swelling, numbness, and the absence of pulse at the ankle, exploration was deemed the safest line of action. The wound was treated in the usual manner, but as the clot was being evacuated from the popliteal fossa the artery, whether completely or partially severed, usually began to bleed anew. In the completely cut artery, ligation of each end was carried out. Sometimes a partially divided artery was successfully sutured. Even when suture of a partially divided artery was possible, thrombosis usually took place. However, when the calf or forearm muscles became swollen and woody hard, with the flexors in contracture, the skin cold, insensitive, and mottled, and with absent pulses, such changes were irreversible and amputation above the knee or the elbow was necessary.

An important point in the management of cases of ischemic necrosis of muscle resulting from prolonged application of a tourniquet was to avoid removal of the tourniquet, since experience showed that this permitted an overwhelming dose of myotoxin to enter the circulation rapidly. Amputation should be above the tourniquet, a second higher one can be employed to control hemorrhage in the operative area if thought necessary.

Patients that developed vascular aneurysms were sent to vascular injury centers. Experience suggested that waiting for the development of an aneurysm after injury to the main vessel was the best way to save the limb.

Measures which were used to safeguard the peripheral circulation were nonremoval of the patient until the fate of the limb was clear, keeping the affected limb cool by elevating and uncovering it and by the use of an electric fan, and the application of electric heaters to the trunk to encourage vasodilatation. Paravertebral blocks or sympathectomy were not practiced to any extent. Another lesion that threatened the vitality of the limb was traumatic vasospasm, or thrombosis of the main artery resulting from concussion or bruising by a missile having passed nearby.

*Injuries to the peripheral nerves* Rough tests for voluntary movements and sensation were made in all limbs injured and the findings recorded. Until the last few weeks of war primary suture of cut nerves was discouraged and no attempt was made to rectify the situation until several weeks later at the Base. This policy was based on the knowledge that nerve suture in the presence of infection was doomed to failure, but when the ends of severed nerves were seen during operation, they were often connected loosely by a solitary stitch as a guide for future intervention. During the last period of the war, with penicillin plentiful, surgeons began formal nerve suture at the time of the delayed suture. This would save much time, and it promised success since not only did the technique give clean wounds but the early closure eliminated the formation of scar tissue, the nerve would then lie in a bed of normal tissue.

*Amputations* Early in the war, before the policy of routine delayed suture of all wounds became a practical proposition, the tendency was to save as much of the limb as was viable, and leave it to the surgeons at the Base or in the United Kingdom to perform a secondary and definitive amputation suitable for prosthesis. With growing experience the Syme and Stokes-Griffith procedures were largely abandoned and surgeons conformed to the principles laid down between the wars by limb-fitting surgeons. After penicillin became available amputations performed in the forward areas were suitable for delayed suture within 5 days and healed by primary intention. It became necessary to plan primary amputations as definitive ones. Broadly speaking, two amputations for both the upper and lower limbs were dictated by the form of prosthesis provided by the Ministry of Pensions. This was of the bucket type of artificial limb, with circumferential weightbearing. The two sites advocated for the upper limb were below and above the elbow. The best site below the elbow was 3 inches above the wrist, and the shortest stump that would support an artificial limb had to have at least 1 inch of ulna beyond the biceps insertion with the elbow flexed. In the above-elbow amputation the site of selection was 3 inches above the joint, and not less than 1 inch of humerus below the anterior axillary fold would control the socket of the artificial limb. For the below-knee amputation the tibia was 5½ inches from the line of the knee joint, although 4 inches was sufficient. Nothing less than from 2½ to 2 inches was of any use. Above-knee amputations should be through the lower third of the thigh, or about 10 inches from the tip of the greater trochanter. The shorter the femoral stump the less adductor power remained, and anything less than 4 inches required a tilting-table limb. Following a coneshaped amputation with abundant skin flaps, with or without crushing of nerves, the flaps were left wide open, penicillin powder was insufflated, gauze dressings were applied, and the stump was splinted. After 2 or 3 days the amputee was evacuated to a "delayed healing by first intention in over 90 per cent of the cases."

*Joint injuries* In the early days of war wounds, the wounds of the major joints were rightfully regarded as serious lesions because even when the limb was saved it was at the price of a stiff joint resulting from sepsis. After the importance of thorough surgical toilet was established, improvement followed and with penicillin the number of stiff joints became far less. The wound was excised in the usual manner, and the rent in the capsule was enlarged sufficiently for exploration of the joint cavity. Loose pieces of cartilage or bone and foreign bodies were removed and the rent was washed out. The capsule was closed when possible, and a solution containing 25,000 units of penicillin was injected into the joint cavity. The skin incision was left wide open and the wound dressed with gauze. The limb was then put up in plaster, extension being applied when possible. In



the case of the knee joint, the Tobruk splint was used, and as long as the extension was adjusted at frequent intervals, these patients traveled very well. In cases in which the patella or the olecranon process was badly comminuted, it was usual to excise the fragments.

**Fingers and toes** It was important to apply splints to the hands and feet in such a manner that the fingers and toes remained free, and to encourage activity from the beginning. This guarded against adhesions and militated against crippling stiff digits. When possible the wrist was also left free, but in cases of musculospiral involvement it was put up in dorsiflexion. This was also practiced when the flexor muscles or the tendons of the wrist and fingers were cut, as otherwise contracture was likely to occur. Even in hand wounds fixation was reduced to a minimum and active and passive movements of the fingers started as soon as possible.

**Splinting** for fractures was *sine qua non*, but from what has already been said in regard to the hazards of transportation, adequate immobilization is vital in wounds of the soft tissues. For first aid work, Thomas knee splints and Cramer wire were most commonly used. Extension was applied through a clove-hitch or a Milbank clip. The extension was tightened by a Spanish windlass which was checked often during transport. For postoperative splinting, plaster of paris was invariably used. Experience taught that skin-contact plasters and even padded plasters that were not split were a hazard. Therefore, every plaster splint was padded and all except the Tobruk type were split before evacuation. The thoracobrachial splint, binding the upper limb to the trunk, was the favored splint for evacuation when the bones involved were those of the shoulder, arm, or forearm. For fracture of the forearm, a long plaster slab was molded to the posterior surface of the limb from the shoulder down to the metacarpophalangeal joints, and kept in position by encircling bands of plaster. This was fixed to the trunk by a light plaster jacket. The cast was split before evacuation.

Fractures of the femur, whether they were high, in the midshaft, or supracondylar, were treated by skeletal traction. Mobile, balanced skeletal traction was employed by introducing a Steinmann pin through the tibia at the level of the tuberosity, and attaching a pull of 15 pounds, which after 6 or 8 weeks was reduced to 10 pounds. The thigh and the leg were rested on a Braun's splint. The difficulty in high fractures was to control the flexion of the short upper fragment, it being necessary to bring the lower fragment into apposition with it. In midshaft fractures, skeletal traction was employed but the limb was cradled in a Thomas splint slung to a Balkan frame. In supracondylar fractures, in addition to the methods described, it was often necessary to insert a Kirschner wire through the proximal tip of the lower fragment and apply vertical traction to the lower fragment. Active knee flexion followed as soon as muscle control of the limb was present. In these cases, callus formation was often rapid and

union often occurred in about 8 weeks. The British favored and used closed reduction of fractures of the upper extremity, the leg, and foot, in almost all of the cases. Only in very exceptional instances was skeletal traction required. It was found that proper reduction of these fractures with adequate plaster of paris splinting gave very satisfactory results.

When penicillin became available the authors decided to plate a series of fractures which were considered suitable for this procedure. Plating must have a limited application because the majority of fractures are grossly comminuted and if there are more than three fragments it is unlikely that the plate can be fixed securely enough to hold the fragments in reduction or to render the fracture stable. To be effective the plate must be long and the screws must hold tightly in both cortices. In a consecutive series of 70 cases with missile fractures of the femur, only 16 were found to be suitable for plating. In some patients, the knee movement increased rapidly during the early stages of physical therapy, but except in a few instances the final range was usually less than that in patients treated by balanced skeletal traction. At the end of 3 months, the same proportion of closed wounds was found among the patients treated without internal fixation. Other complications of internal fixation were persistent sinus formation, requiring removal of the plate, and loosening of the plate with infection. The subsequent history of patients treated with internal fixation reveals that in the majority, the plates need to be removed because of persistent quiet infection and toxemia, and inevitably the plate is responsible for delayed union.

Skin grafting was used much earlier than in previous wars, even within a few days of the wounding. However, only under exceptionally favorable circumstances were skin grafts applied at the primary operation. At a later stage, even when drainage was still necessary, a large raw surface could often be reduced by grafting to little more than a sinus.

JOHN H. MOHARDT, M.D.

# Osteoporosis Following Burns NEAL OWENS *Brit J Plast Surg*, 1949, 1: 245

Sudeck's osteoporosis was detected in 8 patients following first and second degree burns. Osteoporosis may be considered as a possible burn complication because of the acidosis, the negative nitrogen balance, the endocrine imbalance, and the other metabolic disturbances associated with burn trauma.

The diagnosis of osteoporosis is rendered difficult in burn patients because of bone pain, muscle atrophy, edema, and disuse of the involved extremity. X-ray examination of the involved bones shows irregular areas of rarefaction and progressive decalcification. Secondary infection complicating a burn is also a predisposing factor to osteomyelitis and spontaneous fracture.

Although the cause of bone atrophy is not definitely established, it is believed to be due to trophic changes or chemical biological changes in skeletal

calcium Meticulous care of the metabolic balance involving nitrogen, calcium, and phosphorus must be observed in the treatment of burn cases Prompt skin coverage so as to allow for early motion is also requisite for the prevention of osteoporosis Surgical or chemical sympathectomy is not indicated for this type of osteoporosis

BENJAMIN G P SHAFIROFF, M D

**Some Observations of Curling's Ulcer** F BRAITHWAITE and P H BEALES *Brit J Plast Surg*, 1949, 1 284.

Curling's ulcer is an ulceration of the duodenum following extensive burns of the body surface The development of infection in the burned areas is a likely factor in the cause of such ulcers because their incidence has considerably decreased since the advent of penicillin These lesions also occur with other septic conditions

Two cases are reported In the first, the burns involved 65 per cent of the body surface and hematemesis started on the tenth hospital day This continued intermittently until death about 10 days later, despite blood transfusions Autopsy revealed an ulcer of the duodenum 4 cm in length which had eroded into the gastroduodenal artery In the second case, severe burns of the hand were followed in a week by abdominal pain before meals, and in 3 more days hematemesis and melena developed These continued till the patient was in shock Continuous blood transfusion was necessary and laparotomy revealed a duodenal ulcer similar to that in the previous case A partial gastrectomy was performed and an uneventful recovery followed

These ulcers grow rapidly in width and depth and there was no indication of repair in either of the cases presented, which suggested that when extensive hematemesis or melena occurs 1 or 2 weeks following surface burns, surgery is indicated Immediate medical measures are urged for any signs of abdominal distress following such burns

STANLEY W TUELL, M D

## ANESTHESIA

**Studies of the Circulation of Anesthetized Patients by a New Method for Recording Arterial Pressure and Pressure Pulse Contours** KENNETH F EATHER, LYSLE H PETERSON, and ROBERT D DRIPPS *Anesthesiology*, 1949, 10 125

A practicable method for the recording of direct arterial pressures involves insertion of a small plastic catheter into a brachial artery Pressure changes are recorded by connecting the catheter to a capacitance manometer This method supplies accurate beat-to-beat pressure readings, pulse rate, and evidence of changes in the cardiac output and peripheral resistance as they occur

Direct recordings from approximately 100 patients during anesthesia and surgery have demonstrated their practical value in supplying a knowledge of alterations in the circulation Such information can

be of value to measure such phenomena as the circulatory effects of traction and visceral manipulation during operation, abnormal cardiac rhythm and force of cardiac contraction, the effect of posture on the circulation, the circulatory action of drugs commonly used by the anesthesiologist, and the effect of changes of pressure within the respiratory tract

The method is recommended as an adjunct to the study and evaluation of patients subjected to anesthesia and surgery It is of particular value when patients are considered poor risks, during pulmonary and cardiac operations, and during the development of new surgical techniques

MARY FRANCES POE, M D

**Convulsions Under Anesthesia in Children** STANTON BELINKOFF *Current Res Anesth*, 1949, 28 40

Convulsions under anesthesia present a serious problem If allowed to continue, a severe degree of anoxia, permanent brain damage, or death may result

The immediate treatment of choice is the slow intravenous administration of a 2.5 per cent solution of sodium pentothal If venipuncture is impossible, 20 c c of pentothal should be given rectally Curare is another agent that may now be added to the list of useful drugs in combating this complication When it is impossible to perform a venipuncture to administer the curare, it may be given intramuscularly, even though the effect of the drug may not be apparent for several minutes

The patency of the airway must always be assured Oxygen should be administered continuously, if necessary, by artificial respiration or intratracheal insufflation

MARY FRANCES POE, M D

**Pathologic Findings in Some Deaths during Anesthesia** KEITH BOWDEN *Med J Australia*, 1949, 1 86

An analysis is made of the last 50 unselected deaths under anesthesia which occurred in Melbourne on the operating table, before operation was commenced or completed, or in the postoperative period before the patient recovered from the anesthetic. The group serves chiefly to emphasize that insufficient regard for the well established principles in the administration of anesthetics sometimes leads to disaster The analysis is given in table form and the relevant facts are tabulated as far as they could be gathered for each case The cases are divided into five categories

- 1 Deaths caused by the disease for which the operation was designed and the anesthetic given
- 2 Deaths resulting from disease present, apart from the disease for which the operation was undertaken
- 3 Deaths directly due to the anesthetic
- 4 Deaths due to the operative procedure, shock, or hemorrhage
- 5 Deaths due to the complications of anesthesia, such as the inhalation of vomitus

Much information of practical value emerged from the study of these cases. The time-honored practice of waiting until 4 hours have elapsed since the last meal and then giving an anesthetic under the impression that the stomach will be empty, has led to many fatalities. One patient had no solid food for 28 hours preceding anesthesia and died from asphyxia from inhaled vomitus. The fact that asphyxia can and does occur in the absence of frank cyanosis was stressed. Also, the use of a laryngoscope, bronchoscope, and suction might prove a life-saving measure, as might laryngotomy or tracheotomy with efficient suction.

The more thorough the postmortem examination the less does one have to fall back on status lymphaticus as the cause of death. It is not very well known that laryngospasm in the induction stage may be fatal, a fact that should make the anesthetist pause before he proceeds to pour on more anesthetic to get the patient over a spasm.

Twenty-seven of the deaths may be regarded as having been theoretically preventable, 14 of them showed typical asphyxia as their cause. After completion of an operation on the nose, throat, or mouth, the patient should be turned on his side and put to bed in this position until he has recovered from the anesthetic, and no patient should be removed from the operating theater if he presents any traces of cyanosis.

The author concluded that there is a certain amount of risk with every anesthetic administered and that that risk can be made only the irreducible minimum when due regard is paid to the well established principles governing the administration of anesthetics and the immediate after-care of the patient.

MARY KARP, M D

#### **The Effect of Vasoconstrictors Upon the Duration of Spinal Anesthesia. A Controlled Study in Man.** KENNETH C. BRAY, SIDNEY KATZ, and JOHN ADRIANI. *Anesthesiology*, 1949, 10: 40.

The use of a vasoconstrictor in local anesthetic solutions for infiltration or block anesthesia has long been accepted technique, but the use of these agents intrathecally for prolongation of spinal anesthesia has not been widely accepted. Cullen studied the effect of a vasoconstrictor with procaine for spinal anesthesia, and the authors have studied the action of nupercaine and pontocaine with several different sympathomimetic drugs added. The study was unusually well controlled, for every patient received at least two spinal anesthetics of the modified saddle block type. One group of patients received no vasoconstrictor in either of the anesthetic mixtures, while other groups were given first one injection without vasoconstrictor and later another anesthetic employing the anesthetic drug with some sympathomimetic agent. The vasoconstrictor agents studied were epinephrine, neosynephrin, ephedrine, and oenethyl.

There were variations in the duration of anesthetics given to the same patient, regardless of whether or not a sympathomimetic agent was em-

ployed. However, the figures used for comparison represented the average durations, and significant results were obtained. With nupercaine and vasoconstrictor, the average difference in duration of anesthesia was an 0.38 per cent increase, which is not significant, and the average durations of anesthesia were altered the following amounts by the different sympathomimetic agents: ephedrine, 50 mgm, a decrease of 4.9 per cent; neosynephrine, 5 mgm, an increase of 8.0 per cent; epinephrine, 1 mgm, an increase of 36.2 per cent. With the use of pontocaine without a vasoconstrictor, the average difference in duration of anesthesia was 2.3 per cent decrease, and the average durations of anesthesia were altered the following amounts by the different sympathomimetic agents: ephedrine, 50 mgm, an increase of 6.68 per cent; neosynephrin, 5 mgm, an increase of 8.15 per cent; oenethyl, 100 mgm, an increase of 1.6 per cent; epinephrine, 1 mgm, an increase of 61.56 per cent.

There were 10 significant rises in blood pressure and 15 significant falls in blood pressure during anesthesia in a total of 341 anesthetics. No delay was noted in the onset of anesthesia when a vasoconstrictor was combined with the spinal anesthetic drug.

The authors concluded that changes occurring with ephedrine, neosynephrin, and oenethyl were not clinically significant. Epinephrine proved to be the only vasoconstrictor which prolonged the duration of anesthesia appreciably with either pontocaine or nupercaine. No neurologic complications or sequelae were noted in any cases.

R. GIBSON PARRISH, M D

#### **Anatomic Reasons for Caudal Anesthesia Failure.**

M. GENE BLACK. *Current Res Anesth*, 1949, 28: 33.

The literature on caudal anesthesia leads one to believe that a persistent percentage of failures occur even in the hands of experienced anesthesiologists. This study was undertaken to determine some of the reasons for these failures and, if possible, to aid in their prevention.

In reviewing the osteology of the sacrum, we find adequate reason for many of the anatomical defects found in 104 sacra. Fifteen and three tenths per cent showed defects which made successful caudal anesthesia improbable. Absent hiatus, complete agenesis and bony septum, together with 3 cases in which spinal anesthesia appeared inevitable because of distortion, made up this group. Of the total number of sacra with defects, those showing absent hiatus appear to represent the basic minimum of failure, or 7.7 per cent.

In those cases in which caudal anesthesia is considered essential for the safety of the patient, it is suggested that x-ray studies of the sacrum will provide a valuable means of combating failure, as in many cases anesthesia may be possible but difficulties may be experienced because of the presence of structural changes and defects.

MARY FRANCES POE, M D

## SURGICAL TECHNIQUE

### The Therapeutic Uses of Intravenous Procaine DAVID J. GRAUBARD and MILTON C. PETERSON *Anesthesiology*, 1949, 10: 175

The results in the management of 448 cases in which 1,954 intravenous procaine infusions were given have been evaluated, and it is concluded that this technique should be considered as an adjuvant to the treatment of selected traumatic, inflammatory, and spastic conditions.

The importance of vitamin C therapy cannot be overemphasized. It is suggested that vitamin C be given prior to the use of large doses of procaine to increase resistance to toxic side effects, particularly in patients in a poor nutritional condition. There is evidence that interference with the reflex arc which is established following trauma will hasten the recovery and rehabilitation of the injured individual.

The intravenous administration of procaine, in conjunction with vitamin C, in the treatment of arthritis has given some promising results, and the improvement noted in spastic conditions of neurologic origin recommends this form of therapy for further clinical study. MARY FRANCES POE, M.D.

### Anesthesia for Neurosurgical Procedures: Analysis of 1,000 Cases C. R. STEPHEN and A. PASQUET *Current Res. Anesth.*, 1949, 28: 77

The authors review 1,000 consecutive operations performed at the Montreal Neurological Institute from July, 1946 to September, 1947 and discuss some of the problems encountered. General anesthesia was employed in 700 cases. In all of these, a patent airway was maintained by means of an endotracheal tube. Premedication for craniotomy consisted of atropine alone because of the dangers of morphine in patients with increased intracranial pressure. In other cases demerol or morphine was added. An avertin basal anesthetic was often used to allay fear in patients. This was followed by induction with ether by the closed or open method. In the majority of cases smooth induction was accomplished with small amounts of pentothal followed by gas or gas ether and intubation under direct vision. Packoffs of vaseline gauze were used almost entirely, liberally coated with 2 per cent nupercaine water-

soluble ointment. A description of the sponge rubber pad for supporting the chest in the prone position is included. Maintenance was attained by the use of ether-air anesthesia, with a nonresistant, non-breathing valve close to the endotracheal tube.

As an alternative, 123 patients were given pentothal nitrous oxide and oxygen of from 8 to 10 liters per minute. This combination was found satisfactory for procedures lasting up to 2 hours but in longer operations it was common to find the development of an increased pulse rate and a decreased pulse pressure. No abnormal increase in intracranial pressure was noted with this technique.

A series of 211 patients received spinal analgesia for the removal of intervertebral discs, 1 to 1500 nupercaine was the agent used and the procedure was described in detail. Only in the semicomatose and the poor-risk patient was local analgesia used without supplement, and nupercaine in 1 to 1500 and 1 to 4000 dilution with epinephrine in 1 to 125,000 dilution were the agents of choice. For arteriograms general anesthesia was employed and a deep plane of anesthesia was established during the period of manipulation to avoid troublesome reflexes from the carotid sinus. Fluid replacement was considered an important responsibility of the anesthetist. Only in sympathectomies was blood purposely withheld because in these cases a somewhat decreased blood flow was beneficial to the patient whose blood pressure was being substantially reduced by the operation. Analeptics were rarely used during intracranial operations under general anesthesia, but were of value in patients under spinal analgesia. To control restlessness under spinal analgesia, the intravenous use of nembutal was found most effective.

Complications during the induction of anesthesia were few. During operation a rapid fall of the blood pressure and a weak pulse were the most common abnormality. Two patients had severe blood reactions. Postoperative complications were not common. There were 67 deaths, 3 of which occurred in the operating room and the patients were children. Fifty of the 67 patients had received general anesthesia. MARY KARP, M.D.

# PHYSICOCHEMICAL METHODS IN SURGERY

## ROENTGENOLOGY

**The Diagnosis of Chronic Subdural Hematoma in Children and Adolescents** J W D BULL. *Brit J Radiol*, 1949, 22 68

In chronic subdural hematomas of adults, pneumography presents certain constant features, but angiography alone can firmly establish the diagnosis prior to operation. In children and adolescents the skull is more malleable and, therefore, a correct diagnosis can often be made by roentgen examination without the use of contrast media. The subdural hematoma in newborn infants is not discussed by the author.

The material consisted of 15 cases, 13 of which were confirmed. The patients varied in age from 20 months to 20 years and fell into the following three distinct groups: group 1, with appearances similar to those seen in adults, i.e., negative findings in ordinary roentgenograms and characteristic positive findings on pneumography (3 cases); group 2, with definite pathognomonic changes in ordinary roentgenograms (9 cases); and group 3, with calcified hematoma and hemiatrophy of the affected side of the skull shown in ordinary roentgenograms (3 cases).

The main features of the 15 cases are summarized and arranged in a table.

**Group 1** The 3 patients belonging in this group were 1, 11, and 15 years old, respectively. In the baby of 1 year the hematoma was encountered when the burr hole was made for ventriculography. In the other 2 cases ventriculograms showed the typical deformity seen in adults.

**Group 2** The ages in this group of patients varied from 4 to 18 years. The important roentgen findings were (1) bulging of the middle fossa on the affected side, shown in the lateral and submentovertical view, (2) elevation of the lesser wing of the sphenoid, shown in the posteroanterior view, and (3) bulging out of the greater wing of the sphenoid, likewise shown in the posteroanterior view. Dyke and Davidoff described three additional signs which were not confirmed by the author. These were (4) atrophy of the superior and lateral wall of the superior orbital fissure, (5) hypertrophy of the frontal and ethmoidal sinuses on the affected side, and (6) thickening of the skull.

Emphasis is laid on the proper technique of roentgenography. Exposures are usually made in 5 views: right lateral, left lateral, frontal (posteroanterior) with a 25 degree tilt of the rays toward the feet to show the orbits, occipital with 35 degree tilt of the rays, and basal (submento vertical) view. The techniques of taking the frontal and basal views are described in detail.

In the author's series the time interval between the trauma and the roentgen demonstrability of the bulg-

ing of the skull was 3 months. Hardman reported the case of a boy aged 8 who had a bulging middle fossa 10 weeks after a head injury, while A. Schuller thinks that no more than 6 weeks are necessary for this sign to appear.

**Group 3** The 3 cases in this group pathologically represent the end result of untreated hematomas in which calcification or ossification has occurred. They are described in detail. Two cases also showed a hemiatrophy of the skull on the side of the calcification which was parietotemporal in position. There was a marked displacement of the sagittal sinus to the affected side of the head and encephalography showed that the septum pellucidum was also displaced, which signified concomitant hemiatrophy of the brain.

The general conclusion is drawn that ordinary roentgen examination of the skull can provide the diagnosis in most cases of chronic subdural hematoma in children and adolescents and thus enable the surgeon to carry out a relatively minor curative operation.

T. LEUCUTH, M.D.

**The Roentgenologic Features of Neurofibromatosis** JOHN F. HOLT and EDWIN M. WRIGHT. *Radiology*, 1948, 51 647

Neurofibromatosis or von Recklinghausen's disease is characterized by multiple tumors of the peripheral nerves associated with areas of pigmentation in the skin. Less frequently an involvement of the central nervous system and of the skeleton may also occur.

The authors reviewed the findings in 127 cases of neurofibromatosis seen at the University of Michigan Hospital between 1934 and 1947, paying particular attention to the osseous manifestations. They were surprised by the frequency, variety, and yet consistency of the patterns encountered in these lesions. Slightly over 29 per cent of the total group showed some form of a skeletal defect, but these defects must have been more numerous as in 50 cases no roentgenograms were available. The bone changes were placed into 6 categories.

1 **Erosive changes** Norgaard described these changes as the "pit or cave" due to erosion of the bone by an adjacent neurofibroma. While such defects are characteristically observed in the bones of the extremities, the authors encountered 2 cases in which neurofibromas of intercostal nerves produced bilaterally symmetrical notching of several ribs, which somewhat resembled the roentgen appearance of coarctation of the aorta.

2 **Scoliosis** This was the most frequent osseous defect occurring in conjunction with neurofibromatosis. It may be due to a coexisting anomalous development of one or more vertebrae or to a compensatory function in overgrowth or undergrowth of a lower extremity. It occurs most commonly in the

lower dorsal region, consisting of kyphoscoliosis, with the kyphotic element predominating, but the authors also observed cervical kyphosis of varying degrees of severity

3 *Disorders of growth* Among these, overgrowth of one or several bones constituted the most ordinary finding. The overgrowth in the majority of the cases was longitudinal as well as circumferential, but rarely an actual diminution in the caliber with increase in the length of the bone was also found. It is significant that in all growth disturbances an elephantiasis neuromatosa of the soft tissues was present, which could easily be identified in the roentgenograms and was a helpful point in the differential diagnosis.

4 *Congenital bowing and pseudarthrosis of the lower leg* The frequent association of neurofibromatosis and congenital bowing of the tibia (with subsequently developing pseudarthrosis) is generally accepted. However, considering the fact that neurofibromas first appear at puberty or later in life, the question arises whether a congenital bowing of the tibia may always be conceived as a precursor of von Recklinghausen's disease. The authors observed 1 case in which the sequence of events seems to lend support to the theory.

5 *Intraosseous cystic lesions* The presence of cystic lesions is often encountered in all stages of neurofibromatosis. Apart from the subperiosteal cyst, which seems to be an established entity, the authors have found a number of cystic lesions within the cortical and cancellous bone. In some instances the lesions were located in the distal metaphyses and suggested localized fibrous dysplasia.

There were 2 cases in the authors' series which were most remarkable. In one, that of an infant 4 months old, a clinical and histologic diagnosis of neurofibromatosis was established. Roentgenograms of the skeleton revealed multiple cystic lesions of the metaphysis of many of the long bones. Thirteen months later the osseous changes had completely disappeared. In the other case, likewise that of an infant with innumerable subcutaneous tumors and very extensive bone changes, biopsy of the soft tissues demonstrated neurofibroma but three biopsies from bone failed to show the presence of a similar tumor. Therefore, the authors think that a relationship between neurofibromatosis and fibrous dysplasia may exist, although Jaffe has denied any such link.

6 *Associated anomalies of the skeleton* These include spina bifida, fusion of the vertebral bodies, congenital dislocation of the hips, clubfoot, and other similar anomalies. In 1 patient symmetrical anomalies of the hands and feet were noted. In 2 cases the involvement of the eyelids and orbital soft tissues was associated with orbital wall defects.

The general conclusion is drawn that von Recklinghausen's disease is not a rarity and that the incidence of bone involvement is considerably greater than the figure of 7 per cent commonly quoted in the literature.

T LEUCUTA, M.D.

# **The Detection of Gastric Carcinoma by Photofluorographic Methods I Introduction II Equipment Design** JOHN F. ROACH, ROBERT D. SLOAN, and RUSSELL H. MORGAN *Am J Roentg*, 1949, 61: 183, 188

A study has been established at the Johns Hopkins Hospital, Baltimore, to determine the efficiency of examination for carcinoma of the stomach of all patients above the age of 40 who are admitted to the Dispensary Out-Patient Clinic of the Hospital by use of a photofluorographic unit. The study will be pursued for a period of 5 years. It has been statistically shown that cancer of the stomach is a prevalent and rapidly fatal disease for which the only promising form of therapy is early surgery. The equipment employed for these examinations consists of a standard 200 milliamper generator, a rotating anode tube, and a grid-screen camera assembly using a Patterson type E-2 screen and a Schmidt camera. The grid-screen camera assembly is mounted beneath a horizontal roentgenographic table to permit the examination of patients in the recumbent position. The nucleus of the installation is a 70 mm Schmidt camera, constructed by the Danish engineer Helm. Results of the use of the equipment in the early detection of gastric carcinoma will be reported in subsequent articles.

FRANK L. HUSSEY, M.D.

# **The Early Diagnosis of Acute Septic Osteomyelitis, Periostitis, and Arthritis, and Its Importance in the Treatment** SIGVARD JORUP and SVEN ROLAND KJELLBERG *Acta radiol*, Stockh, 1948, 30: 316

The author emphasizes the importance of early diagnosis of acute septic osteomyelitis, periostitis, and arthritis.

The first roentgen sign of an acute septic osteomyelitis is the appearance of edema of the soft tissues at the site of the disease. This is manifested by a swelling of the surrounding muscles, and by blurring or obliteration of the fatty intramuscular septa. Engorgement of the vessels also appears in the subcutis. In a somewhat later stage, edema of the subcutis, which results in this layer appearing more indistinct and becoming broader than on the healthy side, is sometimes noticed as well. If the change affects a joint, a distention of the soft tissues of the joint with possibly an increase in the amount of fluid in the joint, can often be noticed. The changes in the soft tissues begin early. In acute septic coxitis, not infrequently an infiltration is observed in the soft tissues on the inner side of the pelvis. One can then observe on the diseased side a more or less increased breadth of soft tissue shadows proceeding down and along the inner edge of the pelvis. Roentgenograms showing a higher degree of contrast of the different soft tissue structures are necessary. Low radiation, varying between 35 and 45 kilovolts, and greater focal distance are necessary to produce roentgenographs of this type. The authors present 5 cases which demonstrate the value of soft tissue films.

FRANK L. HUSSEY, M.D.

**Polyostotic Fibrous Dysplasia (Albright's Syndrome) and Its Comparison with Dyschondroplasia (Ollier's Disease) A Correlation of Roentgenological and Pathologic Findings**  
L. R. SANTE, WM. BAUER, and R. M. O'BRIEN  
*Radiology*, 1948, 51: 676

Polyostotic fibrous dysplasia was described in the earlier literature as a variant of osteitis fibrosa cystica (von Recklinghausen's disease). In 1937, Albright, Butler, Hampton, and Smith reported 5 cases, suggesting for the first time that the syndrome represents a distinct entity. In 1938, Lichtenstein differentiated the condition from other diseases with which it was confused and recommended that the name of polyostotic fibrous dysplasia be used for its designation.

The authors present 4 cases and discuss the clinical, roentgenologic, and pathologic features of the syndrome as well as the differentiation from cystlike lesions and Ollier's disease.

Clinically, fibrous dysplasia of bone has an insidious onset, the osseous changes developing at a very slow pace. Often the condition goes unsuspected for years until there is interference with proper function or a pathologic fracture occurs. The diagnosis is usually made by roentgen examination.

The most important roentgen findings in the early stage are tiny cystlike areas within the cortical structure, often fusing with each other and giving the appearance of pseudoeexpansion. There is no evidence of periosteal elevation and osteoporosis does not occur. Later, the process leads to a shell like thinning of the cortex complicated by spontaneous fractures which, however, heal readily by new bone formation. Under certain conditions varying degrees of sclerosis of the involved bones may occur.

The bone lesions have a tendency to unilateral involvement but in the advanced stages both sides may become affected. They are often associated with pigmented areas of the skin and sexual precocity in the female.

The etiology is unknown. It was suggested that the condition may be due to a congenital disturbance of the activity of the undifferentiated fibrous bone-forming mesenchyme, or to damage of the region of the hypothalamus, or to an anomaly of the sympathetic system and the adrenals. The serum phosphatase is sometimes increased but the calcium-phosphorus balance is not disturbed.

Microscopically, there is an osteoclastic absorption of the bone structure followed by fibrosis of the bone marrow in the cortical and subcortical areas. The process starts in the haversian canals and spreads to the surrounding structures. Sometimes a moderate periosteal bone deposition is noted despite the absence of such a sign in the roentgenograms. Rarely, small islands of hyaline cartilage may be embedded in the characteristic tissue of polyostotic fibrous dysplasia.

In the presence of the extraskeletal lesions, the differential diagnosis from other cystlike diseases of the bone is easy.

The differentiation from von Recklinghausen's disease is based on the fact that the latter nearly always shows marked osteoporosis due to hyperparathyroidism. The bone deformity in polyostotic fibrous dysplasia is caused by weakening of the cortex secondary to local enlargement of the individual lesions. In the very advanced stage, however, a distinction between the two conditions may not be possible from a study of the roentgenograms alone. A correlation with the clinical findings and mineral metabolism, or a biopsy may prove necessary.

The differentiation from Ollier's dyschondroplasia has not been widely discussed in the literature. On roentgen examination, this condition shows characteristic rarefaction at the diaphyseal ends of the bones with areas of intervening decrease in density due to remnants of cartilage. Either one or several bones may be involved. There is no periosteal reaction or other sign of new bone formation. Microscopically, Ollier's disease shows cartilaginous proliferation remaining within the bony structure rather than fibrous replacement.

The 4 cases are presented in detail, numerous roentgenograms and some photographs being used to illustrate the characteristic features. The opinion is expressed that the condition undoubtedly occurs much more frequently than was formerly supposed.

T. LEUCUTIA, M.D.

**The Subarachnoid Spaces of the Root Sheaths in the Lumbar Region**  
K. LINDBLOM  
*Acta radiol*, Stockholm, 1948, 30: 419

Histological studies by Rexed revealed that the spaces adjacent to the root tips might form proliferations with cysts covered by a thin nervous tissue. In an effort to determine whether "Rexed cysts" were the same as widened endings of root sheaths as seen in myelograms, a roentgenographic and anatomic study of the lumbar root sheath was done on 35 specimens, and 150 myelograms were reviewed.

Anatomical studies revealed that the subarachnoid space varied with the length of the nerve root. Four specimens were injected with barium sulfate, subjected to roentgenography, and then cross sections, 1 mm thick, were made of the nerve root, dural sheath, and adjacent ganglia. The barium in the subarachnoid spaces might project to the ganglia. The latter ended in fimbrialike tips projected between the roots and root bundles and were interrupted by incomplete septa. Cysts that were present did not communicate with the subarachnoid space and were not demonstrable in myelograms. Differences in the shape, size, and extent of the dural sac were considered as variations of the normal.

MAURICE D. SACHS, M.D.

**Hip Lesions of Infants and Children Seen at the Newington Home and Hospital for Crippled Children**  
GILBERT W. HEUBLEIN, LOUIS BERNSTEIN, and B. J. HUBENET  
*Radiology*, 1948, 51: 611

As an introduction to the subject, the authors give an excellent discussion of the embryology, anatomy,



and roentgen anatomy of the hip joint. In connection with the last they painstakingly analyze the different methods used to localize various landmarks which are so important from the point of view of early diagnosis, especially in infants.

The anatomical components of the hip in the newborn are largely cartilaginous, which fact renders many structures invisible on the roentgenograms. In addition, slight variation in soft tissue detail in an otherwise normal-appearing hip may point to the presence of infection. Timely recognition of such diseases as coxitis and osteochondropathy may mean the difference between a satisfactory end-result and a subsequent crippling deformity. An early diagnosis is also of considerable help in the treatment of congenital dislocation of the hip.

The authors reviewed 300 normal hips of children up to 6 years of age examined at the Newington Home and Hospital for Crippled Children. Their findings paralleled and corroborated those of Kleinberg and Lieberman.

For the purpose of description the diseases of the hip in infants and young children were classified in the following manner:

- I Dislocation
  - A Congenital
    - 1 Congenital dislocation
    - 2 Arthrogryposis
    - 3 Dislocation associated with or secondary to spina bifida
  - B Acquired
    - 1 Traumatic
    - 2 Septic
    - 3 Still's disease
    - 4 Poliomyelitis
    - 5 Subluxation in muscular dystrophy
- II Osteochondropathy (Legg-Perthes disease)
- III Congenital coxa vara and epiphyseolysis
- IV Rare lesions
  - A Myositis ossificans
  - B Achondroplasia
  - C Osteogenesis imperfecta

Every one of these diseases is discussed in considerable detail, illustrative case histories and some very unusual roentgenograms being presented. A bibliography of 78 articles is appended.

T LEUCUTIA, M.D.

#### Sickle-Cell Anemia in Adults: Roentgenographic Findings

OMAR LEGANT AND ROBERT P. BALL.  
*Radiology*, 1948, 51: 665

Sickle-cell anemia is a chronic hemolytic disease which occurs almost solely in the negro race. The condition was first reported by Herrick in 1904. Since then numerous other articles appeared in the literature dealing with various phases of this condition. It is now estimated that about 7 per cent of the negro population show the phenomenon of sickling (sicklelema) and that 1 or 2 per cent of these develop severe sickle-cell anemia.

The mortality rate from sickle-cell anemia is not known. Many of the affected persons die during

infancy and childhood but some complete a normal span of life. The terminal phase is characterized by extreme prostration, peripheral vascular collapse, and shock.

The authors studied the roentgen findings in 26 cases of sickle-cell anemia in adults seen at the Presbyterian Hospital in the city of New York since 1930. A postmortem examination was performed in 5 of the 26 cases.

The most frequent abnormal roentgen finding was enlargement of the heart (13 cases). There was no characteristic configuration and in the 5 autopsies no valvular lesion was found. The cardiac enlargement is thought to be the result of compensatory hypertrophy and dilatation in response to the long-standing severe anemia and anoxemia.

Next in frequency was generalized osteoporosis (11 cases). About one-fourth of all cases showed definite bone infarction. The bone lesions consisted of biconcave deformity of the vertebral bodies (4 cases), patchy cortical thickening of the long bones (7 cases), and localized bone infarcts, not unlike those seen in caisson disease (5 cases).

Four of the 26 cases showed nothing abnormal on the roentgenograms.

One unusual case is reported in detail. It showed an infarction of the body of a vertebra which was studied by means of serial roentgenograms, from its inception to healing 18 months later.

The clinical features and laboratory findings of the 26 cases are summarized in tabular form, and some very interesting roentgenograms are presented to illustrate the salient roentgen findings.

T LEUCUTIA, M.D.

#### The Roentgenologic Changes in Sickle-Cell Anemia

STANLEY H. MACHT and PAUL W. ROMAN.  
*Radiology*, 1948, 51: 697

This article is based on a study of 48 cases of sickle-cell anemia observed at the Baltimore City Hospitals from 1936 to 1947. Twenty-nine of the patients were children under 14 years of age.

The most common findings were cardiac enlargement (76.2%), pneumonia (38%), coarsening of the trabeculae of the long bones associated with widening of the marrow cavity and thinning of the cortex (57.1%), similar changes in the short bones (35.2%), and the infarction type of destruction of the bone. After healing a roentgen appearance reminiscent of caisson disease is produced.

There is a definite time interval between the appearance of the clinical symptoms and the roentgen demonstrability of the bone changes. In 2 of the authors' cases the first roentgen examination, made soon after the onset of pain, swelling, and local heat of the affected area, remained negative, but a second examination made 3 weeks later showed evidence of bone destruction involving both the marrow and the cortex. Repair occurs after a long period of time.

If the thrombosis obliterates the blood supply near the articular surfaces, a permanent destruction of the joint may result. The authors observed 2 such



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means of a two way petcock to a 20 c.c. Luer-Lok syringe, is introduced into the common carotid artery 1 or 2 cm caudad to the bifurcation. When the needle is in the artery some citrate solution already in the syringe is injected to prevent clotting of the blood in the syringe and needle, and then a syringe containing the diodrast is attached to the needle. The needle is directed laterally and downward so that the contrast media enters the internal carotid artery and not the external. While 15 c.c. of diodrast are being injected as rapidly as possible, the first exposure is made, the stereoshift is carried out, and a second exposure is taken. The author finds that this lateral stereoview is more valuable than a single lateral and a single anteroposterior view. The entire procedure requires great co-operation between the neurosurgeon and the radiologist.

JOHN W. HOPE, M.D.

**Place of Deep External X-Ray Irradiation in the Treatment of Carcinoma of the Cervix by Long Element Needles** GEORGE W. WATERMAN and WILLIAM A. REID *Radiology*, 1949, 52: 34.

The authors review their experience over a 10 year period (from 1933 to 1942) at the Rhode Island Hospital, Providence, Rhode Island, with the treatment of 347 cases of cancer of the cervix. One hundred and thirteen patients were treated primarily with radium needles alone, and 234 were treated primarily with radium needles and x-rays. The 5 year survivals in this group was 154, or 44.4 per cent.

In order to give a more accurate picture, comparisons between the two groups are made on the basis of similar clinical stages. The Schmitz classification was used. Stages 1 and 2 represent the operable or favorable group and stages 3 and 4 the inoperable and still purely radiological group.

In reviewing the statistics of the cases it is noted that 56 patients in stages 1 and 2 who were treated by interstitial radiation alone showed a 5 year salvage of 45, or 80.4 per cent. On the other hand, the salvage for a similar group of 77 operable patients treated by radium needles and x-ray irradiation was only 64.9 per cent, a difference of 15.5 per cent in favor of radium alone. In the inoperable or unfavorable group (stages 3 and 4) there was a 22.8 per cent survival for the 57 patients treated with needles alone and a 29.3 per cent survival for 157 patients receiving x-ray irradiation in addition to the radium.

The incidence of complications was markedly higher in the operable cases when x-rays were used with needles, being 22.1 per cent or more than twice that with needles alone (10.7%). In the inoperable group the gross incidence of complications did not vary so widely. The group treated with needles and x-rays showed fewer complications—12.1 per cent as compared with 14 per cent when radium alone was used.

The incidence of fistula in patients treated with needles alone was 3 in 113, or 2.7 per cent, occurring in patients with carcinoma of stages 3 and 4. In the patients treated with needles and x-rays the fistula

incidence was 13 in 234, or 5.6 per cent. Five of these had carcinoma in stage 1 or 2, an incidence of 6.9 per cent for these two stages. In 94 patients to whom x-ray therapy was given less than 1 month before or after radium treatment, the incidence of complications was 22.3 per cent as compared with a gross incidence of 12.3 per cent for all stages when radium was used alone. By increasing the interval to at least 8 weeks between the radium and x-ray therapy the complications were cut down. The use of a 4 cm lead strip over the lower abdomen above the symphysis was found to reduce the x-ray overdosage to the paracervical area, which was considered responsible for some of the complications.

The x-ray factors used were 200 kv., 20 ma., target-skin distance 50 cm., filter 0.4 mm. of tin (Thoraeus). Two large fields (one anterior and one posterior) were used. The method of radium treatment consisted of using 2 and 3 mgm. needles (a total from 24 to 30 mgm. in early cases, and rarely more than 50 mgm. in late cases), and a 20 mgm. cervico-uterine application, gamma radiation, 0.5 mm. of platinum filter, and a long interval of 168 hours or 7 days.

The authors conclude that in making use of long paracervical and parametrial element needles, great caution should be used in stages 1 and 2 when x-ray radiation is given externally. The cervix and paracervical triangle should be shielded as much as possible. An interval of from 9 to 12 weeks after treatment with radium before use of x-rays gives the best results with regard to freedom from complications. In badly infected and more advanced cases preliminary x-ray therapy has its proper place.

FRANK L. HUSSEY, M.D.

## RADIUM

**Probable Trends in the Irradiation Treatment of Carcinoma of the Cervix Uteri with the Improved Expanding Type of Radium Applicator** EDWIN C. ERNST *Radiology*, 1949, 52: 46.

The author presents an improved type of radium applicator to meet the problem of obtaining a greater degree of radiation effectiveness in the potential metastatic parametrial pelvic field, in the treatment of carcinoma of the cervix uteri. More effective and uniform irradiation is obtained by use of this radium applicator. The uniform spacing of multiple equal radium sources is not disturbed when the lateral capsules of this particular type of radium holder are expanded to pre-established fixed positions, irrespective of the anatomical size and shape of the vaginal vault or the extent of the malignancy.

The applicator is so constructed that in the closed position the transverse diameter measures less than 3.0 cm., which makes for ease of introduction. The lateral colpostats are expanded mechanically by use of a rotating knob on a handle which is detached after introduction, and the applicator is packed and fixed in the desired expanded position. The cervical stem of the applicator, when three longitudinal capsules are employed, is approximately 7 cm. in

cases, one with destruction of the wrist and the other with destruction of the hip.

Thromboses of the capillaries of the skin lead to chronic ulcers of long duration, especially at the ankles. The secondary infection which is common in these ulcers often produces periosteal changes in the underlying bone similar to those observed in varicose ulcers.

The poor nutrition of the tissues leads to general changes consisting of a linear habitus, emaciation, long extremities, short trunk, upper dorsal kyphosis, deep chest, protuberant abdomen, spider hands, and occasionally a slight turrecephaly. Abnormal dentition and delayed osseous union have also been found.

The authors have arranged all the roentgen changes in a tabular form which is as follows:

1. Roentgen evidence of involvement of the viscera
  - (a) Cardiac enlargement
  - (b) Pathological changes in the lungs
  - (c) Enlargement of the liver, cholelithiasis
  - (d) Enlargement of the spleen—possible calcification later in life
2. Skeletal changes due to hyperplasia of the erythroblastic elements
  - (a) Long bones
    - (1) Irregular trabeculation
    - (2) Widening of the medullary spaces
    - (3) Cortical thinning
  - (b) Short bones and flat bones
    - (1) Exaggeration of trabecular markings of the ilia, scapulae, phalanges
    - (2) Cupping of the vertebral bodies
    - (3) Skull Widening of the diploe, thickening of parietal and frontal bones, thinning of outer tables, and radial arrangement of trabeculae
3. Skeletal changes due to thromboses
  - (a) Long bones
    - (1) Cortical thickening
    - (2) Narrowing of medullary cavity
    - (3) Loss of bone tissue
    - (4) Periosteal reaction
  - (b) Short bones
    - (1) Necrosis and resorption of bone
    - (2) Periosteal reaction
4. Skeletal changes due to disturbances of growth

T. LEUCUTIA, M.D.

#### The Angiocardiographic Measurement of the Normal Great Vessels. CHARLES T. DOTTER and ISRAEL STEINBERG. *Radiology*, 1949, 52: 353

Recognizing a need for greater accuracy of measurement of the great vessels, Dotter and Steinberg have used angiocardiographic material in an attempt to establish some normal values. One hundred selected patients were measured at various specific sites, and the minimum, maximum, and average values for the series recorded.

The authors anticipate that a larger series of similar measurements will support their preliminary data. Those interested in this subject should consult the

original diagrams of sites measured and the tables of measurements.

PAUL W. EYLER, M.D.

#### The Aid of Arteriograms in the Diagnosis and Treatment of Intracranial Aneurysms. JAMES L. POPPEN. *Radiology*, 1949, 52: 347

This article is based on a series of 114 intracranial aneurysms occurring in 110 patients studied at the Lahey Clinic. In all but one of the cases the cause was presumably a congenital defect in the arterial wall. The 1 exception was found to be due to a mycotic embolism. Twenty-three of the patients were hypertensives and none of them had syphilis. In 63 cases the aneurysm occurred on the left side, and in 47 on the right side. Seventy-two of the patients were females and 38 were males. The majority of the symptoms occurred in patients between the ages of 20 and 60 years, the youngest being 14 years and the oldest, 70.

The symptomatology of this condition is variable and there is no definite clinical syndrome. The symptoms found in the 110 cases and arranged in the order of decreasing frequency were subarachnoid hemorrhage, cranial nerve changes, unilateral headache, generalized headache, convulsions, vertigo, facial pain, the migraine type of headache, and signs of hypopituitarism.

It is desirable to make the diagnosis of an intracranial aneurysm prior to rupture as 35 per cent of the patients in this series died on the first rupture and 21 per cent died because of recurrent hemorrhages.

It is necessary to know the tolerance of the affected hemisphere to reduction in the blood supply. This can be found by temporarily occluding the internal carotid artery by digital compression. If an irritable carotid sinus is present the compression should be on the common carotid artery well below the bifurcation.

If the aneurysm is large enough, plain roentgenograms of the skull may show a unilateral enlargement of the sella turcica, elevation or thinning of one of the anterior clinoids, or thinning of the lateral margin of the optic foramen. At times, calcification within the aneurysm may be seen.

In this series of cases thorotrast was originally used as the contrast media, but diodrast is now used more frequently. Since 75 per cent of intracranial aneurysms involve the anterior two thirds of the circle of Willis this portion should be visualized first. If the closed method is used the posterior third can be visualized by occlusion of the internal and external carotid arteries during injection of the common carotid. The Lahey Clinic uses the closed method more routinely than the open method because often both sides have to be investigated and the closed method is a minor procedure compared to exposure of both the carotid arteries.

The closed method is carried out with the patient on his back with his head in the horizontal position alongside of an upright automatic Bucky diaphragm. An 18 gauge needle, 2 inches long and attached by

means of a two way petcock to a 20 c.c. Luer-Lok syringe, is introduced into the common carotid artery 1 or 2 cm caudad to the bifurcation. When the needle is in the artery some citrate solution already in the syringe is injected to prevent clotting of the blood in the syringe and needle, and then a syringe containing the diodrast is attached to the needle. The needle is directed laterally and downward so that the contrast media enters the internal carotid artery and not the external. While 15 c.c. of diodrast are being injected as rapidly as possible, the first exposure is made, the stereoshift is carried out, and a second exposure is taken. The author finds that this lateral stereoview is more valuable than a single lateral and a single anteroposterior view. The entire procedure requires great co-operation between the neurosurgeon and the radiologist.

JOHN W. HOPE, M.D.

**Place of Deep External X-Ray Irradiation in the Treatment of Carcinoma of the Cervix by Long Element Needles** GEORGE W. WATERMAN and WILLIAM A. REDD *Radiology*, 1949, 52: 34.

The authors review their experience over a 10 year period (from 1933 to 1942) at the Rhode Island Hospital, Providence, Rhode Island, with the treatment of 347 cases of cancer of the cervix. One hundred and thirteen patients were treated primarily with radium needles alone, and 234 were treated primarily with radium needles and x-rays. The 5 year survivals in this group was 154, or 44.4 per cent.

In order to give a more accurate picture, comparisons between the two groups are made on the basis of similar clinical stages. The Schmitz classification was used. Stages 1 and 2 represent the operable or favorable group and stages 3 and 4 the inoperable and still purely radiological group.

In reviewing the statistics of the cases it is noted that 56 patients in stages 1 and 2 who were treated by interstitial radiation alone showed a 5 year salvage of 45, or 80.4 per cent. On the other hand, the salvage for a similar group of 77 operable patients treated by radium needles and x-ray irradiation was only 64.9 per cent, a difference of 15.5 per cent in favor of radium alone. In the inoperable or unfavorable group (stages 3 and 4) there was a 22.8 per cent survival for the 57 patients treated with needles alone and a 29.3 per cent survival for 157 patients receiving x-ray irradiation in addition to the radium.

The incidence of complications was markedly higher in the operable cases when x-rays were used with needles, being 22.1 per cent or more than twice that with needles alone (10.7%). In the inoperable group the gross incidence of complications did not vary so widely. The group treated with needles and x-rays showed fewer complications—12.1 per cent as compared with 14 per cent when radium alone was used.

The incidence of fistula in patients treated with needles alone was 3 in 113, or 2.7 per cent, occurring in patients with carcinoma of stages 3 and 4. In the patients treated with needles and x-rays the fistula

incidence was 13 in 234, or 5.6 per cent. Five of these had carcinoma in stage 1 or 2, an incidence of 6.9 per cent for these two stages. In 94 patients to whom x-ray therapy was given less than 1 month before or after radium treatment, the incidence of complications was 22.3 per cent as compared with a gross incidence of 12.3 per cent for all stages when radium was used alone. By increasing the interval to at least 8 weeks between the radium and x-ray therapy the complications were cut down. The use of a 4 cm. lead strip over the lower abdomen above the symphysis was found to reduce the x-ray overdosage to the paracervical area, which was considered responsible for some of the complications.

The x-ray factors used were 200 kv., 20 ma., target-skin distance 50 cm., filter 0.4 mm., of tin (Thoraeus). Two large fields (one anterior and one posterior) were used. The method of radium treatment consisted of using 2 and 3 mgm. needles (a total from 24 to 30 mgm. in early cases, and rarely more than 50 mgm. in late cases), and a 20 mgm. cervico-uterine application, gamma radiation, 0.5 mm. of platinum filter, and a long interval of 168 hours or 7 days.

The authors conclude that in making use of long paracervical and parametrial element needles, great caution should be used in stages 1 and 2 when x-ray radiation is given externally. The cervix and paracervical triangle should be shielded as much as possible. An interval of from 9 to 12 weeks after treatment with radium before use of x-rays gives the best results with regard to freedom from complications. In badly infected and more advanced cases preliminary x-ray therapy has its proper place.

FRANK L. HUSSEY, M.D.

## RADIUM

**Probable Trends in the Irradiation Treatment of Carcinoma of the Cervix Uteri with the Improved Expanding Type of Radium Applicator** EDWIN C. ERNST *Radiology*, 1949, 52: 46.

The author presents an improved type of radium applicator to meet the problem of obtaining a greater degree of radiation effectiveness in the potential metastatic parametrial pelvic field, in the treatment of carcinoma of the cervix uteri. More effective and uniform irradiation is obtained by use of this radium applicator. The uniform spacing of multiple equal radium sources is not disturbed when the lateral capsules of this particular type of radium holder are expanded to pre-established fixed positions, irrespective of the anatomical size and shape of the vaginal vault or the extent of the malignancy.

The applicator is so constructed that in the closed position the transverse diameter measures less than 3.0 cm., which makes for ease of introduction. The lateral colpostats are expanded mechanically by use of a rotating knob on a handle which is detached after introduction, and the applicator is packed and fixed in the desired expanded position. The cervical stem of the applicator, when three longitudinal capsules are employed, is approximately 7 cm. in

length. The distal stem can be removed if less length is desired. The two lateral colpostats can be expanded to the desired extent to contact the parametrial fields effectively. When the lateral transverse diameter measures only 5 cm, four or five radium capsules can be comfortably introduced. The 6.5 cm vault occasionally will accommodate six radium capsules. If the cervical canal is occluded, the cervical stem of the applicator may be removed. The roof and floor of the vaginal vault are packed with a single narrow gauze strip to maintain constant pressure on the radium holder. Roentgenograms taken after insertion of the applicator are of value to determine its position. In a contracted vaginal vault, only four or five capsules can be accommodated. The radium compartments of the applicator are for either one, two, or three 10 mgm needles.

Injury to the bladder and the rectum are minimized due to the design and mechanical features of the lead-filled ends of the vertical radium capsules. The radiation distribution has been evaluated for both the single capsule and the total radium intensity effects of the applicator upon photographic films by substituting a presdwood phantom for the soft tissues of the pelvis in order to determine that all the surrounding pelvic fields were uniformly and effectively irradiated.

The studies show an improved field of radiation around the present applicator which employs nine equally spaced radium sources. Unequal distribution of the radium sources within the cancer fields or the surrounding normal structures of the pelvis creates a clinicobiological irradiation hazard.

From the standpoint of clinical research, this method facilitates the more accurate comparison and

clinical evaluation of the relative effectiveness of various radium application in relation to the time and intensity factors of the total radium dose.

FRANK L. HUSSEY, M.D.

#### MISCELLANEOUS

**The Lethal Dose of Total Body X-Ray Irradiation in Swine** JOHN L. TULLIS, CARL F. TESSMER, EUGENE P. CRONKIRE and F. W. CHAMBERS, JR.  
*Radiology*, 1949, 52: 396

The effect of ionizing irradiation on swine was studied in an effort to better interpret the data obtained in the Bikini tests. Experiments on swine are of value because of a closer similarity to the radiosensitivity of man.

A one million volt unit operating at 3 ma (angle beam of 95 to 135°), 1 meter distance, and at 30 roentgens per minute, was used. Two lateral fields were given to each swine over a 45 minute period, the dosages varying from 200 to 600 roentgens in air. All swine were sexually mature, from 12 to 15 months old, there were 4 females and 4 males in each group.

Results within a period of 30 days following irradiation showed no difference as far as sex was concerned. Of the 8 animals receiving 200 roentgens, one (12.5%) died, of the 8 animals receiving 300 roentgens, 5 (62.5%) died, 7 of 8 (87.5%) that received 400 roentgens, died, and 8 of 8 (100%) that received 600 roentgens, died.

The results of these studies show that in spite of some differences in the ionizing components of the atomic bomb and one million volts, the biologic responses are similar and comparable.

MAURICE D. SACHS, M.D.

# MISCELLANEOUS

## CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

**Venous Pressure in Relation to Blood Volume in Man** MARTIN E. ANDERSON, JR., and JOHN S. LUNDY *Anesthesiology*, 1949, 10 145

In the state of shock, the effective volume of the circulating blood is reduced. This may be due to actual loss of blood volume (as whole blood or plasma), to pooling of the blood in the venous reservoirs of the body, or to other factors such as heart failure. When the effective blood volume of the body is reduced, there is a measurable drop in the blood pressure, often greater on the venous than on the arterial side. With recovery from shock, the arterial and venous pressures approach more nearly normal limits.

It is an easy matter to make frequent observations of the arterial blood pressure, and much reliance is placed on these determinations in evaluating the efficacy of management of the patient in shock. It is unfortunate that a record of the venous pressure is not so easy to obtain, for the venous pressure also reflects the disparity between the capacity of the circulatory bed and the volume of the circulating fluid within the vascular system. A drop in the venous pressure may be an earlier warning of impending shock than is a fall in the arterial pressure.

Since it has been found that the effective blood volume drops in shock and is restored toward normal as this condition is overcome by replacement of the lost fluid, two series of observations were made to determine whether measurement of the relative venous pressure could be used as a method of measuring this change. In the first series, the change in venous pressure was measured on 25 human donors after removal of 500 c.c. of blood. In the second series, the change in venous pressure was determined in 20 patients after the infusion of 500 c.c. of whole blood. As a corollary to this latter series of observations, the change in venous pressure was determined in 20 postoperative patients after infusion of varying amounts of saline solution at a constant rate.

The authors found that it is a simple matter to obtain venous pressure determinations when intravenous tubing is in progress by attaching the intravenous tubing to a venous pressure manometer with its saline reservoir. It is believed that determinations of venous pressure accurately reflect changes in the total blood volume which are more difficult to discover by other methods. The procedure has a limited usefulness in guiding the intravenous therapy of patients in surgical shock, and might also be of value when solutions are to be administered intravenously to patients with a variety of conditions in which further increase in venous pressure is to be avoided, such as congestive heart failure, constrictive pericarditis, ascites, and Banti's disease.

Rapid withdrawal of 500 c.c. of blood from each of 25 donors produced a fall of venous pressure from an average resting value of 112 mm. of saline solution to 77 mm. Transfusion of 500 c.c. of whole blood into 20 patients produced a rise of venous pressure from 64 mm. to 92 mm. Infusion of physiologic saline solution did not restore the venous or arterial pressure to the preoperative level.

**The Common Nonvascular Nevi and Their Treatment** A. J. DELARIO *Am J Surg*, 1949, 77 53

The commonness of the various forms of pigmented and nonpigmented nevi is established, and a classification of these many and varied lesions is given. Nevi are defined as skin lesions containing neval cells with or without pigment, and with or without hair. Their origin is probably from nerve tissue, due to their ability, through the neval cells, to produce pigment, and the fact that the production of melanin is under the control of the pituitary, adrenal, and gonads—other derivatives of nervous tissue.

Differentiation between pigmented nevi, and other similar lesions such as seborrheic warts and senile keratoses, may be made on the fact that when superficial layers are removed the base is still easily identifiable. Further differentiation may be made on designation in which other lesions form basal or squamous cell carcinomas, whereas pigmented nevi form melanomas.

Malignant degeneration must be suspected when changes in size, shape, or coloration take place. Most common are (1) the small deeply pigmented nevi, with or without hairs, which occur especially on the extremities, and (2) the soft, smooth, slightly elevated, moderately pigmented mole, which is not common on the extremities. From 30 to 60 per cent of malignant melanomas arise from recognizable pigmented nevi, fewer, however, arise from the hairy types. They may occur at any age from 6 months on, however, the average age of onset is 50 years. Usually, they do not metastasize before puberty. They occur anywhere—most frequently on the head, neck, foot, and trunk.

Prophylaxis consists of removal. Criteria have been established to include those that are darkly pigmented, those appearing suddenly late in life, those subjected to trauma and irritation, those which show increased pigmentation, and those that show signs of hemorrhage.

Methods of treating nevi vary from simple excision or electrocautery to multiple-stage resection of the larger types with removal of the proximal lymphatic chains. In some instances in which disfigurement would be excessive, lesions were irradiated in the hope that a few of them might be radiosensitive. The cure rate in presented case studies has not been higher than 33 per cent, including all types of therapy.

ARMAND D. ALBRECHT, M.D.

**Studies in the Virulence of *Clostridium Welchii***  
W A ALTEMEIER and W L FURSTE *Surgery*,  
1949, 25 12

It has long been recognized that certain types of wounds, such as extensive lacerations, compound fractures, or crushing injuries are particularly prone to develop gas gangrene. In World War I, Callender and Coupal found the incidence of gas gangrene to be from five to six times higher in compound fractures than in soft tissue wounds. Gas gangrene is of multiple bacterial etiology, a great variety of gas-producing anaerobic bacteria have been found associated with this condition, although the fact remains that the *Clostridium welchii* is the principal cause of gas gangrene and was present either alone or in association with other gas-producing anaerobes in from 56 to 100 per cent of the patients who were studied.

Since the *Clostridium welchii* is found in all human environment with widespread distribution in the soil, sewage, the hair of domestic animals, dust, skin, and vaginal tract, contamination of a considerable proportion of the open wounds is almost inevitable, and the average incidence of contamination of 3,027 collected wounds was 15.7 per cent. Nevertheless, clinical gas gangrene is relatively infrequent, with an average incidence as an infectious complication of open wounds of 1.62 per cent. Clinically, when a muscle is deprived of its blood supply for 6 or 8 hours, it usually dies, and hence it becomes a more suitable site for *Clostridium* development. This explains the gas gangrene which sometimes takes place following thrombosis or embolism.

A study to measure accurately the effect of crushed muscle and dirt on the development of gas gangrene, and, if possible, to evaluate the importance of these two factors was undertaken. Measured doses of the *Clostridium welchii* of high virulence were injected into the thigh muscles of guinea pigs which were (a) normal, (b) traumatized by crushing 5 times with a Kocher clamp, and lacerated by a twisting clamp, and (c) traumatized as before with the addition of 1 c.c. of an autoclave and a finely divided mixture of soil and cinders in the wound just before closure.

It was found that 1,000 times fewer bacteria were required to produce fatal gas gangrene in lacerated muscle than in healthy muscle, and that 1,000,000 times fewer bacteria were required to produce fatal gas gangrene in the presence of devitalized muscle and dirt than when injections were made directly into healthy muscle.

The factors governing the virulence of the same strain of *Clostridium welchii* are not well known. It is clear that the potential virulence of the same strain may vary considerably, even under apparently identical conditions (passage through pancreatic digest medium enhances the virulence of the strain of *Clostridia* used in these experiments, as does weekly passage through pigeons).

FRANK B. QUEEN, M.D.

**Blastomycosis Infestation with the *Paracoccidioides Brasiliensis*** *Anatomopathologic Study and Fluorescent Coloration of the Parasite* (Blastomycosis por paracoccidioides brasiliensis estudio anatomopatológico y coloración fluorescente del parásito) JUAN C. RADICE and SALOMÓN KAPLAN *Rev. As. méd. argent.*, 1949, 63 61

The cadaver turned over to the authors for study presented numerous lesions of the mouth, trachea, bronchial tree and lungs, right suprarenal gland, and both lobes of the cerebrum. There were suggestive lesions palpable in other organs (spleen and pancreas), however, those cited were the only ones subjected to extensive study. All the lesions examined were either in the form of ulcerations, nodular infiltrations, or abscesses, and all were typical of the reported lesions of blastomycosis, that is, they were not easy to distinguish from those of tuberculosis.

For more definite and more frequent recognition of the parasite the authors resorted to a special method of treatment of the tissues. The tissues were fixed in alcohol, cut into microscopic sections (7 microns) by the usual paraffin fixation method, then the paraffin was removed with xylol, and the section was rehydrated with decreasing strengths of alcohol and treated with phosphomolybdic acid (1 per cent) for a half hour and then stained with primulin (1 to 5,000) for 24 hours. The tissue sections were then dehydrated a second time, cleared with xylol, and mounted in Canada balsam. The preparation was then exposed to the rays of the sun or to rather long waves (3,600 U.A.) of ultraviolet light. When rendered fluorescent the sections were examined by means of special filters and a special fluorescent microscope.

The *Paracoccidioides brasiliensis* is identifiable by its fluorescent effects. It has a secondary fluorescence, colorless, brilliant, and luminous. The parasites were found in the giant cells in the pulmonary tissues, in the suprarenal gland tissues, and in the tissues of the brain. In each case, and especially in the brain tissues, it was found that by this method of fluorescent staining the limits of the lesions could be more accurately determined, the parasite could be more surely recognized, and that the organisms could be found much more frequently than with ordinary hematoxylin-eosin staining.

JOHN W. BRENNAN, M.D.

**Studies on the Self-Disinfecting Power of the Skin** A. HELLAT *Ann. med. exp. biol. fenn.*, 1948, 17 Supp. 8

In the present study, the author seeks to explore and appraise the problem of self-disinfection of the skin. Hellat attempts to determine whether the skin possesses self-disinfecting powers. If so, he wishes to determine the nature of this power if it is detectable. Finally, he attempts to determine whether the self-disinfecting mechanisms of the skin may account for the type of microflora found upon normal skin.

In this investigation, various test organisms were used and the tests were conducted in the Second



Surgical Clinic of the University of Helsinki All tests were performed upon normal healthy skin which had been kept unwashed for at least 3 days The skin was not shaved at any time

Some 13 experiments were performed with use of the various test media upon the skin of the forearm, palm, and sole of the foot, as well as in the armpit As a result of these experiments it was shown that the survival of bacteria differs greatly even under favorable conditions Further, the author is certain that no highly active bactericidal or inhibitory agent was found in the skin, with the possible exception of lysozyme

BENJAMIN GOLDMAN, M D

**Lack of Extractable Carcinogens in the Skin of Patients with Multiple Precancerous Keratoses of Actinic Origin** *FREDERIC E MOHS Cancer Res*, 1948, 8 371

The possibility that the skin of patients with multiple precancerous keratoses of actinic origin might contain extractable carcinogenic chemicals was considered and investigated Twelve patients with such lesions, and who previously had carcinoma, were selected for study All were instructed to wash one side of the face daily with benzene on gauze pads, saving the pads for extraction This material was then extracted and concentrated

Painting the skin of mice with this extract three times weekly for a period of 1 year produced no neoplastic changes The addition of croton oil to the benzene extract produced some thickening and ulceration of the skin, but no carcinomas A group of mice were then given ultraviolet radiation to both ears, and the right ears were painted with the extract, however, the results showed no augmenting effect of the skin extracts, and carcinomas developed on both ears equally Subcutaneous injections of the extract into mice produced no neoplasms, and similar results were obtained by the implantation of whole keratoses The patients showed no difference in the two sides of their faces as the result of washing with benzene, since carcinomas developed with equal frequency on the washed and unwashed sides

These findings are believed to be evidence in favor of the hypothesis that the carcinogenic influence of ultraviolet rays is exerted by a direct effect upon the cell constituent responsible for neoplastic change rather than the formation of a carcinogenic chemical

ROBERT MAYO TENERY, M D

**The Cancer Problem** *C P RHOADS J Urol*, Balt, 1948, 60 797

The author states that outstanding developments in the induction and control of cancer in man have come from the study of the bladder, prostate, and adrenal glands

The bladder cancer which follows exposure to B-naphthylamine is the only instance of the production of a malignant tumor in man by a pure chemical compound of known composition

Its induction led, furthermore, to the demonstration that certain forms of experimental cancer, due

to the administration of azo dyes to animals fed inadequate diets, can be prevented by specific food constituents

The second great contribution of urology to cancer was a procedure for the potential control of human neoplasms From a mass of standard experimental work, it was more than obvious that the prostate, like the breast, requires a hormone (male in this case) not only for its development but for its very existence

The author points out that castration, at least temporarily, causes cessation of growth of the neoplastic cells

The author then goes on to discuss the history of tar as a cause of cancer and how British workers isolated pure crystals from tar that proved to be cancer-producing Shortly afterward the molecules of pure female and male hormone were described

It was obvious that the cancer-producing substance from tar and the steroid sex hormones had some similarity

The chemical relationship between carcinogen and steroid hormone suggested, of course, the most important concept since the observation of Pott This was that cancer in man may be due perhaps to a manufacturing mistake by the body in which there is formed a carcinogen instead of a natural hormone

Two very well established, but oftentimes forgotten, clinical facts show adequately the participation of some systemic generalized factor in the cause of cancer The first of these is the rather frequent occurrence of multiple primary cancers Every student who has investigated this subject has provided confirmatory information A recent and important study is that of Warren and Ehrenreich, who showed that at autopsy 6.8 per cent of their patients dying of cancer had multiple primary growths, and these were not the simple multiple primaries involved in the tiny, comparatively benign, basal-celled epitheliomas of the skin

Rather more important in support of this thesis of the systemic or biochemical metabolic origin of cancer is the astonishing tendency of cancer of the same organ to occur coincidentally in single-ovum twins The proof that this is truly a matter of the similar genes of the monozygotic twins is at hand because of the fact that of 13 pairs of double-ovum twins with tumors of one, only 2 presented involvement of the second twin Macklin's series of similar and dissimilar tumors in twins, both of whom were affected with tumors, is particularly interesting Among the monozygotic twins, there were 22 similar tumors and only 1 dissimilar tumor, whereas among the dizygotic twins, there were only 6 similar and 7 dissimilar tumors

Support for the systemic origin of cancer is found in seven other factors

1 The tendency of testicular tumors to occur in cryptorchids, and their treatment by pituitary extracts

2 The occurrence of uterine cancer with granulosa-cell tumors of the ovary



3 The experimental production of adrenal tumors by the castration of certain strains of very young animals and by the intrasplenic transplantation of genital tissue

4 The effect of biologically active steroids on cancer of the prostate gland in man and of the breast in women is well known

5 The administration of estradiol to experimental animals is capable of producing regularly no less than five different types of malignant neoplasms

6 There is a profound peak for many forms of cancer at the age of the menarche and menopause, and sex-linked cancer is enormously common, so much so as to make reasonable the statement that the malignant neoplasm is one of the most fundamental importance

7 The geographical incidence of cancer provides further confirmatory evidence for the etiologic role of a general disorder

The author then discusses the search for endocrine substance in the urine of individuals with cancer

He notes certain compounds are absent in individuals with cancer and other substances not found in normal urine are found in the urine of individuals with specific types of cancer. One substance in particular "Δ<sup>9</sup>Etiocholone" is of particular interest

He presents an interesting case in which the urine was studied for 2 years prior to discovery of the cancer and for several years after its excision

Paget's disease is a condition peculiarly liable to be due to, or associated with, an abnormality of steroid hormone metabolism, because of the important role played by these hormones in bone growth and calcification

For these reasons an ideal patient with Paget's disease was hospitalized for a long period and patterns of urinary steroid excretion were prepared. An extraordinary abnormality was apparent. One wholly new steroid, of a type never found in any other urine, was present.

The author states that they have found that in patients with cancer there is adequate evidence indicating a disturbed manufacture of steroid hormones, a fact which is significant but not specific for the disorder. He suggests that before cancer is obvious a similar disturbance of hormone manufacture is present. He has evidence that in conditions which are fully accepted as precancerous (notably Paget's disease of bone) abnormalities of steroid hormone excretion are present, a fact which warrants the belief that this condition is endocrinologic in origin.

GEORGE W. RICHARDSON, M.D.

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\* \* \*

## SERIOUS COMPLICATIONS

*"The frequency of such contamination is attested by the increasing number of case reports of serious complications due to talc. Animal experiments show that the granulomatous reaction can be regularly produced in the peritoneum, pleura, pericardium, muscle, joint, nerve and tendon"<sup>1</sup>*

## FOREIGN BODY REACTION

German<sup>2,3</sup> found intra-abdominal granulomata which he proved came from foreign body reaction to talc in 40 out of 50 unselected patients subjected to a second laparotomy

\* \* \*

Seelig<sup>4,5</sup> repeatedly demonstrated the danger of talc in mice, which are notably resistant to the production of adhesions, by injecting 2cc of a 5% saline suspension of the powder intra-peritoneally, and has stated that "the average surgeon cannot possibly perform this experiment and ever afterward face talcum powder with equanimity"

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## SAFETY CONFIRMED

*The findings of Lee and Lehman<sup>6</sup> that Bio-Sorb is safe have been confirmed by Lindenmuth<sup>7</sup> and MacQuiddy<sup>8</sup>. Postlethwait et al<sup>1</sup> concluded that "talc is a dangerous agent in its present use as a surgical glove lubricant," and stated that "a modified starch powder (Bio-Sorb) which is absorbed with little or no reaction is again suggested as a satisfactory substitute for talc"*

\* \* \*

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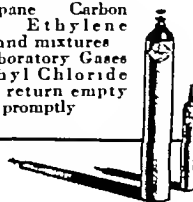
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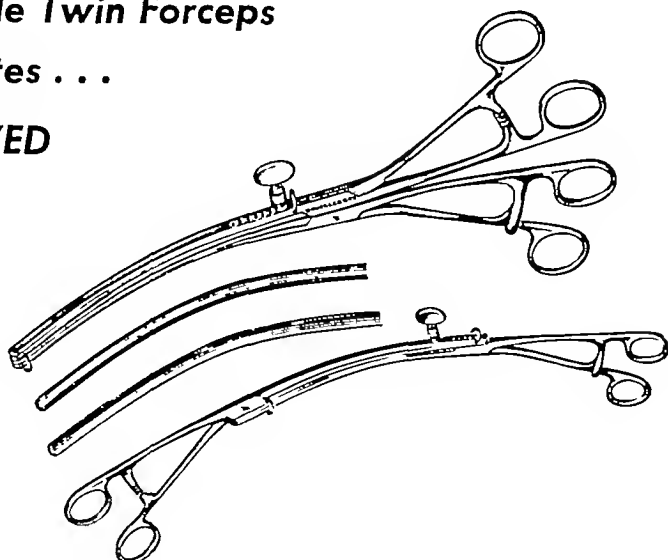
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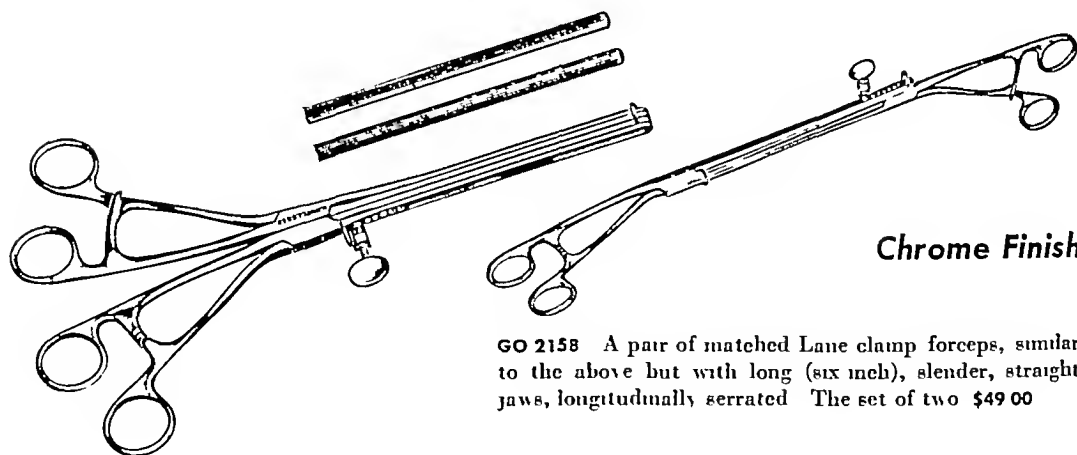
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# SURGERY

## GYNECOLOGY AND OBSTETRICS

VOLUME 89

NOVEMBER, 1949

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### EXPERIMENTAL ASCITES

#### Effects of Sodium Chloride and Protein Intake on Protein Metabolism of Dogs with Constricted Inferior Vena Cava

F W McKEE, M D, J A SCHILLING, M D, G H TISHKOFF, B S, and  
R E HYATT, A B, Rochester, New York

**A**SCITES may be produced experimentally in dogs by constricting the inferior vena cava above the diaphragm, with an aluminum band. The protein content and the amount of ascitic fluid formed in these animals may be predictably influenced by the protein or sodium chloride intake. The fluid content of the peritoneal cavity shares to a greater or lesser degree in the expansion and contraction of the interstitial fluid volume, though in an altered way when abnormal hydrostatic, osmotic, or permeability factors exist in the portal system. The removal of ascitic fluid is essentially an internal plasmapheresis in that it represents a removal of protein from the circulating plasma and tissue protein stores. Also the ascitic fluid protein may enter into the dynamic protein equilibrium of the body. The purpose of this paper is to report further observations (47) on our experimental animals, to describe the surgical technique, and to review the pertinent literature.

Ascites has been noted clinically for many centuries. The literature is replete with case reports and treatments of this symptom which has many causes. These causes may be listed

under several headings: cardiovascular, hepatic, renal, inflammatory, neoplastic, nutritional, and idiopathic. Bright in 1839, classified the causes of ascites and effusions very completely with descriptive case reports. The lucid descriptions of Flint (28) in 1863, have hardly been surpassed in recent literature. In reviewing the reports of surgical and medical methods of treatment of ascites little may be found regarding the actual nature of this symptom. Most of these reports are of historic interest only. Medically such drugs and methods as the mercurials, iodine, strychnine, quinine, adrenalin, camphor, pilocarpin, tobacco, digitalis, intraperitoneal alcohol, ether, sclerosing agents, and claret, chloroform, African honey, oxygen, oil of copaiba, electrical stimulation, compression, decompression, etc. have been recorded with beneficial results. Little attention was given to exact diagnoses and most of the cures reported were probably due to bed rest and improved nutrition.

Surgically symptomatic relief from intractable ascites of one cause or another has been attempted in various ways. Most frequently repeated paracenteses (29) have been carried out. Second, attempts have been made to devise a more permanent form of drainage of ascitic fluid from the peritoneal cavity sub-

From the Departments of Pathology and Surgery, The University of Rochester School of Medicine and Dentistry.



cutaneous buttons of rubber or glass into the peritoneal cavity (54, 63, 20, 42), a subcutaneous tunnel of omentum (55), anastomosis of the peritoneum to the saphenous veins (5) or renal pelvis (27), the use of "lymphatic lined" tubes from silk sutures (62, 46), parafined veins (4), cannulas to the external surface of the abdomen with a detachable cap (17), subcutaneous dermic fistulas (40), and finally resection of the parietal peritoneum (52) has been attempted. A third approach has been to attempt to improve the collateral circulation of the hypertensive portal system. Methods in this group include the Talma (62) Drummond-Morrison (23) omentopexy, anastomoses of sigmoidal to saphenous veins (3), splenic to renal veins (7), superior mesenteric to vena cava (14, 51), and finally the Eck fistula (24) used by Krestowsky, Rosenstein, and most recently by Whipple (65) and Blake-more (6). A fourth surgical method has been laparotomy in females with unexplained ascites and excision of pelvic tumors if present (2). These cases of ascites associated with pelvic tumors comprise a small but very interesting group. When associated with a hydrothorax both effusions may be cured by excision of the ovarian fibroma. This method was first described and reported by Cabot from the Massachusetts General Hospital in Boston though recently it has been emphasized by Meigs and many others in the last decade. The etiological factors of this bizarre syndrome are unknown. Lastly splenectomy (65) or enterectomy (31) has been employed to reduce the quantity of portal blood flow to the liver in cases of portal obstruction where hematemesis rather than ascites often was the main symptom. It is not the purpose of this communication to discuss the merits and results of the above various forms of therapy. These may be obtained in the above references and the following reviews (18, 36, 65).

Experimental methods for production of ascites are few. Bollman (8) ligated the common bile duct in dogs. Ascites regularly occurred and increased after a high protein diet. Massive saline infusions are known to increase the peritoneal fluid content in moderate amounts (19). Wangenstein mimicked ascites by introduction of tap water under pressure

The most reliable method has been the constriction of the inferior vena cava above the liver. This procedure was carried out in conjunction with other work by Whipple and Sperry (66) through a transthoracic approach by use of sutures to constrict the vena cava above the diaphragm. Bolton (10) constricted the pericardium around the right auricle by sutures and was able to cause ascites in cats. In later years (11, 12, 13) he used ligatures and metal bands around the vena cava above the liver. Zimmerman and Hillsman used an aluminum band successfully in 1930. Kershner and associates, in 1946, in multiple stages ligated the inferior vena cava above the liver with ligatures. The mortality rate among their animals was prohibitive, however. Bollman (9) has recently employed cellophane bands above the liver around the inferior vena cava with production of ascites after an unpredictable interval of fibrosis about the vessel. Below the liver, cellophane bands failed to produce ascites, when placed around the portal vein. Ascites could be produced at a later date in these animals by constricting the vena cava above the liver.

Ascitic fluid has also been investigated extensively as a transudate under clinical and experimental conditions (33). This subject has been recently reviewed by Armstrong, Patek and his associates, Mankin and Lowell, Gibson, and Peters. Their experimental observations indicated that the flow of water between plasma and ascitic fluid was not entirely in accord with Starling's original hypothesis. Ascitic fluid formation was not determined solely by the level of plasma oncotic pressure, i.e., plasma albumin. They suggested other factors, namely, changes in permeability in the portal vascular bed and in sodium chloride and water metabolism. The importance of the sodium ion in the production of edema is now generally recognized though it was first suggested by Herringham and Hadfield, in 1905. The recent experimental work of Rall, Farnsworth, Merrill, Luetscher and Hall (44), Eder and associates, and Fox, in addition to that of the aforementioned investigators, may be referred to for detailed discussions regarding the mechanism of ascitic fluid formation, the relation of the sodium ion, and the

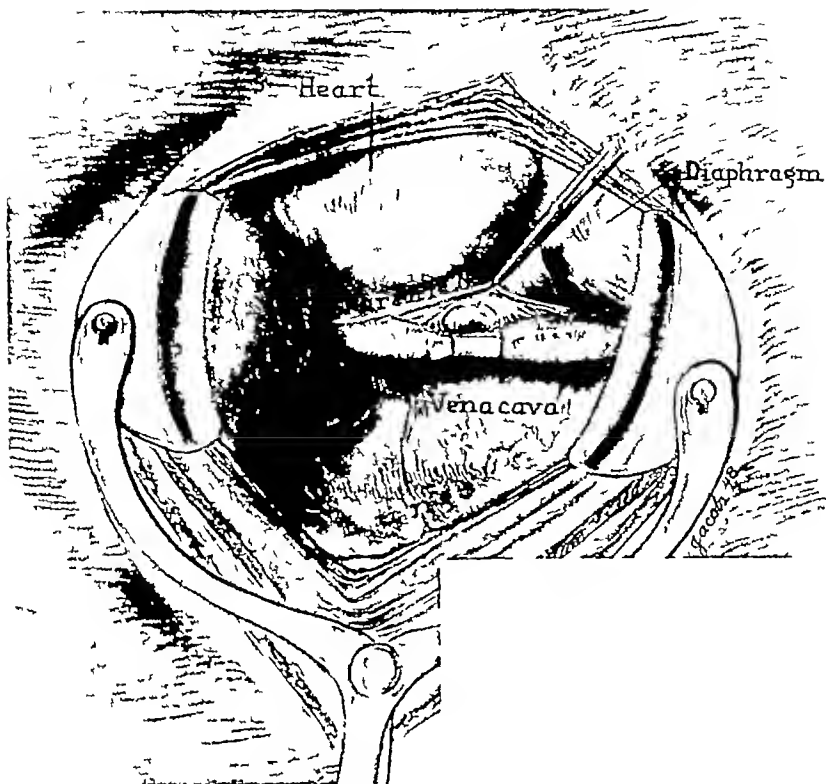


Fig 1 Anatomical relations of inferior vena cava in the chest showing site of constricting band

role of the underlying pathological process. Specific mention should be made of the experimental findings of Grindlay and his associates. They were able to demonstrate that there was a marked increase in hepatic lymph flow following chronic obstruction of the inferior vena cava above the liver with cellophane bands. The liver lymphatics became greatly dilated and enlarged. The lymphatics of the spleen and mesentery were not engorged. Finally mention should be made of the use of ascitic fluid as a blood substitute (21, 22, 50). This is of interest particularly because of the similarity between the protein composition of ascitic fluid and plasma (43) (Fig 2).

#### METHODS

Normal healthy dogs, averaging 8 to 10 kilograms, were used in these experiments. The animals had been in the animal house under routine care a number of months before use and were fed a kennel diet of hospital

scraps mixed with prepared dog food. The animals were free of distemper and any discernible intestinal parasitic infestation. Prior to operation the animals were placed in metabolism cages in the laboratory and constantly observed. Here nitrogen balance studies were carried out. Blood proteins, weight, fluid intake and urine output were recorded in this control period. Fibrinogen levels and sodium chloride studies were made in some animals. The animals were fasted 24 hours before operation, and then anesthetized with intravenous veterinary nembutal. The initial dose averaged 65 milligrams per 24 kilograms of body weight or 1 grain per 5 pounds. The drug was injected slowly at first to determine any sensitivity, then fairly rapidly to within 1 cubic centimeter or 65 milligrams of the required dose. The remainder of the drug was then injected slowly depending on the animal's reaction. A lateral leg vein was usually used with the animal in a comfortable lying

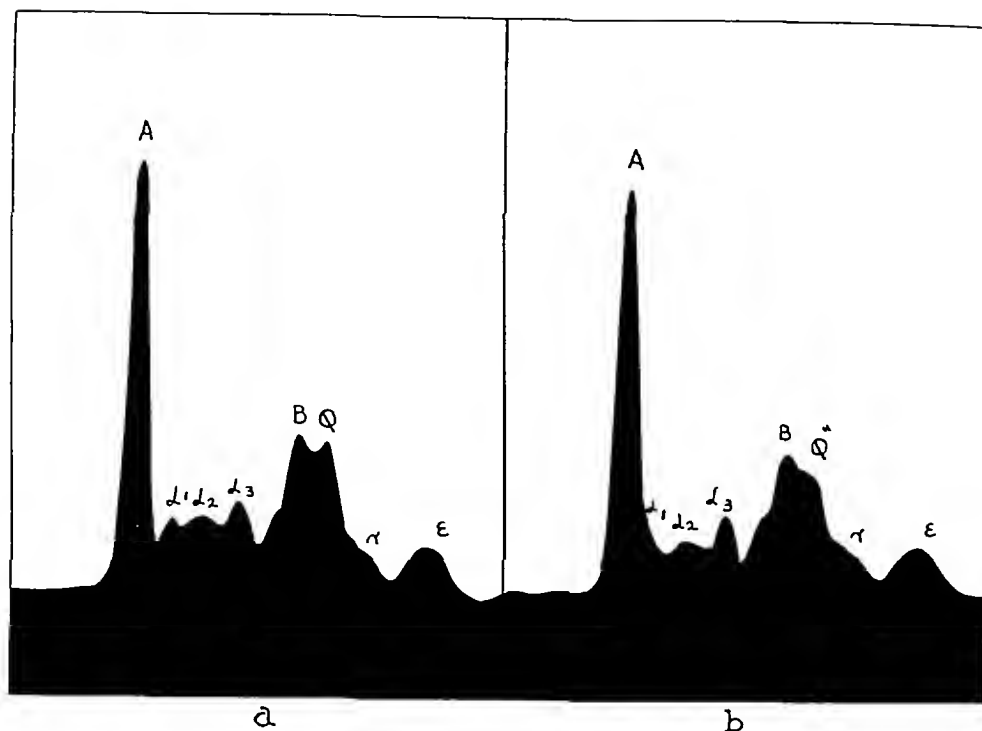


Fig 2 Electrophoretic patterns of plasma, a, and ascitic fluid, b, protein of Dog 42-893 drawn on consecutive days

position on the table and an assistant patting and talking to the animal. This has been very effective in allaying apprehension and reduces the amount of nembutal necessary. The animal was then gently placed on his left side and the right chest was clipped and shaved. A continuous infusion of normal saline was started in one of the accessible hind leg veins. This served to maintain the animal's fluid balance during the operation and also to provide a readily available route for repeated injections of small amounts of nembutal when necessary to support a satisfactory plane of surgical anesthesia. An intratracheal tube was then introduced and the balloon distended to make a closed system. A Foley catheter served very well for this purpose. The right chest was then cleansed with soap, water, alcohol, and zephiran, and draped. An incision was made over the 6th or 7th interspace from the costochondral junction of the ribs anteriorly to their posterior angle. The skin, subcutaneous tissue, and external fascia were divided. The latissimus dorsi was cut transversely. The in-

terdigitations of the serratus anterior were separated and the intercostal muscles cut, with exposure of the pleura. At this point the intratracheal tube was connected to a positive, alternating oxygen pressure device of Gunkler. The pleura was incised and the lower lobes of the right lung allowed to collapse. A self-retaining retractor was inserted which gave adequate exposure without rib resection. They were gently moved upward and lateralward, covered with a moist sponge, and the inferior vena cava was exposed as it traversed the pleural cavity from right auricle to diaphragm. This is shown in Figure 1. The vein was easily freed from its pleural reflections and the phrenic nerve, which was intimately associated with the vein, was readily dissected away. The diameter of the vein was accurately measured with a caliper and a malleable aluminum band 1 centimeter in width was placed around the inferior vena cava midway between the heart and diaphragm. The band was then constricted in a circular fashion so that the resulting lumen of the vein was one-half of its original

diameter. The lobes of the lung were then replaced and allowed to re-expand. The wound edges were approximated by two No. 2 chromic catgut sutures around the rib above and below the incision. The remaining layers were closed with continuous or interrupted No. 000 silk sutures. Interrupted No. 00 plain catgut continuous subcuticular suture was then placed in the dermis. If interrupted silk sutures are used for the skin instead, a jacket should be placed on the animal. Ordinarily, if the animal can lick the wound, healing is better without a dressing or covering of any sort. Strict hemostasis and aseptic technique were observed throughout. When the pleura was completely closed, the positive pressure was discontinued, and the balloon of the intra-tracheal catheter released, allowing the dog to take over his own respirations. Due to the mobility of the dog's mediastinum this was the only critical period in the anesthesia. However, if care is taken at this stage to avoid a sucking wound and pneumothorax with collapse of the lung after re-expansion has been carried out, no difficulty will ensue. The animal was then placed in his cage and observed. Recovery was usually prompt. Kennel diet and water were allowed ad libitum the next day. The animal was then given a rest period of observation of 3 weeks or more on a high protein, low salt diet until the wound was completely healed and all outward effects of the operation were over. Ascitic fluid accumulation was detected within a few days in each of the dogs studied.

Determination of blood total protein and albumin, ascitic fluid total protein and nitrogen, and urinary nitrogen were made throughout the experiment at semi-weekly intervals, in order to study variations in the levels of the plasma and ascitic fluid protein constituents, and to establish the course of the nitrogen balance under the varied experimental conditions. The plasma and ascitic fluid total protein levels, together with the amounts of protein and volume of ascitic fluid removed at each paracentesis are recorded in graphs (Figs. 4 and 5). Exact data concerning analytical methods, the albumin content of the plasma and ascitic fluid, hematocrit and fibrinogen levels, and



Fig. 3. Infra red photograph showing collateral circulation of abdominal wall of dog 42-893.

nitrogen balance variations, were presented in the previous report (47), and will be referred to in general terms only.

The ascitic fluid was usually reddish with a specific gravity of 1.012–1.018, and a hematocrit of 1.0 to 0.2 per cent. The protein content fluctuated considerably under the experimental conditions, an observation readily apparent from the graphs. Electrophoretic studies showed a striking similarity of plasma and ascitic fluid protein composition, and Figure 2 illustrates a pattern comparison of these two fluids drawn on consecutive days and represented in Figure 4 period 3–4 when the plasma protein level was 7.5 grams per cent, and the ascitic fluid protein 6.3 grams per cent respectively. We are indebted to Dr. Eric Alling for performing and interpreting the electrophoretic studies.

#### EXPERIMENTAL OBSERVATIONS

The 2 dogs described in this report followed similar postoperative courses. Accumulation of ascitic fluid began a few days postoperatively, and weekly paracenteses were carried out. In 1 dog on which the operation of vein con-

# SURGERY, GYNECOLOGY AND OBSTETRICS

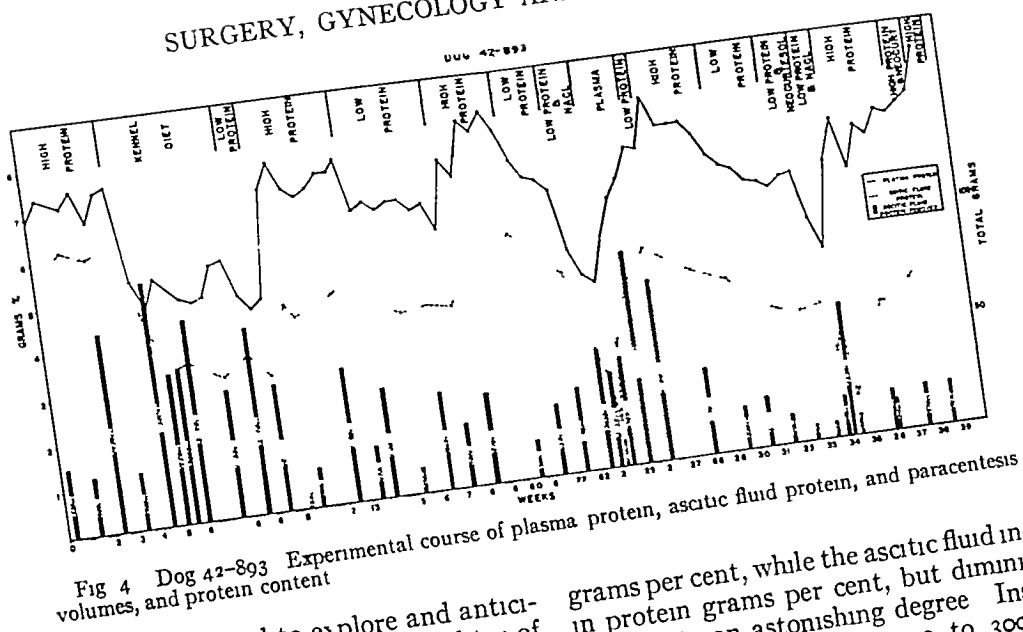


Fig 4 Dog 42-893 Experimental course of plasma protein, ascitic fluid protein, and paracentesis volumes, and protein content

restriction was performed to explore and anticipate difficulties in technique, about 1 liter of clear yellow fluid was found in the peritoneal cavity when the animal was sacrificed under ether anesthesia 5 days later.

Collateral circulation became evident in 4 to 6 weeks following operation. This is particularly evident in the female of the 2 dogs studied, since this animal had apparently had numerous offspring and had well developed mammary vessels. Figure 3 is an infra-red photograph illustrating this.

During the postoperative recovery period it was noted that the plasma protein levels gradually diminished and the ascitic fluid steadily accumulated. At the time, the kennel diet was largely a mixture of vegetable matter and grains (wheat, rice, and potatoes), and though not analyzed was definitely on the low protein side. About 5 weeks after the operation, the dog, 42-893, was placed on a high protein diet (period 1-4, graph I, Fig 4) consisting of 200 grams of cooked soy bean meal, 200 grams of cooked horsemeat, added vitamins and ferric citrate solution, with a daily nitrogen intake of 13.6 grams.

Graph I (Fig 4) illustrates the sequence of events and the response to high and low protein diets, with additions of sodium chloride and sodium-free seasoning, and intravenous plasma.

On the high protein diet, the plasma protein level rose rapidly to its former level of over 7.0

grams per cent, while the ascitic fluid increased in protein grams per cent, but diminished in amount to an astonishing degree. Instead of weekly paracenteses of 2500 to 3000 cubic centimeters of fluid, with amounts of protein up to 100 grams, weekly amounts of 400 to 500 cubic centimeters with one exception were evacuated with only 25 grams of protein therein. The dog was returned to kennel diet (period 4-9, Fig 4) after 4 weeks of high protein diet, and immediately the fluid began to accumulate with concomitant fall in plasma protein levels. During this 5 week period, 6 paracenteses were performed yielding 13,060 cubic centimeters of fluid containing 475 grams of protein (a weekly average of 95 grams) while the animal's plasma proteins fell to slightly below 5.0 grams per cent. During the following 4 week period on high protein regimen (period 9-13, Fig 4) three paracenteses, yielding 1710 cubic centimeters of ascitic fluid containing 77.4 grams of protein, were performed and the dog's plasma protein level rose to and remained above 7.0 grams per cent.

In attempting to establish nitrogen balance studies, the dog was placed on a standard low protein diet with a known nitrogen content for 4 weeks (periods 13-17, Fig 4). This diet consisted of sucrose, lard, bone ash, vitamin supplements, with 30 grams of ground liver or horsemeat, and 600 milligrams of iron as ferric citrate. The nitrogen content was 1.5 grams

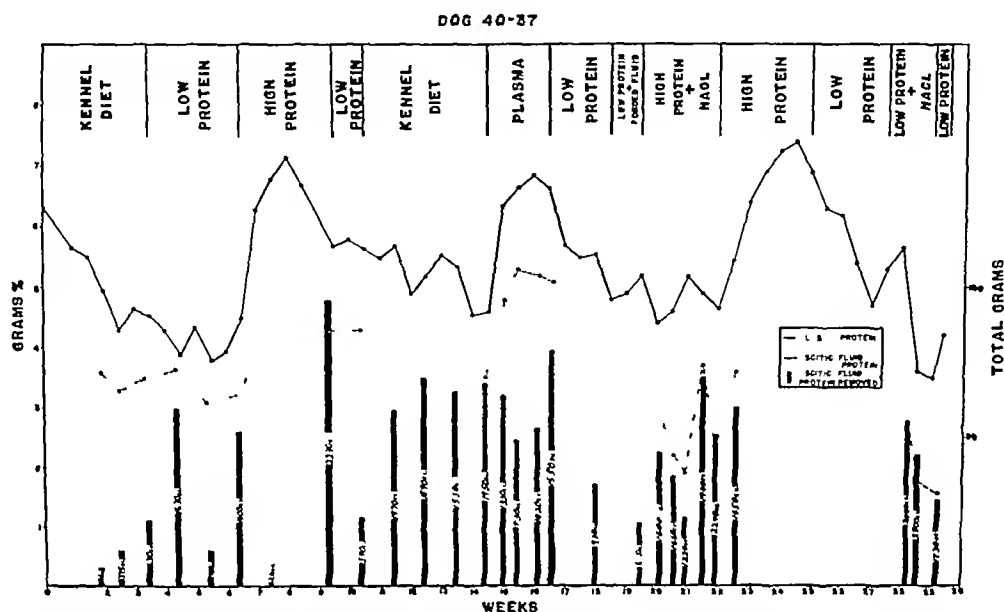


Fig 5 Dog 40-37 Experimental course of plasma protein, ascitic fluid protein, and paracentesis volumes and protein content

daily During the low protein interval, the plasma protein stabilized at slightly over 6 grams per cent Four paracenteses, which yielded 2905 cubic centimeters of ascitic fluid containing 128 grams of protein, were performed in this period, a decided contrast to the output of fluid and protein noted while the animal was on the kennel diet, also a low protein regimen Suspicion arose that factors other than protein intake were responsible for the fluid accumulation, or failure to accumulate One of these factors was presumed to be sodium chloride

Consequently after a period of rest on a high protein diet (period 17-20, Fig 4) and a period of exposure to low protein diet and stabilization of the plasma protein level at about 6 grams per cent (period 20-23 Fig 4), an additional 6 grams of sodium chloride in capsule form were given daily for a 10 day period (period 23-24, Fig 4) Immediately the ascitic fluid accumulation increased, fluid relatively poor in protein, while the plasma protein level dropped During this period three paracenteses, yielding 5390 cubic centimeters of ascitic fluid containing 110.5 grams of protein, were performed and the plasma protein levels fell to 4.0 grams per cent These

results compare favorably with findings noted in period 4-9 when the animal was on the kennel diet

In view of the remarkable change in both the circulating plasma protein levels, and the ascitic fluid production, brought about by the liberal addition of sodium chloride to the diet, it seemed pertinent to try a sodium free seasoning agent as another means of checking the relation of the sodium ion to ascitic fluid production For this purpose we used a sodium-free agent,<sup>1</sup> the trade name for which is neocurtasal<sup>1</sup>

After a 3 week period of rest on the standard high protein diet (period 26-30, Fig 4), and a maintenance period on the standard low protein diet (period 30-32, Fig 4), with stabilization of the plasma protein level at slightly under 6 grams per cent, the dog was given 6 grams of sodium free seasoning agent in capsule form daily for a 10 day period (period 32-34, Fig 4) The plasma protein level did not perceptibly change during this interval, and remained just under 6 grams per cent There were no untoward or toxic effects of the drug,

<sup>1</sup>The formula for the compound is potassium chloride 66.0 per cent ammonium chloride 12.0 per cent starch 17.0 per cent, potassium formate 3.0 per cent, calcium formate 1.0 per cent, and magnesium citrate 1.0 per cent The compound has a saline taste

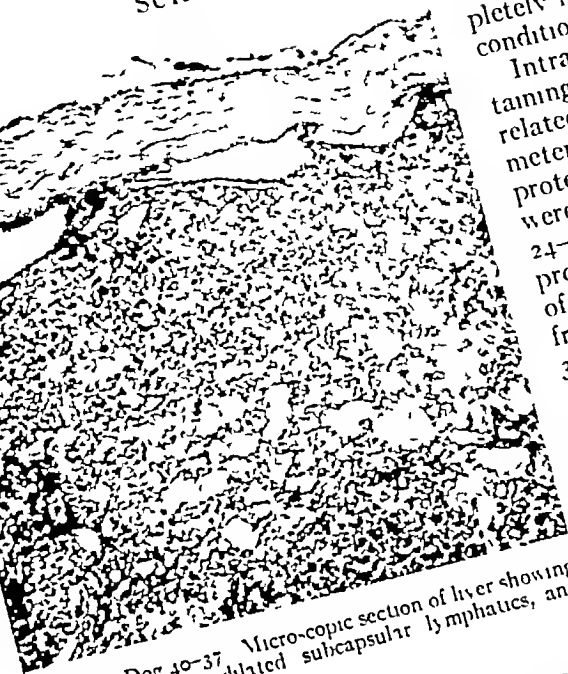


Fig 6 Dog 40-37 Microscopic section of liver showing thickened capsule, dilated subcapsular lymphatics, and dilated blood sinusoids

sodium-free seasoning agent indicating a completely neutral role in the fluid accumulating conditions of these experiments

Intravenous plasma as a method of maintaining the dog's protein level was tried as a related experiment. About 350 cubic centimeters of whole heparinized dog plasma with a protein content averaging about 22 grams were given daily for a 2 week period (period 24-26 Fig 4). Both plasma and ascitic fluid protein percent rose but the increased amount of ascitic fluid formation necessitated more frequent tappings. During the 2 week period 3 paracenteses were performed, which yielded 5810 cubic centimeters of ascitic fluid containing 232.6 grams of protein. Since during this period 306.4 grams of protein as plasma protein were administered, this represents a loss into the ascitic fluid equivalent to 75 per cent of the injected protein. A second administration of plasma to the same dog for a similar period, which is not shown on the graph, resulted in a loss equivalent to 65 per cent of the injected protein, 197 grams of protein being removed as ascites against 301 grams administered as plasma protein.

Throughout the experiments the urinary nitrogen kept pace with protein intake, and the nitrogen balance studies revealed a positive balance when the animal was on a high protein diet and building plasma protein, and a negative nitrogen balance when the dog was on a low protein diet and the plasma protein was falling.

A second dog, 40-37, a male, was surgically prepared in the same manner, though the band was not so tightly constricted. The responses to diet are illustrated in graph II, Figure 5 and are much the same as in the first dog with concomitant rises and falls in the plasma and ascitic fluid protein percentage levels. During the periods of high protein regimen, the plasma and ascitic fluid protein percentage rose while both the amount and total protein content of the ascitic fluid fell. The reverse was observed during periods of reduced protein intake.

Intravenous plasma was also given to an animal with results similar to those of the first dog. During the 2 week period (period 14-16 Fig 5) four paracenteses

the animal remained alert, active, and in good health with formation of only a small amount (670 cc) of ascitic fluid containing 20 grams of protein. Immediately following this 10 day period, the dog was continued for a 7 day period (period 34-35 Fig 4) on the low protein diet, with 6 grams of sodium chloride replacing the 6 grams of neocurtal. Immediately the plasma protein level began to fall and fell steadily reaching 4.2 grams per cent at the end of the period. Increased amounts of ascitic fluid necessitated three paracenteses totalling 4250 cubic centimeters and containing 60 grams of protein during this period. It is readily apparent that the sodium ion is an important factor in the ascitic fluid formation in this type of experimental animal.

After a 3 week period of recovery on a high protein diet (period 34-37 Fig 4) the animal was carried for an additional week on the neocurtal daily in addition (period 38 Fig 4). The protein level was maintained during this interval at slightly over 7 grams per cent, and only a small amount (450 cc) of ascitic fluid containing 18.8 grams of protein was formed. This provides further information about the

necessary, with 4830 cubic centimeters of ascitic fluid containing 245 grams of protein resulting. Plasma protein level rose from 4.7 grams per cent to 6.7 grams per cent during the period of plasma infusion. The dog received 321 grams of protein as plasma protein during this 2 week span, so that the 245 grams of protein removed in the ascitic fluid represent a loss equivalent to 76 per cent of the administered protein. During the period of plasma injection, the dogs were given 50 grams of glucose together with a multiple vitamin mixture in 300 cubic centimeters of water by stomach tube as a dietary supplement. When the large accumulation of ascites was noted, it was not possible to exclude the additional amount of fluid given in the plasma plus the water by stomach tube as a cause for increased ascitic fluid formation. It was also noted that while the dogs were on the high sodium chloride regimen, the fluid intake quite naturally increased. To rule out increased fluid ingestion per se as a cause or even a contributing cause of ascitic fluid formation, the dog was given 800 cubic centimeters of water plus the previous dose of multiple vitamins each day by stomach tube in addition to its normal desires and diet (period 19-20, Fig. 5). There was no appreciable change in the ascitic fluid accumulation and no change in the plasma protein level during a 1 week period of forced fluid ingestion.

The effects of liberal sodium chloride in conjunction with a high protein diet were also studied (period 20-22, Fig. 5). The animal was given 300 grams of horsemeat with the usual vitamin and iron supplements as a daily diet plus 1 gram of sodium chloride in capsule form six times a day. This experiment was continued for 2 weeks, during which period there was no appreciable rise in the plasma protein per cent. At the beginning of the experiment this plasma protein level stood 5.2 grams per cent, and after 2 weeks with minor fluctuations it had fallen to 4.7 grams per cent in spite of the ample protein intake. There was a marked increase in the formation of ascitic fluid with large amounts of protein therein, and 5 paracenteses containing a total of 233 grams of protein were performed during the 2 week period, none of which yielded less

than 1200 cubic centimeters of fluid. Apparently the protein from the diet, which the animal was able to utilize, was washed out and transformed into ascitic protein as a result of the sodium chloride activity.

Thus far we have described and demonstrated the effects of high and low protein diets, additional sodium chloride, fluid, and sodium-free seasoning agent, and plasma intravenously on the protein metabolism of this type of experimental animal. The anatomical findings are also of interest.

The second dog, 40-37, was operated on initially with placement of the constricting band about the vena cava, on December 18, 1946. A second operation was performed on January 7, 1948 with complete ligation and section of the vena cava. The animal responded poorly from this second procedure and became increasingly inactive, succumbing 13 days after operation. At autopsy approximately 1500 cubic centimeters of ascitic fluid were found. Collateral vessels in the omentum were well developed, with adhesions and connections to the vessels of the peritoneal surfaces. Vessels in the mediastinum and throughout the pleural surfaces of the diaphragm were likewise enlarged. Azygos veins were dilated. Numerous fibrous and fibrinous adhesions were present about the liver. The cause of death was determined to be acute pyloric ulceration with massive intestinal hemorrhage.

The liver weighed 500 grams. There were numerous grayish areas of fibrosis in the capsule and both interlobar adhesions and adhesions to the diaphragm and surrounding structures were present. The parenchyma showed numerous nodular deformities. On section, the organ showed a subcapsular zone measuring about 0.5 centimeter which was greatly congested. Numerous nodular areas of paler regenerating tissue intermingled with darker congested tissue were noted. The central areas were dilated and congested, and appeared dark red against a yellowish gray background.

Histologically, the lobular structure was fairly well preserved. The subcapsular sinusoids and lymphatics were greatly dilated and the sections appeared almost hemangiomatous.



in places (Fig 6) The subcapsular liver cells were large and pale and contained considerable glycogen The remainder of the parenchyma showed numerous focal necroses and the portal vessels were greatly dilated in every case

The first dog, 42-893, is still alive and well, 27 months after placement of the constricting band Biopsy of the liver performed under nembutal anesthesia through a small abdominal incision on June 15, 1948, 22 months after placing the band, showed a similar microscopic picture

Liver function does not seem to be seriously affected Thymol turbidity tests were negative Bromsulfalein clearances showed 6 per cent retention in the first dog, 42-893, 9 months following placement of the band, and a mere trace of retained dye 2 years after operation The second dog, 40-37, showed a 7 per cent retention 6 months after operation Fibrinogen levels vary with the levels of other proteins Blood chloride determinations fell within normal limits, and when the animal was on a diet with extra sodium chloride added, the ascitic fluid chlorides rose as the ascitic fluid proteins declined

#### DISCUSSION

The marked influence of the sodium ion on the accumulation of ascitic fluid and hence on the protein metabolism of this type of experimental animal is indicated This influence is supported actively, as well as passively, by the data presented in this report The administration of 6 grams of sodium chloride daily with both high and low protein diets caused a depression of the plasma protein per cent levels and the accumulation of ascitic fluid containing much of the lost protein The mere forcing of fluids in the absence of sodium chloride, the administration of sodium-free salt in amount equal to the sodium chloride dosage, the administration of diets low in sodium chloride, do not produce this effect The administration of whole dog plasma, containing the normal amount of circulating sodium chloride does produce it, for while there is a rise in circulating plasma protein, there is also a great increase in ascitic fluid protein, equivalent to approximately 75 per cent of the injected plasma protein This effect is similar

to that seen in humans with ascites who receive whole plasma The success of salt-poor or salt-free albumin in the treatment of human ascites may be attributed more to the paucity of sodium chloride in the solution than to the oncotic pressure of the protein

The effect of the high protein diet per se on the accumulation of ascitic fluid in these animals is also noteworthy The amount of ascitic fluid produced is greatly decreased, even though the protein grams per cent therein may be raised Thus by use of a high protein diet, with attention to the sodium intake, the second dog, 40-37, remained free of ascites for 5 weeks (period 23-28, Fig 5) and later for a 3 month period not shown on the graph

The large protein output of the dogs by way of the ascitic fluid compares very favorably with the production of protein by standard hypoproteinemic dogs undergoing plasmapheresis (38) These standard hypoproteinemic animals may reach an output of 70 grams of new plasma protein per week in a 10 kilogram dog The experimental ascitic dog by way of internal plasmapheresis may produce as high as 95 grams of new protein per week (period 4-9, Fig 4) Even allowing for a carry over from the preceding high protein regimen, and the drop in the concentration of the circulating plasma proteins, we have at least a normal high plasma protein output by way of the removed ascitic fluid This suggests that the vascular stasis has not seriously interfered with the ability of the hepatic epithelium to manufacture plasma protein

Recent literature reporting the findings in cirrhotics after albumin therapy and reviewed above (1), raises questions which disturb the validity of Starling's hypothesis The actual source of ascitic fluid is not known, but from the work of Grindlay and our own observations (59), it is suggested that the liver is an important source Experiments in banding and ligating the portal vein and vena cava below the liver fail to produce ascites (9, 58) It seems logical to conclude that the ascitic fluid results from the stasis of blood in the liver sinusoids that dilate with transudation of protein-containing fluid into the subcapsular lymphatics and ultimate accumulation in the peritoneal cavity (Fig 6)

Additional work is needed, particularly observations on human subjects, but there seems to be every indication that the salt free diet and high protein diet have a definite place in the treatment of the ascitic patient, even as in the edematous patient of cardiac and renal disease

# SUMMARY AND CONCLUSIONS

1 Ascites may be produced experimentally in dogs by constricting the inferior vena cava above the diaphragm to about one-half its original diameter, with an aluminum band

2 The transthoracic operative procedure is described in detail

3 Ascitic fluid begins to accumulate within a few days postoperatively, and the rate of formation and protein content are influenced by diet and sodium chloride intake

4 Sodium chloride, added daily to both high and low protein diets, causes a depression in the circulating plasma protein per cent and increased accumulation of ascitic fluid. This ascitic fluid contains the equivalent of much of the lost protein from the circulating plasma

5 Administration of sodium free salts in amounts equal to the sodium chloride dosage and administration of diets low in sodium chloride produces no change in circulating plasma protein per cent and no significant variation in ascitic fluid production

6 Forcing fluids with a low sodium chloride intake produces no change in circulating plasma protein per cent and no significant variation in ascitic fluid production

7 Administration of whole dog plasma intravenously causes a rise in circulating plasma protein per cent, but at the same time promotes a marked increase in ascitic fluid formation and its protein concentration. This increase in ascitic fluid protein content is equivalent to approximately 75 per cent of the injected protein

8 The weekly protein output of the experimental ascitic dog (80-95 grams) compares favorably with that of a standard hypoproteinemic dog undergoing plasmapheresis (70 grams)

9 The question of the source of ascitic fluid is raised

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# THE POSTPHLEBITIC LEG

Results With Femoral Vein Interruption

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IN view of the multiplicity of sequelae and the varied pathologic states that usually follow iliofemoral thrombophlebitis, it is not surprising that more than one type of treatment becomes necessary. However, in our experience, the one essential in therapy is femoral vein interruption. The signs and symptoms as well as the physiologic aspects of the postphlebotic leg have been well described in the literature (1-6, 8-10, 12, 15-31). However, brief mention of the essential phases which led up to the sequelae will bear repetition for a better understanding of the treatment with which this presentation is concerned. The history is frequently so typical, that the diagnosis is obvious. The pathologic changes and the signs and symptoms are in the main the consequences of sustained chronic venous insufficiency. This is manifested by the following sequelae which vary in severity: edema, eczema, pruritis, pigmentation, pain, secondary varicosities, recurrent lymphangitis, indurated cellulitis, and ulcers.

Our discussion pertains chiefly to femoral vein ligation as a therapeutic measure in the treatment of the late results of thrombophlebitis—the postphlebotic leg. Femoral vein interruption as a method of treating these late sequelae, a method which would directly stop the venous back pressure, was suggested by Homans (17) in 1941. He stated that “exploration of the femoral and iliac veins may be called for to correct peripheral vasospasm in the limb served by the diseased vein, to oppose recurrence of attacks of femorohilar thrombophlebitis and conceivably, once the femoral vein has suffered destruction of its valves by earlier attacks, to prevent backflow down the vein, the same purpose for which a varicose vein is divided at the groin. Obviously,

the femoral system, once thrombosed, must suffer the loss of all its valves (there is rarely one in the external iliac vein and none above), so that when the body is erect, the venous return must take collateral, valved pathways. Blood must pour down a valveless vein, and it is therefore reasonable to assume that an old, sclerosed, and canalized femoral vein or external iliac vein is better divided. In 1944, Buxton (8) and his co-workers published the first clinical report on the utilization of femoral vein ligation for the treatment of the postphlebotic state in 21 cases. The majority of these cases consisted of chronic ulcerations, but in some patients the major complaints referred to swelling, pain, and easy fatigue. In most of these cases the superficial varices had been ligated before femoral vein interruption was attempted. The authors were of the opinion that arteriosclerosis was a definite contraindication to femoral vein ligation and established 55 years as the age limit for this operation. The results were good in the ulcer cases but uncertain in the others. This series may be analyzed as follows: In 16 of the 21 patients, improvement was definite, 6 of the 21 developed superficial varicose veins following femoral vein ligation and these were ligated as they appeared, in 7 cases persistent or increased swelling followed operation and of these, 4 were controlled by bed rest, in the 14 ulcer cases, all were improved—complete healing in 4, progressive healing in 4, no change in 4, and in the remaining 3 cases operation was too recent to permit proper evaluation. The following year (1945), Buxton and Collier (7) published a supplemental report and added 3 cases to their original list. Their conclusions were essentially the same as previously reported, that the procedure, femoral vein ligation, was of value only in the presence of stasis ulcers. Linton, Hardy, and Irad (23) reported on 34 patients in 1947 in

cluding a follow-up of 2 to 14 months. In addition to femoral vein (superficial femoral) ligation, interruption and stripping of the long and short saphenous veins were performed. The stripping procedure was extended down to the medial malleolus. At the time of operation, venous pressures of both the superficial and deep veins were ascertained in order to determine whether or not simultaneous ligations were advisable or whether a two stage operation was to be selected. A marked increase in pressure in both veins precluded concomitant ligations. The results were encouraging enough for further clinical use of the method. Again, in 1948, these authors (24) published a supplemental report on 49 patients with the same satisfactory results. They formulated a routine plan for the treatment of ulcer. The ulcer is given first consideration because femoral ligation performed in the presence of an infected ulcer (as most cases actually exist) is fraught with danger. Ordinarily, the ulcer is healed before the femoral vein is interrupted except in the case of very large ulcers in which hospitalization is necessary for wet dressings and elevation followed by skin grafting. The femoral ligation is then performed 10 days later. Penicillin is given preoperatively and postoperatively.

It is appreciated by most workers that bed rest with elevation frequently enables healing of the ulcer, the beneficial effects being directly related to the control of the venous back pressure. In addition the infection is permitted to come under control. It is obvious that edema should be reduced or eliminated before definitive treatment is attempted. Again, it is also evident that edema must be initially prevented immediately postoperatively to give every chance for "takes" with skin grafts. Any of the many suitable elastic leg supports may be utilized. Sclerosing agents for the superficial varices are generally supposed to be contraindicated because of the possible effect on the deep veins. However, it would seem plausible that the development of occasional new varicosities can readily be controlled by sclerosing therapy. An exception to this is the presence of obvious tender superficial thrombotic phlebitis. In addition to clearing up the local infection, epidermophy-

tosis should also be treated since superimposed secondary infection as well as allergic phenomena are common accompaniments. Potassium permanganate in 1:5000 dilution is of value for this complication. When bed rest is not possible and if the ulceration or the cellulitis or both are not marked, ambulatory treatment may also effect a temporary healing. This treatment includes support by elastic bandage, elastic stocking, elastic adhesive, gum rubber bandage, or Unna paste boot. A properly shaped rubber sponge directly over the ulcer and under the elastic support is of real value. For the concomitant eczema or dermatitis, local applications consisting of bland ointments or lotions are salutary. Much time may be saved in cases of large indurated ulcers by excision and split skin grafts. When the induration is more extensive and continuous for varied distances into the adjacent subcutaneous tissues, a Kondoleon or modification of this operation may be done in conjunction with a skin graft.

DeTakats and Fowler (11) have experimented with the application of x-rays for their absorptive effect on periphelebitic infiltration and exudation. This method has not been evaluated to date. Allen, Barker, and Hines comment unfavorably on the use of both x-ray and ultraviolet for the postphlebotic leg.

Another form of treatment which Wright claims to be of value is mecholyt iontophoresis applied three times weekly. The beneficial results with this method are said to depend upon the vasodilatory effects.

In the treatment of the secondary varicose veins, a safe general rule is to perform multiple superficial ligations whenever incompetency of the saphenous system can be demonstrated. As previously described, these varicosities are the outcome of increased venous back pressure which takes place when canalization of the deep veins occurs. However, secondary involvement of the superficial veins is not as generalized as might be expected. It would appear to us that the involvement is equally likely to be "spotty" or segmental. To all intents and purposes, when primary varicose veins are present the edema which develops is the same as in the case of equally incompetent secondary varicosities. The presence of

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isolated dilated superficial veins needs no surgical intervention (ligation) unless a "blow-out" demonstrating incompetency of the local communicating vein is present. Although we have no figures to show the incidence of superficial vein inadequacy, we believe that the number of cases in this category is not as great as mentioned by Linton and others. Furthermore, the technical difficulties encountered in the stripping of such veins and the morbidity which might be expected as a result of such a procedure presents a real problem. Not infrequently, "intradermal" varicosities, especially below the knee (uncommon in the thigh), are encountered. These veins are impossible to strip. They can be removed only by excision in most cases, and if they are located in the vicinity of an ulcer or induration, the dangers of infection and nonhealing are real. Multiple properly placed ligations should be satisfactory.

Another procedure which is part of our armamentarium is lumbar ganglion novocain block. This is of definite value whenever signs or symptoms of sympathetic nerve irritation are in evidence, e.g. clammy sweaty cool skin, diminished pedal pulse volume, and pain. Not infrequently, lumbar ganglionectomy is indicated when sympathetic block shows temporary improvement and a sustained effect is desirable and necessary. From the prophylactic viewpoint this procedure may be of additional value in the prevention of recurrent attacks of thrombophlebitis. In the further care of the postphlebitic syndrome, the multiplicity of methods in treatment should also include the eradication of foci of infection, e.g. tonsils, teeth, etc. The direct relationship of these to recurrent inflammatory bouts in the extremities is more than likely. On occasion we have found sensory nerve block of the internal malleolus. The less frequent ulcer with pain over the lateral malleolus can be treated by injection of the sural nerve, whereas blocking the long saphenous nerve will anesthetize the medial aspect of the ankle. This is a simple office procedure.

A high percentage of postphlebitic legs are associated with flat feet. The weakened arches are attributed to the venous pathology

Pressure on the plantar vessels follows and in addition initiates reflex vasospasm. A natural sequence of flat feet which contributes to venous stasis is atrophy of the leg muscles. Since the venous return is normally aided by the efficient action of muscle contraction, stasis is augmented when muscle atrophy is present.

With all the foregoing, one must not forget that a proper general physical examination is essential to rule out contributory disease, such as blood dyscrasias (polycythemia), myxedema, cardiac and renal pathology, arteriosclerosis obliterans, intrathoracic or intra-abdominal malignancy. The conditions just enumerated may be of real etiologic significance in the causation or tendency to edema or venous thrombosis or both. Since the diagnosis of the postphlebitic syndrome is not always an easy one to make, differential diagnosis must necessarily take into consideration the possibilities previously mentioned. For instance, we are all familiar with the high incidence of deep vein thrombosis associated with malignancy. The neoplasm, whether intra-abdominal or intrathoracic, may not be obvious and its presence discovered only during thorough routine examination. Not infrequently this type of malignancy is the actual cause of recurring phlebitis.

Concomitant lymphatic obstruction may be estimated from the information elicited in the history, the presence of a persistent brawny edema with thickened skin, and of even greater significance, the observation that the edema decreases very slowly with elevation and bed rest as compared with the venous type of edema.

The familiar phrase, "let us individualize our cases," applies particularly to the subject of treatment of the postphlebitic leg. The discrepancies in published results lie in attempts to use one form of treatment exclusively for the postphlebitic syndrome. The varied pathology manifested by sequelae in different stages obviously requires varied therapeutic procedures or a combination of treatments. In order properly to evaluate any one form of treatment, similar stages in the disease must be compared. To this end, a working classification such as that given by Ho-

mans (18) is valuable. This author reported on 156 cases and divided them among 5 groups. Individual treatments were referred to each group. In group 1 are those cases characterized by edema of the ankle and lower leg which swells somewhat during the day but disappears or diminishes overnight. The extremity appears normal in all other respects. In group 2 which is the largest one, in addition to edema there is pigmentation, induration, ulceration, or combinations of these. In group 3 the prominent feature is pain which appears early in the postphlebotic history. Vasomotor changes are often present. In group 4, with the least number of cases, marked venous congestion is prominent and distended superficial veins are seen. In group 5, of moderate frequency, the characteristic features are recurrent thrombosis in both deep and superficial veins. These episodes are occasionally associated with nonfatal emboli.

The preceding classification is valuable if one attempts to outline the various methods of treatment essential to each phase of the disease. Although we have not adhered to this suggested outline, in essence, we have unintentionally allowed our treatment to follow such a prescribed pattern. Our extensive experience with femoral vein ligations in the treatment of arteriosclerosis obliterans (13, 14) and also with vein interruption of the inferior vena cava and iliacs as well as the femoral for phlebothrombosis has given us confidence in the technical management of this procedure. We feel that interruption of the femoral vein immediately distal to the profunda branch is a harmless procedure if performed by those who have had experience in vascular surgery. Arteriosclerosis and the age limit of 55 years have been mentioned as contraindications to femoral vein ligation (7, 8). From our experience (13, 14), we cannot agree with this viewpoint. The poor or ineffectual results of femoral interruption in those cases of the postphlebotic leg in which ulcers were absent, as mentioned by Buxton (8) and his co-workers, is also contrary to our experience. We are unable and therefore make no attempt to explain some of the failures as noted in our statistics, first because of the frequent inaccuracy of a clear cut pathological picture, and

secondly because an evaluation would be chiefly on the theoretical side. However, we do have an overall clinical picture and impression as will be noted in a tabulation of our results later on.

In view of the difficulty of follow-up examinations in many of our cases—particularly those from one of our hospitals where only the indigent are treated—it would be impossible and certainly inaccurate to attempt to estimate the individual values of the various methods used in the treatment of chronic thrombophlebitis. It is obvious that data regarding a patient with a healed ulcer are of no value if further follow-up is not carried out after discharge from hospital. Statistical reports which fail to take this viewpoint are usually enthusiastic in their claims, thus the high percentage of "cures" with any one method. We have therefore omitted from our evaluation much unobtainable but desired and necessary information. However, the figures which we do have at hand are reasonably accurate, instructive, and informative.

An analysis of 91 cases of thrombophlebitis in 71 patients is sufficiently comprehensive in only 40 cases in which follow-up was possible. Therefore the total number of cases will be included only wherever data are of value.

In the 71 patients on whom the superficial femoral vein was interrupted immediately distal (below) to the profunda branch, 20 were bilateral, making a total of 91 limbs operated upon. The youngest patient was 28 years old (1 case), 5 patients ranged in age from 30 to 35 years, 6 from 36 to 40 years, 20 from 40 to 50 years, 24 from 50 to 59 years, 9 from 60 to 70 years, 6 from 70 to 80 years. The sex incidence was 48 females, and 23 males, a ratio of more than 2 to 1. The origin of the primary thrombophlebitis was indefinite or vague in so many cases that a comparative percentage of incidence relative to either postpartum, postoperative, or postmedical source could not be ascertained. However, many of the patients could approximate the beginning of their "leg trouble" or "swelling." In other words, a "swollen" leg was recalled but without any definite association to a specific illness in the past. A close approximation of the duration of the postphlebotic state revealed the short-

est interval at 3 years in 1 case, the longest at 30 years in 9 cases. The greatest incidence was at 5, 10, and 20 years in 12, 16, and 15 cases, respectively. In 18 cases, the time element was doubtful. This negative point in the history would make us conclude that the original thrombophlebitis was probably not of the phlegmasia alba dolens type but one in which swelling was moderate or slight or in which the symptomatology at the time was not pronounced. Not too long ago, there were many patients who for economic reasons could not afford to be idle and thus neglected a leg condition, particularly if the signs and symptoms were of minor degree. The high incidence of ulcer as a complication—58 cases—was noted in our series. The presence of other associated complications, such as indurated cellulitis and eczema with or without ulcer, was also frequent. Of special interest is a compilation of surgical methods other than or in addition to femoral vein ligation as recorded in our series. The ulcer was excised and split skin grafts used in 20 cases. This procedure was done prior to femoral interruption in 8 instances and after in 12. The failure of "takes" when grafting preceded other measures was 6 out of 8 operations. The "takes" following femoral ligation were 10 out of 12. These are significant findings, and tend to prove that successful skin grafting is unlikely unless venous stasis is relieved.

Lumbar ganglionectomy (second and third lumbar) was employed for two reasons: (1) to overcome associated vasospastic phenomena, and (2) to improve the arterial blood flow and thus enhance healing of the ulcer. The first objective was attained with uniform success. The second (healing of the ulcer) appeared clinically to be of definite value. There were 8 cases in which lumbar ganglionectomy was indicated following femoral vein ligation. In these, sympathectomy greatly benefited the healing of ulcers which had been refractory to interruption of the femoral vein as well as to other measures. In the 24 cases in which sympathectomy was carried out preceding femoral ligation, the results were good in 12 and without apparent improvement in 12. However, healing followed femoral vein ligation in the latter group.

Lumbar sympathetic blocks with novocain were utilized in 40 patients before the femoral vein was ligated. This procedure was of definite value for the reduction of swelling in 21 of the 40 cases. It succeeded where the edema was of the "soft" type and where evidence of lymphatic obstruction was not apparent. Its value for the relief of pain was definite, being successful in all but 12 cases.

The necessity for saphenous vein ligation subsequent to femoral interruption was deemed advisable in only 12 cases of our series. Ligation of the superficial veins was always multiple. This measure resulted in healing in 9 of the 12 cases. In only 1 instance was concomitant vein ligation employed, i.e. saphenous and femoral veins ligated in one stage. This was done because of an accidental injury to the saphenous vein which necessitated ligation of this vessel in addition to the scheduled femoral interruption.

Sensory nerve block for allaying the pain of indurated cellulitis or ulceration was employed 14 times with uniformly good results. The long saphenous nerve was injected in 10 limbs, the sural nerve in 3 legs, and the superficial peroneal nerve in 1 case. This procedure is of real value and should be employed more often than it has been in the past.

There was no mortality in our series of 91 ligations. The morbidity was negligible. Two infected wounds cleared up within 1 week. The only annoying symptom was pain along the distal course of the femoral vessels, particularly over the inner aspect of the knee. This occurred in 9 cases and was usually accompanied by a moderately elevated temperature lasting 3 to 7 days. The pain lasted 4 days in 6 cases and 10 days in 3 cases. This complication is due to a spontaneous "aseptic" thrombosis which takes place in the femoral and popliteal veins following the operation. The mechanism is probably the same as occurs so frequently following simple ligations for primary varicose veins. Moderate postoperative edema was present in 12 cases. The swelling subsided in 1 week. In 2 cases, edema was marked. Of these, one cleared up in 12 days while the other was improved on discharge from the hospital, the edema completely subsiding after 6 months. There were



28 cases in which paresthesia over the inner aspect of the knee was present. This was due to the operative manipulation of the internal femoral cutaneous nerve or perhaps as a result of inflammation as part of the healing process. In nearly all instances, the paresthesia was either in the form of a partial localized skin anesthesia or an uneasy "awareness" in the skin overlying the inner aspect of the knee. The duration of the paresthesia was approximately 7 to 10 days.

Forty patients were examined in follow-up. Only 3 patients could be followed for 5 years and 3 for 4 years. The results were good in these few, only 1 of the 6 had a recurrence of the ulcer. In this instance, the possibility of trauma as the etiologic factor in the recurrence was probable but not certain—this patient's mental status was below par. The relief of pain and cellulitis were also noteworthy findings. Edema was 1 plus in the case of the ulcer recurrence. Of the 8 cases in the 2 year follow-up the incidence of ulcer recurrence was 50 per cent. However, trauma was a definite factor in 3 of the 4 recurrences and also accounted, at least in part, for the 2 instances of indurated cellulitis. The greatest number of cases which were rechecked were in the 1 and 2 year groups—22 cases. Here again, trauma accounted for 3 of the 6 recurrences of ulcer. In the remaining 4 patients who were examined in 6 months, no ulcers had recurred. The salutary effects of femoral vein ligation on eczema were obvious in our series. The presence of epidermophytosis was the most prominent cause for refractory behavior and response of the eczema.

#### SUMMARY

1. A description of the postphlebotic syndrome, the sequelae of iliofemoral thrombophlebitis, is reviewed.

2. The physiology and pathology are described in detail to explain the varied pictures of these sequelae.

3. The treatment is not always simple. Multiple procedures may be necessary for satisfactory results. The various surgical measures are enumerated.

4. Satisfactory results are noted in our follow-up of 40 cases.

5. The operation of femoral vein ligation has not been attended by any mortality in our series. The morbidity is only slight.

6. The importance of femoral vein ligation immediately distal to the profunda branch as it is applied to our 91 ligations, is emphasized.

7. Femoral vein ligation is the one therapeutic measure which is essential in the treatment of the postphlebotic state.

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# THE MODERN SURGERIES OF THE PROSTATE

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THE pendulum of opinion has swung from one method of prostatic surgery to another several times within the memory of present-day surgeons, and popular medicine has wavered in its advocacy of the various methods of prostatic surgery, first urging one method and then another. For 50 years perineal prostatic surgery has been strongly advocated in this country, and the suprapubic approach has an even longer heritage in the field of surgery. Transurethral removal of sufficient prostatic tissue to allow micturition has had a 30 year active tenure, and many modern surgeons still have faith in its application for all forms of prostatic and bladder neck obstructions. So much has been published in lay periodicals concerning transurethral "surgery" that patients knowing nothing about prostatic obstruction, its cause, its development, its pathology, its surgical morbidity or its mortality, now come to the surgeon requesting him to operate by the transurethral route. Recently, the retropubic approach, an old procedure, has been revived, with many surgeons as advocates. Proponents of the various methods of prostatic surgery have not only been successful in clinical practice but have also succeeded as teachers in medical schools in propounding their chosen method of prostatic surgery as the superior method for the treatment of all prostatic obstructions. Is there any gyroscope to indicate what the modern surgery or surgeries of the prostate are today? This question can be partially answered by the interjection of another question which sounds distinctly modern. Why are so many young prospective urological surgeons applying for positions where they can obtain training in all methods of prostatic surgery? All of these men have, or plan to have, a broad training in the basic sciences of physiology, bacteriology, pathology and tumor

growth, and lastly surgery. Needless to say, most of the general surgeons of today foresee the necessity for such a broad basis of surgical training. The fact that these young men seek a broad training in prostatic surgery implies that there must be a certain amount of logic which can be applied to prostatic surgery and furthermore it carries a real significance and imposes an actual teaching responsibility on our medical schools.

Surgery of the prostate depends on many factors, such as the character of the obstruction, infection and allied complications. Is the tumor large or small, is it composed of one, two, or three lobes, and do they grow intravesically or extravesically, is there infection of the bladder, prostate, epididymis and kidney, is the infection responsive or resistant to the antibiotics, or is the patient allergic to the antibiotics? Too little has been said and written as to the character of the growth of the prostatic tumor causing the obstruction. The size of the tumor gives no indication as to the amount of obstruction or the volume of retention of urine, the author has had physicians as patients who had minimal urinary symptoms and who were unaware that they carried 1600 cubic centimeters of residual urine. Some prostatic enlargements are due to prostatic calculi, benign cysts, and abscesses, while others are of a malignant nature, and the differential diagnosis must be made. All too frequent are the bladder complications diverticula which do not empty are associated with prostatic obstruction in 8 per cent of patients, calculi, in 20 per cent, carcinoma, in 2 per cent, and papillomas, in 9 per cent. Renal calculi are present in 5 per cent, ureteral calculi, in 5 per cent, and renal cancers, in about 2 per cent. Urethral strictures occur not infrequently and give preoperative and postoperative concern. Renal function is often seriously impaired due to back pressure and infection in patients with retention of urine. In the very old patients cardiac and

both ureters into the sigmoid for cancer of the bladder and at the same time removing the bladder, prostate, and seminal vesicles, has sound principles when we have at our command urinary and bowel antiseptics, blood electrolyte control, and protein balance and vascular support

#### SUMMARY AND CONCLUSION

One hundred patients with prostatism were admitted to this hospital between 1878 and 1908. The majority of them were treated with catheter drainage, 20 were operated upon, 10 suprapubically and 7 perineally, and 3 had castrations, although at that time no differentiation was made between benign and malignant lesions of the prostate. Although an enlargement of the prostate was recorded at the time the bladder was opened suprapubically no attempt was made to remove it except in 1 case, in which the patient died. The surgeon's eyes were focused upon the bladder calculi. The mortality was appalling, being 45 per cent for all patients admitted. During the years 1910 to 1920 the mortality rate in this institution for prostatic surgical patients was 39 per

cent. For the past 6 months, 100 patients with prostatic disease have been admitted with a mortality of 2 per cent, and those 2 deaths occurred in patients admitted in the last stages of cancer of the prostate. All types of prostatic operations have been done by various members of the urological staff. For the benign overgrowths, 60 per cent were done perineally, 20 per cent suprapubically, 15 per cent, transurethrally, and 5 per cent, retro-pubically, for the carcinomas, perineal biopsies, total and radical prostatectomies, as well as conservative perineal excision for relief of obstruction when residual urine was present.

There is hardly an organ of the human body which presents as many opportunities for surgery as the prostate. The different ways in which the benign tumor grows, the tendency for frequent cancer development, and the associated complications involving the bladder and kidney and cardiovascular system all demand surgical consideration. In order to obtain the best results in every case, all the operative procedures have their place if correctly applied, and they should be so taught in our hospitals and medical schools.

# THE ENDOMETRIUM IN OLD AGE

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THIS is a study of the normal postmenopausal endometrium. Although knowledge of the cyclic morphologic changes exhibited by this membrane during the menstrual era has been on record for over 50 years, an adequate description of its postmenopausal picture has probably been retarded by the assumption that it participates in the obvious general involutionary changes in the genitalia. A partial search of the literature, including a random selection of the textbooks on gynecology and gynecological pathology of the last half century, for a systematic study of the normal postmenopausal endometrium has proved fruitless. Only a few authors accord it even brief attention, all without references to any original work on the subject. These brief descriptions of the senile endometrium emphasize the atrophy of the glandular elements and a few take note of the occasional cystically dilated gland.

Interest in the postmenopausal endometrium was aroused by three studies (Breipohl, 1935, Taylor and Millen, 1938, Novak and Richardson, 1941), all of which reported the unorthodox finding of hyperplasia in a fair proportion of cases. Breipohl found hyperplasia in 15 of 130 postmenopausal endometria. His series, however, included patients with as little as 6 months' amenorrhea, and 2 of his patients had granulosa cell tumors of the ovary. Taylor and Millen described a hyperplastic endometrium in 3 of 34 patients with otherwise normal pelvic organs, 4 to 13 years after the menopause. Surprisingly high was the incidence of hyperplasia, either frank or "retrogressive," reported by Novak and Richardson in almost half of a series of 137 endometria from women 2 to 40 years beyond the menopause. These observations have forced a reconsideration of the traditional concept that the postmenopausal endometrium is necessarily an atrophic one.

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Despite their great value in awakening interest in the senile endometrium and in demonstrating its potentialities, previous reports suffer from two serious shortcomings which render their applicability to normal histology dubious. First and most important is the fact that almost all of the specimens were obtained from women with gynecologic disorders, bleeding being their foremost symptom. This makes the material a highly selected one in which abnormalities of the endometrium would be expected with a much higher frequency than among an unselected group of postmenopausal women of comparable age. Second, many of the endometria were classified from the examination of curettings. In a significant proportion of the cases no endometrium was obtained. Exclusion of such cases, as was done by Novak and Richardson, undoubtedly resulted in an artificially low incidence of atrophy. On the other hand, the classification of every endometrium as atrophic solely on the basis of a nonproductive curettage, as was done by Breipohl, would hardly seem justified either. Furthermore, microscopic interpretation of curettings from a postmenopausal uterus is often difficult, because of the fragmentation of the tissue and the ease with which the commonly encountered endometrial polyps may be confused with the diffuse type of hyperplasia (Kottmeier, 1947).

## PRESENT STUDY

The material on which this study is based consists of 60 normal uteri which were removed incidental to vaginal plastic operations because of varying degrees of descensus. Only those cases were included in which at least 2 years had elapsed since the last menstrual period. Except for this criterion there was no special basis for selection. The patients ranged in age from 50 to 85 years. 14 were between 50 and 55 years old, 19 between 56 and 60, 15 between 61 and 65, 10 between 66 and 70, 1

between 76 and 80, and 1 between 81 and 85, a total of 60 patients. About two-thirds of the patients had ceased menstruating within the preceding 15 years, the rest extending as much as 35 years beyond the menopause. In 10 patients the postmenopausal interval was 2 to 5 years, 6 to 10 years in 14 patients, 11 to 15 years in 18, 16 to 20 years in 8, 21 to 25 years in 8, 26 to 30 years in 1, 31 to 35 years in 1. In 16 cases curettage had been performed immediately preceding hysterectomy but in each instance sufficient undisturbed endometrium remained in the uterus to permit study and classification.

Endometrial polyps were present in 10 cases (17 per cent) and adenomyosis of varying degree was diagnosed 13 times (21 per cent). Others have remarked on the relative frequency with which these two conditions are found in senile uteri. The incidence of polyps, for example, is two and one-half times as great as that found by Henriksen (1941) among a large group of younger women, selected because of the complaint of abnormal vaginal bleeding.

**Epithelium.** The surface epithelium consisted of a single layer of low cuboidal cells arranged in a fairly straight or slightly undulating line. Here and there it could be seen dipping down slightly into the stroma (Fig 1), but in only rare instances could any connection be demonstrated between the glands and the surface epithelium. This observation is believed to be of importance in the interpretation of the cysts, described later.

The endometrial glands varied greatly in size, shape, and number. In some cases only an occasional small round gland was visible in the remnant of mucosa which covered the myometrium (Fig 1). In others the endometrium was somewhat thicker and contained a greater number of glands, some slightly larger, and some slightly branched (Fig 2). Occasional mitotic figures could be demonstrated even in some atrophic endometria such as this. It is questionable whether mitotic figures in this tissue are necessarily indicative of specific estrogenic stimulation, as several previous authors have assumed.

An interesting and not uncommon variant in the endometrial pattern consisted of atypi-

cal, irregularly branched and dilated glands (Fig 3). These bore no special relation to the other glands nor were they confined to any specific location. Their lumens commonly contained amorphous material as did the more typically cystic glands, herein described.

In contrast to the findings in previous studies, particularly that of Novak and Richardson, the present material has not revealed hyperplasia as a normal manifestation of the senile endometrium. This diagnosis was made in only 3 cases. When the clinical histories of these patients were later reviewed it was found that 2 of them had received estrogenic therapy for about 3 weeks immediately preceding operation. One, aged 61 years, had been taking stilbestrol by mouth (Fig 4), the other, aged 57 years, had received her estrogen in the form of stilbestrol vaginal suppositories daily (Fig 5). The third patient with endometrial hyperplasia (Fig 6), aged 61 years, had a small tumor in the left adnexal region. This was palpated by the attending gynecologist who had examined the patient prior to her admission to the hospital, and the suspicion of a granulosa cell tumor was recorded. Unfortunately the ovaries were not investigated at operation. In 2 of the 3 cases of hyperplasia, therefore, a definite exogenous source of stimulation was present and in the third instance the presumption is strong that a functional ovarian tumor was responsible. *In not a single case of the present series was spontaneous endometrial hyperplasia encountered.*

Cystic glands, varying in size and number, constituted one of the most consistent as well as one of the most interesting findings in the present study. These cystic structures were seen in routine sections of 43 of the 60 uteri (72 per cent).

Novak and Richardson, in their paper of 1941, redirected attention to the cystic glands of the senile endometrium, clearly demonstrated these structures in photomicrographs, and, impressed with their Swiss cheese pattern, interpreted them as evidence of hyperplasia. The present material and theirs are not strictly comparable, since many of their patients complained of bleeding, whereas the uteri in the present study were all presumably normal save for their descensus. This dif-

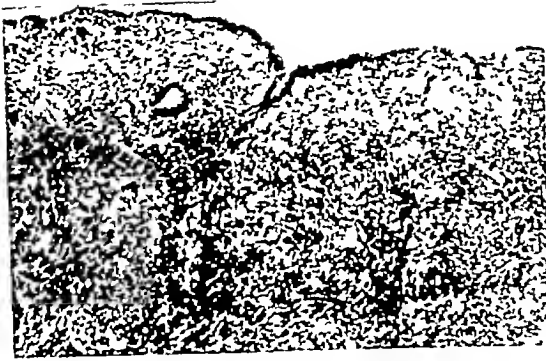


Fig 1



Fig 2



Fig 3

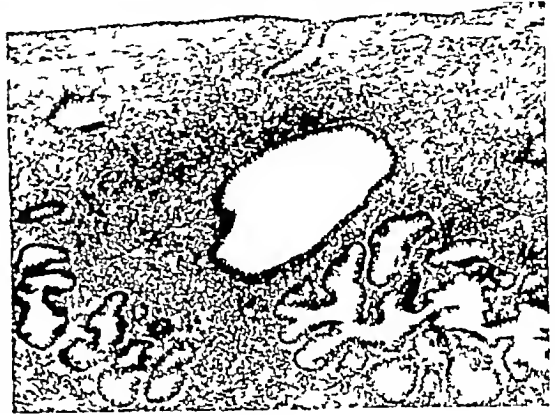


Fig 4



Fig 5



Fig 6

Fig 1 Endometrium of patient, aged 56 years, 8 years after the menopause. Section shows advanced atrophy of glands and fibrosis of stroma.

Fig 2 Endometrium of patient, aged 57 years, 5 years after the menopause. Section shows moderate atrophy of glands in addition to fibrosis and hyalinization of superficial stroma.

Fig 3 Endometrium of patient, aged 54 years, 4 years after the menopause. This photomicrograph shows irregularity of the glands.

Fig 4 Endometrial hyperplasia in patient aged 62 years, 15 years after the menopause. This patient had received stilbestrol for about 3 weeks preoperatively.

Fig 5 Endometrial hyperplasia in patient, aged 57 years, 12 years after the menopause. This patient was treated with 2 stilbestrol vaginal suppositories (0.5 mgm) daily for 3 weeks preoperatively.

Fig 6 Endometrial hyperplasia in patient, aged 61 years, 12 years after the menopause. This patient had a small adnexal mass, possibly a granulosa cell tumor.

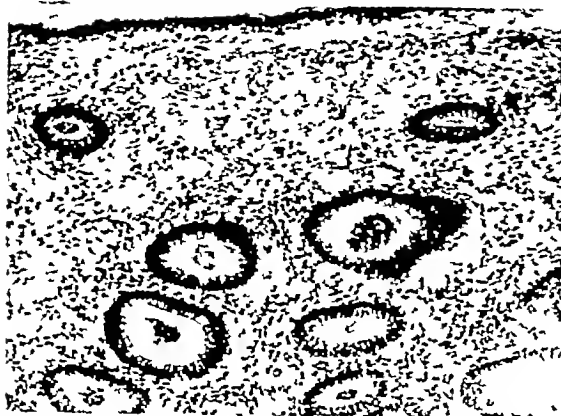


Fig 7 Endometrium of patient, aged 55 years, 6 years after the menopause Glands contain desquamated epithelium in lumens



Fig 8 Endometrium of patient, aged 69 years, 19 years after the menopause Glands are irregular, some slightly dilated, and lumens contain desquamated epithelial cells Surface epithelium removed by previous curettage

ference will help explain our failure to confirm the high degree of hyperplasia reported by Novak and Richardson. Of probably greater importance, however, is the alternative interpretation which we are inclined to give the large cystic glands which have been observed in the majority of our cases and which appear to be identical with the glands in the specimens classified by Novak and Richardson as "retrogressive hyperplasia."

Study of our material has led to the conclusion that the cystic structures in the senile endometrium are indeed retention cysts, as some of the older gynecological pathologists thought them to be. These cysts form, it is believed, following the occlusion of the gland openings which results from the atrophy of their lining epithelium. The stimulus to dilatation of the blind pouches thus formed comes from the desquamating lining cells. The early stages of this process can be visualized in Figures 7 and 8. As the gland cells are replaced and cast off into the lumens the cysts enlarge. The cellular nature of the cyst contents becomes less apparent as autolysis and liquefaction occur (Fig 9). Finally the desquamated material is reduced to an amorphous mass (Fig 10). Sometimes this appears granular, sometimes homogenous, and takes only a faint pink stain with hematoxylin and eosin. Subsequent stages, showing progressive enlargement of the cysts, are shown in Figures 11 to 15. Although they may occur at any level

of the endometrium, the cysts have a predilection for the superficial stratum, where they are covered by the very thinnest layer of surface epithelium. Figure 12 shows such a cyst separated from the uterine cavity by only a single layer of cells.

We visualize these structures, therefore, as cystic dilatations of endometrial glands resulting from mechanical obstruction of their mouths and desquamation or secretion into their lumens. In this respect they are quite analogous to the nabothian cysts of the cervix. Their similarity to the glands of a hyperplastic endometrium is only superficial, the chief characteristic common to both types being the Swiss cheese pattern presented by the cystic glands of varying size. The epithelium of the postmenopausal cyst is flat and inactive looking, mitotic figures rare, in contrast with the histologic picture of the cystic hyperplasia seen in younger women. Important differences exist too in the stroma, herein described. The cystic endometrial glands of postmenopausal women quite commonly attain a size several times that reached by the glands seen in the cystic hyperplasia of younger women. One of the larger glands in the present series is shown in Figure 15. It is difficult to reconcile this observation with the thesis of Novak and Richardson that these structures are the remnants of pre-existing typical cystic hyperplasia. It seems necessary to accept the idea of a progressive dilatation of the glands, be-





Fig 9 Endometrium of patient, aged 85 years, 35 years after the menopause. Glands are moderately dilated and contain amorphous material, cellular detail of which has largely been lost. Evidence of desquamation can be seen in the lining of the upper gland.

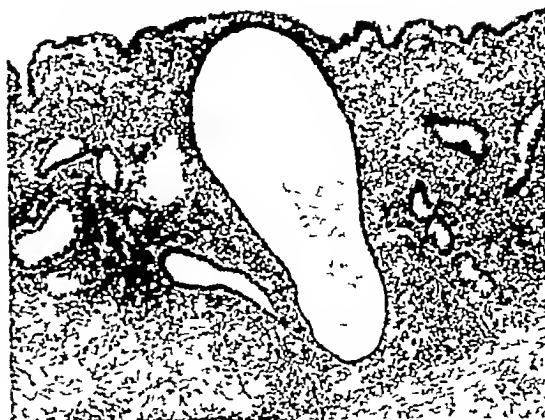


Fig 10 Endometrium of patient, aged 58 years, 8 years after the menopause. Cystic gland, filled with amorphous debris, occupies entire thickness of endometrium.

yond any size ever attained during the reproductive years, when the mouths of the glands are open. The histologic structure suggests a distention rather than an active proliferation.

**Polyyps** Cystically dilated glands are especially common in the endometrial polyyps which occur in postmenopausal women (Fig 16). This association is of interest from three points of view. First, the Swiss cheese pattern has frequently been the basis for the erroneous diagnosis of endometrial hyperplasia, especially when the pathological report has depended on the examination of curettings. Kottmeier has recently established criteria for the differentiation of endometrial polyyps and hyperplasia in curettings with the aim of minimizing this error. Second, rupture of the superficial cysts is the probable mechanism of the uterine bleeding which is commonly seen in patients with endometrial polyyps. The thin walled veins of the senile uterus, described later, are particularly vulnerable to such an accident because of their location just below the surface epithelium. Finally it seems more than possible that the cystic glands themselves are an important factor in the pathogenesis of postmenopausal endometrial polyyps, since these growths consist in large part of such cysts and their surrounding stroma. This thesis would help explain the high incidence of endometrial polyyps in postmenopausal uteri.

**Stroma** The stroma of the postmenopausal endometrium differs markedly from that of the cyclic mucosa of younger women. Most striking is the difference in staining characteristics. In contrast to the deeply basophilic color which the youthful endometrial stroma assumes with the usual hematoxylin and eosin stains, the senile mucosa is predominantly eosinophilic, but considerable individual variation exists in this respect. This change results from the altered histologic composition of the tissue. The lymphoid elements of the stroma are replaced after the menopause by a less cellular, more fibrous structure. The remaining cells are predominantly spindle-shaped fibrocytes, and the relatively more abundant matrix becomes homogeneous and hyalinized, especially near the surface (Figs 2 and 17). Focal accumulations of round cells may persist here and there for many years after the menopause, but they form a quite inconspicuous part of the histologic pattern.

**Blood vessels** The specialized arterial apparatus which supplies the stratum functionalis of the human endometrium and is characterized by coiled vessels atrophies after the menopause. This atrophy sets in promptly and proceeds rapidly, so that in the present material routine sections revealed no structures which could be recognized as spiral arterioles. It is quite likely that the disappearance of these vessels is related to the diminution in circulating estrogen. Okkels and Engle (1938) concluded that the integrity of the coiled arteries of the



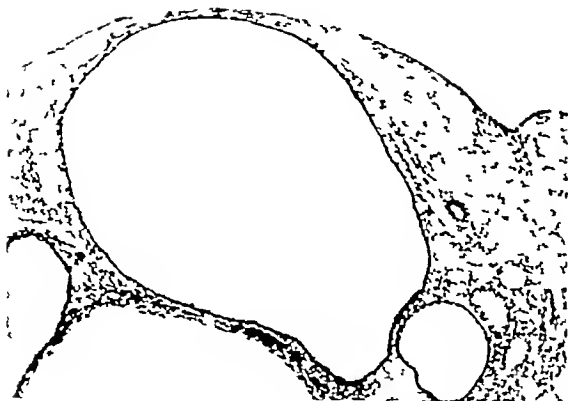


Fig 11 Endometrium of patient, aged 62 years, 12 years after the menopause, showing large cystic glands lined with flattened epithelium

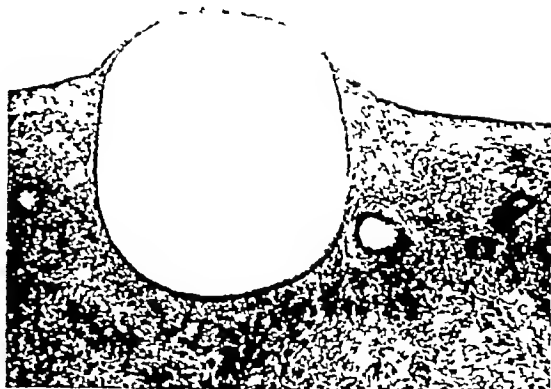


Fig 12 Endometrium of patient, aged 66 years, 23 years after the menopause. Note displacement of surface epithelium by greatly enlarged cystic gland

macaque's endometrium depended upon this hormone, since "fibroelastoid degeneration" occurred in spayed animals and restitution could be produced by treatment with estrone. Spiral arteries have been described recently in the ovary, too, and there is some evidence that here as well the coiled vessels depend on the trophic action of estrogen (Delson, Lubin, and Reynolds, 1948).

Perhaps of greater practical importance is the condition of the veins in the senile uteri, for it is probably from these vessels that most spontaneous bleeding occurs. In a fair proportion of the specimens comprising this series thin-walled veins, filled with blood, coursed through extremely superficial layers of the

endometrium, being separated from the uterine cavity in some instances by only one or two layers of cells (Figs 17 and 18). This arrangement will doubtless explain some of the not infrequent cases of vaginal bleeding in which curettage fails to reveal the cause. The fortuitous location of such a vein superficial to an expanding cystic gland subjects the vessel to the possibility of trauma, especially should the cyst rupture. This is suggested as a common mechanism of hemorrhage from post-menopausal endometrial polyps.

One might suspect the prominence of superficial veins in the present material to be a secondary effect of the uterine descensus, from which all the patients suffered to a varying degree. While recognizing such a possibility,



Fig 13 Endometrium of patient, aged 65 years, 15 years after the menopause. Enlarged cystic gland has displaced surface epithelium. Compare with Figure 12

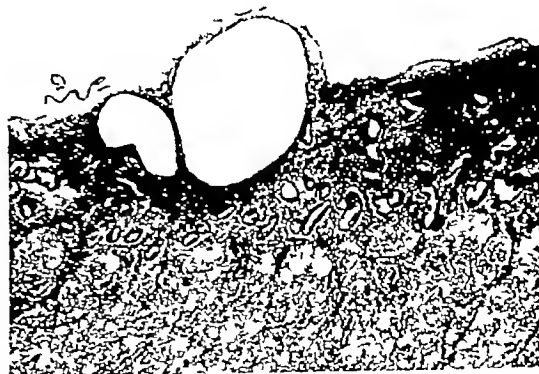


Fig 14 From the same endometrium as in Figure 13, showing cystic glands present in another area of the endometrium

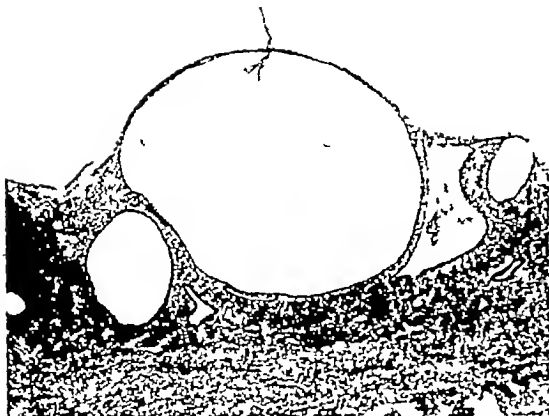


Fig 15 Endometrium of patient, aged 59 years, 11 years after the menopause, showing greatly dilated cystic glands lined by flattened epithelium

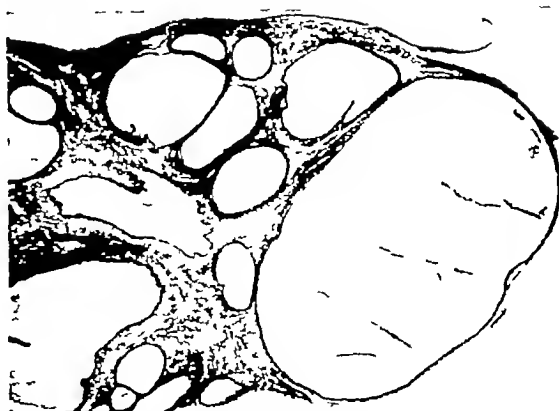


Fig 16 An endometrial polyp which is composed largely of cystic glands, from the same uterus as illustrated in Figure 1

we believe it relatively unimportant, since a recent study of postmenopausal women without uterine descensus also describes circulatory modifications in the form of vascular dilatation and telangiectasia in the endometrium (Gianaroli, 1948)

#### DISCUSSION

The present study differs fundamentally from previous ones on the postmenopausal endometrium because of the different basis for selection of material. Others have chosen their specimens from the postmenopausal endometriums of their pathological laboratories without discrimination because of the patient's complaint. A large proportion of such pa-

tients suffered from postmenopausal bleeding, which was the reason for hysterectomy or curettage. It is apparent that by failing to select their material these previous authors actually obtained a rather highly selected series of endometriums, which would be expected to show a relatively high incidence of abnormality. We have attempted to circumvent this obstacle and to obtain endometriums representative of the normal by choosing our specimens from a group of patients free of bleeding and without evident uterine disease. Furthermore, the entire endometrium as obtained by hysterectomy offers advantages over the fragments of tissue obtained by curettage, as in some previous studies. The principal problems associated with examination of post-



Fig 17 Endometrium of patient, aged 52 years, 3 years after the menopause. Arrow points to superficial vein just beneath surface epithelium



Fig 18 Endometrium of patient, aged 76 years, 16 years after the menopause. Arrow points to superficial vein just beneath (denuded) surface epithelium



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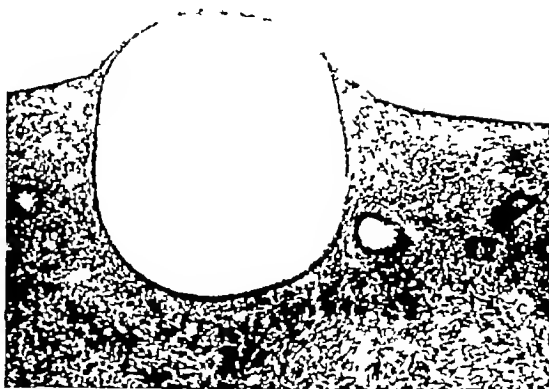


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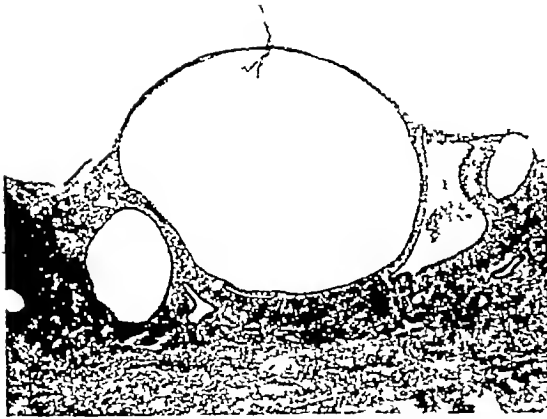


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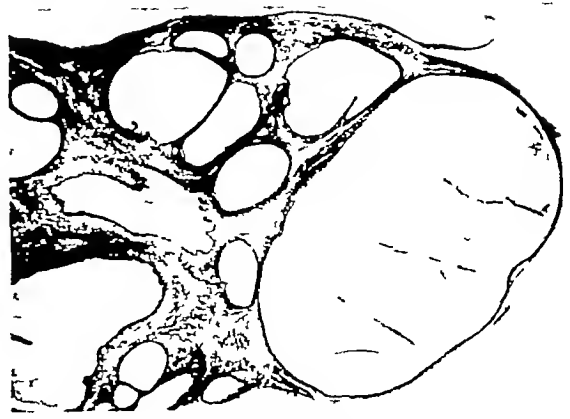


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Fig 18 Endometrium of patient, aged 76 years, 16 years after the menopause. Arrow points to superficial vein just beneath (denuded) surface epithelium

menopausal curettings consist of the impossibility of making a diagnosis in the significant group in which no tissue is obtained, and the difficulties sometimes encountered in interpreting fragmented tissue, particularly in differentiating between an endometrial polyp and hyperplasia.

Finally the different criteria used for the diagnosis of hyperplasia undoubtedly account in large measure for our failure to corroborate the high incidence of hyperplasia previously reported in postmenopausal uteri, particularly by Novak and Richardson. Not all would agree, for example, with the diagnosis of active hyperplasia given to some of the specimens illustrated in their paper, and to the cystic glands which they have interpreted as retrogressive hyperplasia we would accord the alternative interpretation of glandular dilatation resulting from mechanical obstruction of the gland outlets. It is probably because of more exacting criteria used for hyperplasia that Schiffmann (1929) diagnosed this condition in only 1 of 59 women with postmenopausal bleeding.

Our observations indicate that atrophy is the normal condition of the asymptomatic postmenopausal endometrium. The hyperplasia present in 3 cases could be ascribed in each to an actual or presumed abnormal source of estrogenic stimulation. From a purely theoretical point of view it is difficult to see how this could be otherwise, if our current notions concerning the etiology of endometrial hyperplasia are correct. Although women may excrete small amounts of estrogen for several years after their cessation of menstruation, and evidence of estrogenic activity, even of periodicity, may be detected in vaginal smears long after the menopause (Papanicolaou, 1933, Kernodle and Cuyler, 1948), the quantities of available hormone are far below the levels usually associated with proliferation of the genital tissues. This point is attested by the atrophy of the vulval and vaginal tissues and the decrease in bulk of the uterus consistently associated with normal aging.

Castration in the rhesus monkey commonly leads to focal hyperplasia in the mammary gland with the development of discrete nodules in the breast (Speert, 1940), and in cer-

tain strains of mice proliferative changes occur in the adrenal cortex as well following removal of the ovaries (Fekete, Woolley, and Little, 1941). The precise hormonal mechanisms for these atypical growth processes are not understood. This study provides no basis for the belief that the endometrium is a common site for any similar hyperplastic response to the withdrawal of ovarian support. Failure to demonstrate endometrial hyperplasia in the present series of normal specimens leads to the belief that this finding is an abnormal one in the postmenopausal woman.

# SUMMARY

- 1 A histologic study is reported of 60 normal uteri removed from women aged 50 to 85 years and 2 to 35 years beyond the menopause.
- 2 Endometrial polyps were present in 10 cases (17 per cent) and adenomyosis in 13 (21 per cent).
- 3 Cystically dilated glands were present in routine sections of 43 of the uteri (72 per cent). The pathogenesis of these structures, which are believed to be retention cysts, is discussed.
- 4 Changes in the stroma consisted chiefly of fibrosis and hyalinization, especially near the surface.
- 5 The spiral arteriolar apparatus could not be demonstrated, but thin-walled veins were prominent just under the surface epithelium.
- 6 True hyperplasia was present in only 3 uteri, at least 2 of which had been subjected to abnormal sources of estrogenic stimulation. Hyperplasia appears to be an abnormal finding in the postmenopausal endometrium.
- 7 An explanation is suggested for certain cases of idiopathic postmenopausal bleeding, and for the common association of bleeding with endometrial polyps.

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## TREATMENT OF SLIPPING OF THE UPPER FEMORAL EPIPHYSIS

### A Study of the Results of 42 Cases

CLARENCE H HEYMAN, M D, F A C S, Cleveland, Ohio

**S**LIPPING of the upper femoral epiphysis occurs in different forms and degrees. There is the early potential pre-slipping stage with little or no displacement, manifested by comparatively mild symptoms. Deformity may then increase abruptly following mild trauma. This is known as the acute slip with severe displacement of the epiphysis causing immediate and marked disability. More commonly, however, the displacement may progress gradually or intermittently known as the chronic slipping with gradually increasing disability. Bony union between the epiphysis and the neck of the femur eventually occurs with a greater or lesser deformity and disability. There is no sharply defined time to mark the final stage of deformity when union has occurred to such a degree that it becomes impossible to alter the position of the head in relation to the neck without osteotomy.

We are concerned in this study with the treatment of the slowly progressing or chronic form of slipping rather than with the acute slip. During this still formative stage in the development of treatment adaptable to the majority of cases, surgeons of comparable experience practice different methods. These results show why some methods are in favor, and others are in disfavor, in the clinic where these patients were treated and where as in all hospitals the facilities and limitations must be evaluated by every surgeon.

In this group of 42 cases, 2 years or more have elapsed since the cessation of treatment, unless a poor result is already present or may obviously be predicted. The results are classified separately as to the clinical or functional result, and the anatomical or structural result as revealed by the roentgenogram. It is interesting that there is often a discrepancy in the classification of the result according to these two criteria.



Fig 1 a, above W L Extremely overweight boy, 16 years old Duration of symptoms 8 months Had severe lump, pain, and very little motion at the hip Treated by manipulation and cast b, Four and one half years later He has no pain, no lump, and no limitation of motion The head of the femur is moderately deformed, but is otherwise good



Fig 2 a, above R C Markedly overweight boy, 14 years old Duration of symptoms 6 months Had severe lump and external rotation deformity Treated by manipulation and cast b, Five and one half years later Although the epiphysis was not altered in position by manipulation, the head of the femur looks good He has normal motion and function

All of these patients had a gradual onset of symptoms and a slowly progressing disability, sometimes to a marked degree, and the epiphyseal plate was still open The duration of symptoms varied from 2 to 9 months, except for 2 patients who had symptoms for 2 years The ages at the time they came for treatment varied from 10 years to 18 years The average age was 14 years All complained of pain, some moderate and some severe All patients limped and had limitation of motion, some moderate and some marked Some had marked displacement of the epiphysis, and others had only a minimal slip Thirty-five were males, 7 were females Thirty-seven were unilateral slips, 5 were bilateral Twenty-three were of excessive weight suggesting a glandular dyscrasia, and 19 were normal in these respects It was noticed, however, that some of the children who appeared to be of normal weight and development at the time of treatment became overweight and developed the appearances or stigmas of glandular dyscrasia as they became older

#### METHODS OF TREATMENT

Manipulation under anesthesia followed by fixation in a plaster spica with the extremity

widely abducted and internally rotated was the method of treatment in 21 of the 42 cases The method commonly used was that of Leadbetter to reduce fracture of the neck of the femur traction with the hip at right angled flexion, internal rotation, and then with the hip brought down in internal rotation and wide abduction Considerable force was used when it was thought necessary Osteotomy through the neck of the femur or through the epiphyseal plate, with fixation by means of a nail and plaster spica was done in 3 cases, osteotomy with fixation in plaster only was done in 5 cases Simply a removal of the prominent angular portion of bone obstructing motion at the anterosuperior aspect of the neck of the femur, without osteotomy and with no postoperative fixation, was done in 3 cases Fusion of the epiphysis by an open and direct approach, without the insertion of a nail or postoperative fixation, was done in 10 cases These had comparatively slight displacements and were not manipulated

#### RESULTS OF MANIPULATION AND PLASTER SPICA

Good to excellent clinical results were obtained in 17, or 81 per cent, of the cases treat-



Fig 3 a, above. J R Girl, 11 years old. Duration of symptoms 3 months. She had severe disability. Treated by manipulation and cast. b, Three years later. She has a normal hip.



Fig 4 a, above. H H Boy, 14 years old. Had a gradual onset of symptoms beginning 7 weeks before, but the roentgenogram may be suggestive of an acute slip. Manipulation failed to improve position, nevertheless, he was treated by a spica cast with the extremity in wide abduction. b, Five years later. Motions normal except internal rotation is moderately limited. Clinical result is good, roentgenological result is fair.

ed by manipulation. It was found that ability to improve position according to the roentgenogram was not directly dependent upon the duration of symptoms. This, of course, would not apply to the sudden and acute slips with a marked displacement which are not included in this article. Considerable improvement toward restoration of anatomical position was possible in cases with a duration of symptoms varying from 1 to 9 months, while little or no success in improving position was had in other cases with a duration of symptoms varying from 2 to 6 months. This greatly depended upon the width of the epiphyseal plate, or absorption of bone adjacent to it, at the time of treatment.

It was a common observation that even though manipulation in the cases of longer standing sometimes failed to alter appreciably the position of the head on the neck of the femur, the clinical improvement was generally marked. Pain disappeared in all cases, and there was a decided improvement in the ranges of motion. Manipulation with cast appears to bring about a fairly prompt fusion of the epiphysis, and perhaps this may be a cause for the cessation of pain and muscle spasm. Contracture, rather than bony displacement, may be a major factor in many cases causing clinical deformity and limitation of motion. There

is no other way to explain the correction of external rotation deformity and greatly limited abduction in the cases in which position of the epiphysis was not much improved. Release from contracture of the adductor and external rotator muscles, or more likely from contracture of the joint capsule or other fibrous structures, is accomplished by manipulation followed by maintaining the extremity in abduction and internal rotation. It is unlikely that rest alone or abstention from weight bearing would be equally effective. Treatment by traction, which may be effective in the acute slip, was tried in only 1 case. This did not result in any improvement in motion after 6 weeks.

The criterion for estimation of the result on the roentgenogram is not solely the position of the head on the neck. Of greater importance are the structure of the bone, the width of the joint space and smoothness of the articular surfaces. A good viable head and a good articular surface are more to be desired than a normal anatomical relationship with aseptic necrosis. On the basis of these criteria, the roentgenological result was good in 67 per cent of the cases in which manipulation was carried out. Twenty-eight per cent are classified as





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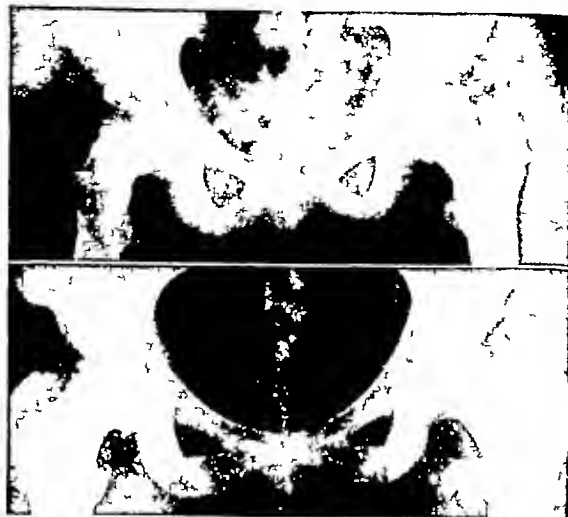


Fig 5 a, above P S Girl, 12 years old Duration of symptoms 4 months Only a minimal slip at the right hip Treated by open fusion of the epiphysis b, Ten years later She has normal function and roentgenological result is practically normal



Fig 6 a, above H H Boy, 15 years old Duration of symptoms 3 months No appreciable slip, but physical findings were typical of slipping of epiphysis Treated by open fusion of epiphysis, b, 2 1/2 years later Function normal Head may be slightly underdeveloped, but otherwise normal

having a fair roentgenological result only because of faulty position of the head on the neck In only 1 case is there a poor roentgenological result (5 per cent) with a poor bone structure in addition to deformity This was the case of a boy, 18 years old, who had symptoms for 2 years before treatment

#### RESULTS OF CERVICAL OSTEOTOMY

By cervical osteotomy is meant open reduction by osteotomy through the epiphyseal plate or a cuneiform osteotomy through the neck It is to be emphasized that these are the results of one surgeon only There were only 8 cases of cervical osteotomy to correct deformity, for it was soon found that the results were not good even after the patient was subjected to this major operation More or less aseptic necrosis with degenerative changes resulted in 7 of the 8 cases A good roentgenological result was obtained in only 1, and this patient has only 45 degrees of flexion, and rotation is greatly limited The only poor results, both clinically and roentgenologically, have been in those patients treated by cervical osteotomy The results of manipulation and cast in the case of longer standing, even though not much improvement in anatomical position has been obtained, have been so much better that the

writer now does a cervical osteotomy only in unusual conditions

#### REMOVAL OF THE BONY OBSTRUCTION TO MOTION

The first operation of this nature was done in 1942 in the case of a marked displacement of 5 months' duration and with a marked limitation of motion Preparations were made for cervical osteotomy and nailing, but at operation it appeared that bony union was so secure that we withheld from osteotomy Since limitation of motion was seen to be caused by an impingement of the angular prominence of bone at the anterosuperior aspect of the neck against the rim of the acetabulum, it was decided to chisel off the obstruction at the neck of the femur Good motion resulted immediately He was kept in bed 1 week afterward and progressed so well that he was then allowed crutches and weight bearing according to his own inclinations He was soon bearing full weight on the leg, and retained most of the greatly improved range of motion gained at operation Encouraged by this success, 2 more operations were done with similar satisfaction Another patient with bilateral involvement, too recent to be included in this report, obtained striking improvement of motion when



Fig 7 a, above R C Boy, 15 years old Duration of symptoms 5 months He had severe pain and was unable to bear any weight on the leg There was very little motion even under anesthesia Operative exposure was made for osteotomy and nailing, but only the angular bony prominence at the neck was removed He was kept in bed 1 week postoperatively and there was a rapid relief of symptoms See text b, Five years later He has no pain, practically no limp, and motion is only moderately limited Clinical result is good, roentgenological result is fair

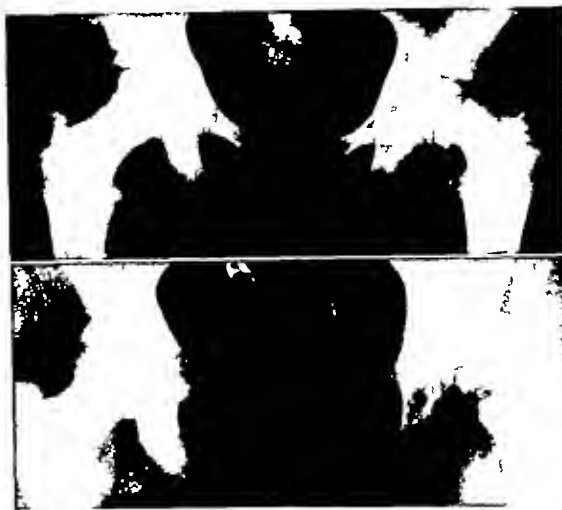


Fig 8 a, above S C Girl, 11 years old Duration of symptoms 10 months Treated by osteotomy and nail which was removed later because of stiffness and pain b, Four years later She has pain and stiffness The clinical and roentgen results are poor

6 weeks of traction in bed beforehand had no effect These patients have good hip joint spaces and no roentgenological evidence of aseptic necrosis Since the roentgenograms show, of course, the deformity as before, these cases are classified as having only fair roentgenological results It is intended to gain further experience with this conservative method of treatment<sup>1</sup>

#### EPIPHYSEAL FUSION

Since a direct operative approach to bring about a prompt fusion of the epiphysis has proved to be reliable in arrests of growth, an adaptation of this method for fusion was done in 10 cases presenting only a minimal displacement It was thought that a graft of bone across the epiphyseal plate would be more reliable in bringing about a prompt fusion than the introduction of a Smith-Petersen nail It was also taken into consideration that nailing

a capital epiphysis requires considerably more precision, particularly in the exact length of the nail and in centering, than is required in nailing a fracture of the neck of the femur Multiple drilling was done in 1 case only This epiphysis ultimately fused after many months of nonweight-bearing protection, and there is a good result

*Description of the operation of fusion* Exposure of the anterosuperior aspect of the neck of the femur is made through a Smith-Petersen approach The capsule is incised longitudinally and is reflected only enough to expose the neck at its junction with the head incurring a minimum of disturbance to the blood supply The epiphyseal line is looked



Fig 9 R M Boy, 15 years old Bilateral case treated by a capable surgeon by means of cervical osteotomies and nailing Nails were removed later He has ankylosis of both hips 1 year after operations

<sup>1</sup>The writer was not aware that this operation had been done before but, during a recent conversation with Dr L Ramsey Straub of New York, he was told that Dr Royal Whitman referred to it in an article published in the *Medical Record* January 9 1909

for, but may not always be identified. A rectangular section of bony cortex, about 4 centimeters long and 1 centimeter wide, is removed along the long axis of the neck, with care not to disturb the articular surface. This is laid aside to be used later. A small curet or gouge is introduced into the gutter, and by a rotatory motion is forced into the central portion of the head deeply enough to be sure that it passes across the epiphyseal plate. Small pieces of cancellous bone, obtained from the crest of the ilium, are impacted into the depths of the hole which passes into the head of the femur. The piece of bony cortex previously removed is then replaced or may be driven in as a peg. The capsule is sutured, and the wound is closed.

No postoperative fixation is used other than light temporary traction for comfort and restraint. Weight bearing is not permitted until the roentgenogram shows that fusion has occurred, or until progress is well under way toward fusion. Traction, as a rule, is continued for about 6 weeks, followed by ambulation with crutches and only partial weight bearing for another 6 weeks. It was found that pain and muscle spasm rapidly subsided, and there was soon a return to normal passive and active motion. Fusion of the epiphysis occurs in about 3 months after this operation.

#### RESULT OF EPIPHYSEAL FUSION

Ten operations were done upon 8 patients—2 were bilateral—without manipulation or other treatment. The ages ranged from 13 to 15 years. Both the clinical and roentgenological results are good to excellent in all cases. All have complete relief of symptoms and have practically normal motion and no limp, and the roentgenograms showed a prompt fusion with no increase in displacement over that originally present. There is a normal appearing bony structure and a normal joint space.

#### SUMMARY OF RESULTS

A clinical result is classified as good when the patient has no disability, no pain, little if any limitation of motion, and no more than a very slight limp, the result is fair when the patient has no pain, but there is a moderate limitation of motion or a moderate limp, the

result is poor when there is pain, or a considerable degree of limitation of motion, or a conspicuous limp. The roentgenological result is classified as good when at most there is only a slight deformity, which would not seem to be important, and no appreciable aseptic necrosis or articular changes, the result is fair when the displacement of the fused head on the neck of the femur is moderate, but there is no appreciable aseptic necrosis or articular changes, the result is poor when there is aseptic necrosis accompanied by narrowing of the joint space and roughening of the articular surfaces.

All of the 10 patients selected for operative fusion of the epiphysis have a good to excellent clinical and a good roentgenological result. Of the 21 patients treated by manipulation and cast—and it is to be considered that all of these cases of considerable displacement were less favorable—17, or 81 per cent, have a good to excellent clinical result, and 14, or 67 per cent, have a good roentgenological result. Only 1 patient has a poor joint space and aseptic necrosis. There were no poor clinical results following manipulation and cast, and most patients have little or no physical disability. Still more important, none has pain. There are no poor roentgenological results following manipulation and cast other than failure to improve anatomical position of the head, except 1 case of an 18 year old boy who had had pain and disability for 2 years. These generally good results of manipulation and cast are in marked contrast to the poor clinical and roentgenological results of treatment by cervical osteotomy. There was only 1 good clinical result and 1 good roentgenological result in the 8 cases treated by cervical osteotomy. These were not in the same patient. Removal of the angular bony obstruction to motion greatly improved function in each of 3 cases, and the joint space and bony structure look good.

These unanticipated results of manipulation are deserving of further comment. It seems that there has been an almost unanimous opinion expressed by recent writers that manipulation must be avoided, and those who confess to manipulation expressly caution that it must be gentle to avoid disturbances to the

circulation of the head of the femur or damage to the hip joint. This opinion is not confirmed, for these patients have no aseptic necrosis up to the present time. It was formerly contended that manipulation per se caused the unfavorable late changes of the head of the femur following reduction of congenital dislocation of the hip, and it is also likely that manipulation itself in slipping epiphysis does not cause the joint damage ascribed to it. Perhaps the failure to obtain better clinical results in the slowly progressing case of longer standing is because manipulation had been so gentle that nothing in the way of improvement could be accomplished. In the hands of the writer and of most orthopedic surgeons, manipulation is far less likely to be attendant with damage to the hip than in the procedure of cervical osteotomy and nailing which is also a difficult operation even in the hands of the most experienced and skilled surgeons. The choice of the method of treatment must be a matter for the individual who is governed by his own abilities and limitations.

#### CONCLUSIONS

These results, analyzed separately and conjointly according to the functional and roentgenological results, have determined the writer's present practice in the treatment of slipping of the femoral epiphysis. They are regarded as intermediate results only. Final results cannot be determined until later in life.

Operative fusion by means of a bone graft across the epiphyseal plate is the method of choice during the early stage when there is no displacement to more than a slight degree. This method is reliable to bring about prompt fusion of the epiphysis, it shortens the period of disability, and prevents further displacement.

This method of manipulation and cast remains preferable to osteotomy in the still active stage when displacement has progressed to a considerable degree. Motion may be restored in most cases to a near normal range, and the limp practically eliminated, even though not much improvement in the anatomical position of the head is obtained. Aseptic necrosis is rare. The small number of patients treated by cervical osteotomy was sufficiently large to convince the writer that, in his hands, the results are generally poor. The manipulation and cast procedure is a safe method of treatment, patients are not made worse by it. Cervical osteotomy, on the other hand, may give a good result, but one must realize that this is a difficult operation to do well and that aseptic necrosis is a complication of intracapsular fracture of the neck of the femur.

Treatment of the late or residual stage of deformity when fusion has already occurred depends on the amount of disability. It is better to accept some limitation of motion and limp without pain than to strive for free motion with probable pain or even more stiffness. Motion in these cases of long standing can be improved only by some form of osteoplastic operation. While subtrochanteric osteotomy may correct external rotation and adduction deformity, it would not seem likely to improve flexion of the hip. No settled conclusion can be reached on the basis of 3 cases, but simple removal of the bony obstruction to motion at the anterosuperior aspect of the neck of the femur gave good functional results, and there is no roentgenological evidence of disturbance of the blood supply to the head of the femur. If further experience confirms this result, we shall have an important conservative method of treating the case of long standing with a fixed and disabling deformity.



Fig 4 Ulcer following laminectomy and 5 full courses of irradiation for spinal cord tumor a, Initial defect, note vertebral spines (June 1941) b, Defect after multiple conservative débridements and zinc peroxide treatment (January 1943) c, Final removal of necrotic tissue and start of plastic procedure (July 1944) d, Completion of closure Under fluorescein study all of Zone 1 could have been outlined and removed at first operation

weakly fluorescent area corresponding to the partially devitalized skin and subcutaneous tissue classified as Zone 2, and, in many ulcers, extending deeply to the muscle and bone (Fig 1) The fluorescence gradually increases away from the lesion until normal is reached Sections of these ulcers in the operating room reveal a deep penetration of the completely devitalized Zone 1, and a similar deeply penetrating surrounding area of partially devitalized Zone 2 (Fig 2)

From a preliminary superficial study the repair can be planned and the size of flaps estimated After local control of the infection is attempted as outlined in a previous paper (3), the surgical toilet of the wound is carried out in the operating room The anesthetist injects the fluorescein solution, the room is darkened, and the area is viewed under the filtered ultraviolet light In the case of superficial ulcers, the zones are estimated and are marked with indelible pencil, the lights turned

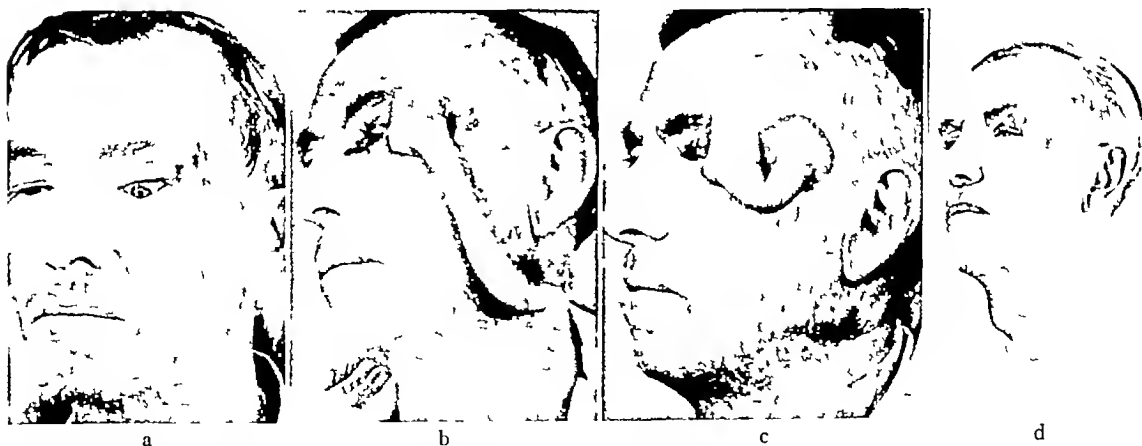


Fig 5 Case 3 Reconstruction of left temporal postirradiation ulcer with residual carcinoma extending to lateral wall of orbit and upper lid Fluorescein studies permitted the major portion of the reconstruction to be carried out in less than 2 months, despite osteoradionecrosis a, Postirradiation defect with extension to upper lid and lateral wall of orbit b, After excision of soft tissue and bone extension and implantation of flap to prevent protrusion of orbital contents c, Excision of radionecrotic area and implantation of distal end of tube into area of good vascularity d, Tube opened and defect closed

on, and the excision carried out. For deeply devitalized lesions, frequent observations under filtered ultraviolet light are made during the course of the operation. Those portions showing complete devitalization by a total absence of yellow gold fluorescence are excised in extent to normal fluorescence in skin and subcutaneous tissue and in depth to partial fluorescence in muscle, etc., unless the area is sufficiently superficial, or small, to warrant excision of all damaged tissue. In other words, all of Zone 1 should be removed and as much of Zone 2 as possible unless vital structures are involved. In the repair, the principle of revascularization is brought into play and from a normally fluorescent area a flap is bridged over the saucerized defect to another normal area, and, when healing is complete, the tubed flap is opened and approximated laterally to the normally fluorescent sides. Throughout the repair, the optimum time for transference of pedicled flaps is estimated by fluorescein, as outlined by Lange (5).

Out of a group of several hundred postirradiation ulcers requiring active surgical treatment during the past 10 years, 3 characteristic cases are presented to show the advantages of diagnostic fluorescein.

The first is a deep necrotic ulcer (Fig. 3) of the scalp. When, after 2 delays, a flap was swung to this area, the blood supply was inadequate, and the distal end died (Fig. 3b). Fluorescein would have outlined this zone of relative avascularity and obviated implantation in a devitalized area.

The second series of pictures shows the result of 5 full courses of irradiation for a post-

laminectomized spinal cord tumor. Because of the lack of appreciation of the extent of the completely avascular area, the final result was not accomplished until after 3 years of work. Under fluorescein study, all of Zone 1 could have been outlined and removed at the first operation.

The last series of pictures shows the comparative rapidity with which knowledge of the vascularity as outlined by fluorescein can speed up the procedure. The main structural correction was carried out in a matter of months.

#### SUMMARY

Fluorescein as an agent for determining the residual vascularity and extent of deep radionecrotic lesions places on a more objective plane the demarcation of devitalized and partially devitalized tissues. Its use enables the surgeon to determine the actual extent, levels, and degree of revascularization. The incidence of failure, as well as the time necessary for these multiple staged procedures, is reduced.

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# THE USE OF URECHOLINE IN THE PREVENTION OF POSTOPERATIVE DISTENTION

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ABDOMINAL distention is a common postoperative problem that distresses both the surgeon and the patient. Our present concept, however, of the physiology of the autonomic nervous system in relation to intestinal atony has done much toward progress in the treatment of this important complication. Following every abdominal operation and many surgical procedures in other parts of the body, there is apparently depression of the parasympathetic nervous system affecting the gastrointestinal tract. This is seen in varying amounts and is attributed to the effects of such factors as trauma of surgery, shock, anesthetic agents, sedative and narcotic drugs.

During recent years, an increasing number of drugs which affect the parasympathetic system have been used for the relief of postoperative distention (2, 5, 8). These parasympathetic agents can be divided into 2 groups—the choline esters and physostigmine with its related synthetic compounds. The choline esters such as acetylcholine, mecholyl and doryl act as chemical mediators in stimulating the receptor cells of smooth muscle. The effect of acetylcholine, however, is rapidly neutralized by the hydrolytic action of cholinesterase, an enzyme present in blood and tissues. The physostigmine group which includes the synthetic compound, prostigmine, does not act as a chemical mediator and has no direct action on smooth muscle. It inhibits cholinesterase and thus allows acetylcholine, which is produced in the body, to give more prolonged and constant action (1).

These cholinergic drugs have given good results in the treatment of postoperative intestinal distention, but have some disadvantages.

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(2) In searching the field of synthetic choline esters for suitable therapeutic products for postoperative distention, a major objective has been to find a stable drug with a constant action in the body. A second objective has been to find derivatives that are free from toxic symptoms when used in clinical dosage. Finally, attempts have been made to find drugs which would have a selective effect on smooth muscle of the gastrointestinal tract and not on other structures such as the vascular and respiratory systems.

Recent attention has been directed toward urecholine (the urethane of beta-methylcholine-chloride) because of its effect in stimulating gastric motility after vagus resection for peptic ulcer (3, 4, 7). This choline derivative has a parasympathomimetic action but is not destroyed by cholinesterase as is acetylcholine and mecholyl, and it has no undesirable nicotinic action as does doryl (8). When administered in therapeutic dosage sublingually, orally or subcutaneously, it has little or no effect upon heart rate, blood pressure, or peripheral circulation of normal human subjects. However, it increases peristalsis, and stimulates micturition and defecation (8). When the drug is given intramuscularly or intravenously, it loses its selective action on the gastrointestinal tract and may produce a drop in blood pressure with circulatory collapse. These effects may be abolished by prompt intravenous injection of atropine.

Because of these pharmacological effects of urecholine in producing gastrointestinal stimulation, it appeared to be a possible remedy for intestinal atony, the basis of postoperative distention. The clinical value of the drug was therefore investigated to determine whether its administration to patients would prove to be an effective method of overcoming postoperative distention with a minimum of side effects.

## METHODS AND MATERIALS

Observations were made on 100 patients following major surgical procedures, including hernioplasty, appendectomy, hysterectomy, cholecystectomy, and gastrectomy. Urecholine in dosage of 10 milligrams was given routinely by sublingual route, 3 times daily beginning the day following surgery. Another 100 patients, following similar types of surgery, were observed as controls. This group received no routine prophylactic measures to prevent gas discomfort. In both groups, the patients were classified as (1) those who had no evidence of abdominal distention and required no therapy, (2) those who had definite gas discomfort and abdominal distention and required routine hot packs and special enemas.

Further observation was made on the use of urecholine when administered subcutaneously in doses of 5 milligrams. This was given to some of the patients in addition to the oral medication, when severe gaseous distention was present. In every case, the nurse giving the injection was cautioned to avoid the intramuscular route of administration in an effort to decrease the incidence of untoward side effects.

## RESULTS

In the control group, 28 per cent of the patients had no evidence of abdominal distention, while in the urecholine treated group, 45 per cent of the patients were apparently free from abdominal distention. No undesirable side effects were noted in any of the patients who received the sublingual administration of the drug although the dosage was increased to 20 milligrams in some cases.

When urecholine was administered subcutaneously in doses of 5 milligrams there were cases in which the drug produced the passage of flatus and stool as soon as 5 minutes after injection. A few of these patients complained of sweating, nausea, and increase of abdominal cramps although these effects were not marked and usually subsided within 15 to 20 minutes. Sweating was the most frequent of the untoward effects noted.

## DISCUSSION

The statistical analysis of this clinical study shows a significant difference in the incidence

of postoperative distention in the urecholine treated group of surgical patients as when compared with the nontreated group. The use of the drug by the sublingual route has the advantage over other drugs of the cholinergic group in the simplicity of administration. The subcutaneous injection of suitable dosage gives a satisfactory therapeutic effect after other methods of treatment have failed to give relief.

The therapeutic effect of urecholine has the disadvantage of other cholinergic drugs in varying considerably with the patient to which it is administered. Because of these variable effects, it is difficult to standardize a routine dosage and in many cases, it must be adjusted for the individual patient in order to obtain a satisfactory result. In a few cases there is no apparent therapeutic effect and in rare instances, the untoward side effects defeat the therapeutic usefulness of the drug.

Certain contraindications to the use of this drug should be noted. Urecholine, like other choline esters, may exert a bronchoconstrictor effect and therefore should be used with extreme caution in cases with asthma or history of allergy. The drug should not be used in the presence of acute inflammatory lesions of the gastrointestinal tract or associated peritonitis where the stimulation of peristalsis may spread the infection present. In this series of cases the drug was not used following large bowel surgery or when peritonitis from any cause was present.

The results of this study would seem to indicate that the routine use of urecholine in the care of the postsurgical patient has an effect in reducing the incidence of abdominal distention with a minimum of undesirable side effects.

## SUMMARY

1 Abdominal distention is a common postoperative problem. In a series of 100 control cases, 72 per cent of the patients complained of moderate or severe pain due to gas distention.

2 The pharmacological effects of urecholine indicate that this is a suitable drug to use in the treatment of postoperative distention.

3 Toxic reactions following the use of urecholine may be prevented or controlled by using specific precautions

4 Clinical observations made on 100 post-surgical patients when urecholine was used, demonstrate a definite decrease in the incidence of abdominal distention

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# A COMPARISON OF PAIN PRODUCED EXPERIMENTALLY IN LOWER ESOPHAGUS, COMMON BILE DUCT, AND UPPER SMALL INTESTINE WITH PAIN EXPERIENCED BY PATIENTS WITH DISEASES OF BILIARY TRACT AND PANCREAS

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THE purpose of this investigation has been to compare the localization of pain arising from the biliary tract, lower esophagus, and proximal portion of the small intestine. With few exceptions, lesions in these viscera give rise to discomfort in the upper abdomen, at or near the midline. Yet on the basis of the pain localization alone it is often impossible to tell clinically which structure is involved. During the study of an individual with known biliary tract disease it was noted that balloon distention of the duodenum produced pain apparently identical with that complained of by the patient. This observation raised the question whether pain arising from the bile ducts and the duodenum may have an identical area of localized reference in any given patient. Such a possibility is difficult to demonstrate clinically for various reasons.

1 A history of the pain symptom is usually not taken with sufficient care to elucidate slight variations in the localization of pain.

2 An evaluation of pain arising from lesions of the lower esophagus, biliary tract, or upper small intestine would necessitate comparing the discomfort in patients usually having only one of these lesions.

3 Individual differences in the angle of the costal margin and in the contour of the abdominal wall make pain localization difficult to assess in different patients (7).

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For these reasons we have felt it preferable to study the localization of pain from these viscera by stimulation of each of these structures in the same individual and mapping out the areas of discomfort.

Clinically certain locations have come to be assigned as the area of reference for pain arising from lesions of the lower esophagus, biliary tract, upper small intestine, and pancreas. Disturbances at the lower end of the esophagus such as hiatus hernia or esophageal ulcer usually cause discomfort at the lower end of the sternum or tip of the xiphoid with occasional spread to the back, upper chest, and rarely to the left shoulder or left arm (3, 10, 13). Duodenal ulcer commonly gives rise to pain sharply localized to the midepigastrium over an area about an inch in diameter, and usually nearer the xiphoid than the umbilicus (4). Occasionally, in the case of a perforated posterior wall ulcer adherent to the pancreas, the discomfort may be felt only in the back and has even been known to be present only in the left arm (8, 20). Initially the pain of acute cholecystitis, cholelithiasis, and choledocholithiasis may start in the midepigastrium, remain there, or radiate around the right costal margin to the right scapula. Less commonly the pain may radiate into the left epigastrium or through to the back. In many instances the initial site of pain from the biliary tract may be in the right upper quadrant and very occasionally in the right lower quadrant (5). Pancreatic pain is localized in the epigastrium commonly just left of the midline with occasional reference to left subscapular area (6).

These clinical impressions of the localization of pain arising from these viscera have been substantiated in certain instances by experimental studies. Jones found that distention of the cardiac end of the esophagus produced discomfort in the midline beneath the lower sternum or in the epigastrium just below the xiphoid (11). He also observed that this procedure gave rise in the rare patient to pain in the left postauricular area, the angle of the left jaw, and down the left arm (13). The localization of pain from distention of the duodenum depended somewhat on the area stimulated, the pain being high in the epigastrium on stimulation of the duodenal cap and moving nearer to the umbilicus when the duodenojejunal junction was distended (12). Layne and Bergh, Zollinger, and others found that distention of the gall bladder and common duct produced severe epigastric distress as well as right upper quadrant pain with radiation to the back (15, 16, 22).

In this investigation we have employed these same experimental techniques to test all of these viscera in the same patient. Our observations have been of two kinds

1 A comparison of the pain experienced from distention of the lower third of the esophagus, common duct, and upper small intestine (duodenum or jejunum or both areas) in each of our patients

2 A comparison of the experimentally induced pain arising from each viscus with the clinical pain noted by a given patient<sup>1</sup>

Nine patients were studied, all of whom were convalescing from a common duct exploration. Six patients had biliary tract calculi and 2 had chronic pancreatitis. One patient had had a recurrence of symptoms similar to those existing prior to removal of a stone in the common duct.

#### METHOD

Experimental pain was produced by distention of the common duct, the cardiac end of the esophagus, and the duodenum or upper jejunum. The esophagus and upper small bowel were stimulated by air inflation of a calibrated

<sup>1</sup>Throughout this paper the term clinical pain is used to signify the pain of which the patient complained arising from his lesion as contrasted to the induced or experimental pain elicited by mechanical distention.

balloon of a Miller-Abbott tube. The common duct was distended by two methods (1) was run rapidly through the catheter left the common duct at operation, (2) in 3 patients the common duct was also stimulated by air inflation of a small balloon attached to a ureteral catheter. This catheter was threaded through the intracholedochal tube at operation in such a manner that the balloon was lying freely in the common duct itself. The procedure of balloon distention of the esophagus or duodenum was carried out under fluoroscopic observation so that the position of balloons could at all times be determined. The esophagus, duodenum, or jejunum, air was introduced into the balloon at a uniform rate of from 2 to 4 cubic centimeters per second until the subject reported an uncomfortable sensation. The total amount of air required to produce pain was from 40 to 120 cubic centimeters for the small intestine and from 15 to 30 cubic centimeters for the esophagus. Flushing of the common duct consisted of running in sterile saline by sudden elevation of a feeding flask, the amount of pressure being recorded on a water manometer calibrated in inches. When a ureteral catheter was used the balloon was inflated with 8 to 10 cubic centimeters of air which on all occasions was sufficient to produce pain. The similarity of the pain elicited by the ureteral catheter balloon and by distention with saline infusion of the common duct together with the small quantity of fluid displacement required to cause pain by the latter procedure made it seem unlikely that the infusion method was producing discomfort by the escape of fluid into the duodenum. A cholangiogram with hippuran was performed about 48 hours prior to the visceral distention studies to establish the patency of the biliary tree. Although it was possible to increase the intensity of the experimental pain by increasing the balloon distention or the rate of flow of saline through the common duct, this intensification of the stimulus was not attempted routinely. Before the experiments were started, the subjects were asked to state accurately the position and distribution of their clinical pain and to describe its quality and radiation. The experimentally produced pain was recorded

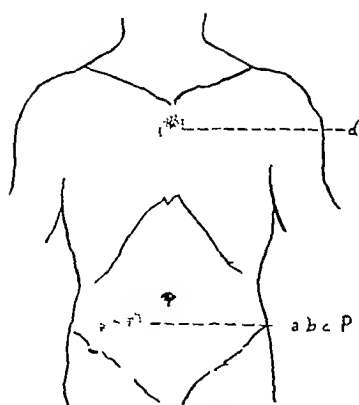


Fig 1 Case 1

TABLE I —PAIN STUDY,  
CASE I

	Location	Quality
P Clinical pain	Right sided midabdomen	Deep seated colicky
Experimental pain		
a From common duct	Right-sided midabdomen	Deep seated colicky
b From duodenum	Right sided midabdomen	Deep seated colicky
c From upper jejunum	Right-sided midabdomen	Deep seated colicky
d From lower esophagus	Substernal between 2nd and 3rd interspaces	Deep seated burning

Common duct stimulation and distention of the upper small intestine produced similar pain which was also like the clinical pain. Lower esophageal distention produced pain in a different area.

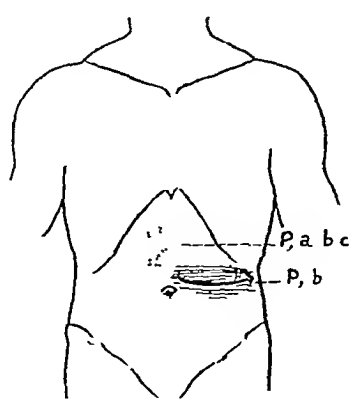


Fig 2 Case 2

TABLE II —PAIN STUDY  
CASE 2

	Location	Quality
P Clinical pain	Right upper quadrant and epigastrium with radiation to left upper quadrant and around the left side to the back	Deep seated, sharp
Experimental pain		
a From common duct	Same as P but without radiation	Deep seated sharp
b From duodenum	Same as P with radiation	Deep seated, sharp
c From lower esophagus	Same as P but without radiation	Deep seated burning

Only duodenal stimulation reproduced the clinical pain completely. Common duct distention failed to produce the pain radiation. Lower esophageal stimulation failed to produce either radiation or the quality of discomfort.

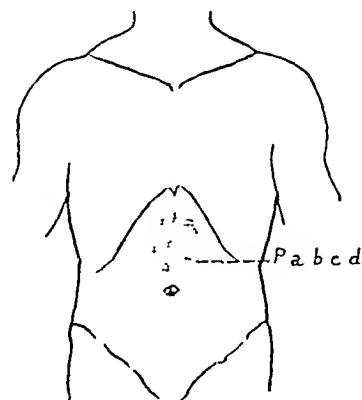


Fig 3 Case 3

TABLE III —PAIN STUDY,  
CASE 3

	Location	Quality
P Clinical pain	Midepigastric radiating straight through to the back	Deep seated "like knotting of muscles"
Experimental pain		
a From common duct	Same as P with radiation	Same
b From duodenum	Same as P with radiation	Same
c From upper jejunum	Same as P with radiation	Same
d From lower esophagus	Same as P without radiation	Same

All areas stimulated gave rise to the same pain which was also similar to the clinical pain except for the lower esophageal stimulation which did not produce radiation of the discomfort straight through to the back.

1 The subject was asked to report any sensation

2 He was asked to outline with one finger the area of any sensation experienced

3 He was asked to describe the quality, intensity, depth, and radiation of the sensation and to compare such sensation with his clinical pain

In each viscus studied, the test was repeated at least three times. Before each experiment the patients were free of clinical pain or other discomfort. Precaution was also taken at all times not to let the patient know which viscus was being stimulated. Aside

from the discomfort caused by the tugging of the tube in the patient's throat when the lower esophagus was being distended, it was possible to keep an individual unaware of any alteration of the experimental situation.

## EXPERIMENTAL RESULTS

The results of experimental distention of the lower esophagus, common duct, and upper small intestine are presented in tabular form for each patient, along with a short history of each case. In each table the characteristics of the clinical pain are presented first. Following this the results of experimental stimulation

are presented with the viscus stimulated indicated in the left-hand column, the location of pain in the middle column and in the sketch, and the quality of the sensation elicited indicated in the right-hand column

*Experiment 1 CASE 1 L B (M G H No 520066)* A 57 year old housewife entered the hospital on February 22, 1946, with colicky right midabdominal pain and icterus of 1 week's duration. Past history was essentially noncontributory. Physical examination was negative except for mild icterus and midabdominal tenderness, maximal on the right side. Laboratory studies revealed

Van den Bergh 1 2/1 9 milligrams per cent, prothrombin time 28 seconds (normal 19-22), Graham test showed a functioning gall bladder which was full of stones

Cholecystectomy and choledochostomy were performed on March 15, 1946. Stones were found to be present in both the gall bladder and the common duct although the latter was normal in size. The ampulla of Vater was dilated to a diameter of 4 millimeters. A T tube was inserted into the common duct. Cholangiograms made at the time of operation and on the tenth postoperative day showed a patent ampulla and no stones

Diagnosis cholelithiasis and choledocholithiasis

The patient remained asymptomatic throughout a 15 month postoperative period. Pain studies were performed on March 29, 1946 and are shown in Figure 1 and Table I

*Experiment 2 CASE 2 A LaS (M G H No 516436)* A 44 year old housewife entered the hospital on April 9, 1946, with intermittent sharp epigastric pain, of 15 years' duration, without jaundice or food intolerance

Physical examination was negative except for a right lower quadrant appendectomy scar. There was no abdominal tenderness. Laboratory examination was negative except for Graham test which showed a nonfunctioning gall bladder

Cholecystectomy and choledochostomy were performed on April 15, 1946. Three small stones were found to be impacted in the ampulla of the gall bladder and in the cystic duct, but none were found in the common duct. The ampulla of Vater was dilated to a diameter of 5 millimeters. A T tube was inserted into the common duct

Diagnosis cholelithiasis

The patient was asymptomatic throughout an 8 month postoperative period. Pain studies were performed on April 28, 1946 and are shown in Figure 2 and Table II

*Experiment 3 CASE 3 M H (M G H No 118739)* A 42 year old housewife entered the hospital on April 13, 1946, with midepigastric pain of 24 hours' duration which began one-half hour after eating an egg. A similar attack had occurred 5 months previously. There was a definite history of fat intolerance but not of jaundice. Physical exami-

nation revealed moderate right epigastric tenderness and spasm. Laboratory findings van den Bergh, 0 9/1 2 milligram per cent, serum amylase, 44 units (normal up to 35 units)

Cholecystectomy and choledochostomy were performed on April 14, 1946. An edematous pancreas was found and two stones were impacted in the cystic duct. The common duct was twice normal size but without stones. The ampulla was dilated up to a diameter of 8 millimeters. A T tube was inserted into the common duct

Diagnosis cholelithiasis and mild pancreatitis

The patient was asymptomatic throughout a 14 month postoperative period after which she had some epigastric distress. Pain studies were performed on April 26, 1946 and are shown in Figure 3 and Table III

*Experiment 4 CASE 4 M R (M G H No 466120)* A 43 year old widow entered the hospital on November 5, 1945, with intermittent, severe epigastric pain of 11 years' duration. During the last year preoperatively the pain radiated throughout the entire abdomen and to the back. She gave no history of jaundice or food intolerance. Physical examination revealed marked midepigastric tenderness. The Graham test showed good dye concentration and innumerable small stones in the gall bladder. White blood count, gastrointestinal roentgenogram, stool examination, and serum amylase were within normal limits

Cholecystectomy and choledochostomy were performed on November 24, 1945. The gall bladder was filled with small stones. The common duct and pancreas were normal. The ampulla was dilated up to a diameter of 5 millimeters and a whistle-tip catheter was inserted. On the tenth postoperative day a cholangiogram reproduced the patient's preoperative pain and showed no obstruction

Diagnosis cholelithiasis

The patient was asymptomatic until 8 months postoperatively when some food intolerance and headaches occurred. Pain studies were performed on December 5, 1945 and are shown in Figure 4 and Table IV

*Experiment 5 CASE 5 S S (M G H No 519120)* A 30 year old housewife entered the hospital on March 18, 1946, with a 2 months' history of intermittent, crampy, left epigastric pain associated with nausea and vomiting. There was no history of food intolerance, clay stools, or jaundice. Physical examination was negative except for generalized abdominal tenderness most marked in left upper quadrant, and rebound tenderness in left upper quadrant. Urinalysis, blood hemoglobin and cell counts, and gastrointestinal roentgenogram were within normal limits, van den Bergh 0 5/1 1 milligram per cent and 0 9/1 6 milligram per cent, serum amylase, 38 units and 34 units, prothrombin time, 25 seconds (normal 19-22). Two Graham tests gave "unsatisfactory visualization" of the gall bladder

Choledochostomy was done on March 25, 1946. The gall bladder was normal in appearance. The

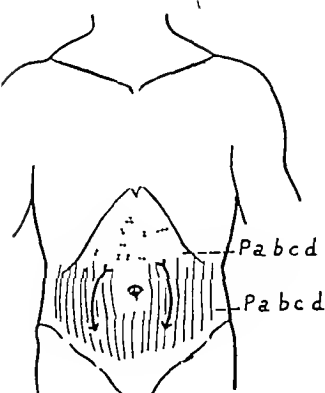


Fig 4 Case 4

TABLE IV —PAIN STUDY,  
CASE 4

	Location	Quality
P Clinical pain	Epigastric, radiating to back and over entire abdomen	Deep seated, excruciating 'ache like something kicking around inside
Experimental pain		
From common duct	Same as P with radiation	Same
From duodenum	Same as P with radiation	Same
From upper jejunum	Same as P with radiation	Same
From esophagus	Same as P with radiation	Same

Stimulation of all areas produced identical pain which was similar in type to the clinical pain

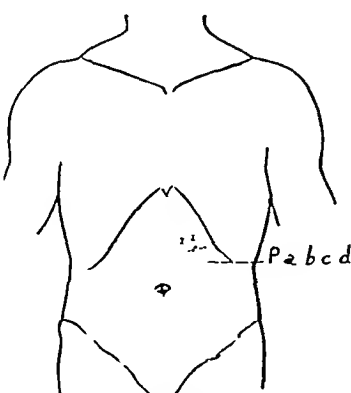


Fig 5 Case 5

TABLE V —PAIN STUDY,  
CASE 5

	Location	Quality
P Clinical pain	Epigastric just to left of midline	Deep seated crampy
Experimental pain		
a From common duct	Same as P	Same
b From duodenum	Same as P	Same
c From upper jejunum	Same as P	Same
d From lower esophagus	Same as P	Same

Stimulation of all areas reproduced identical pain which was similar in type to the clinical pain

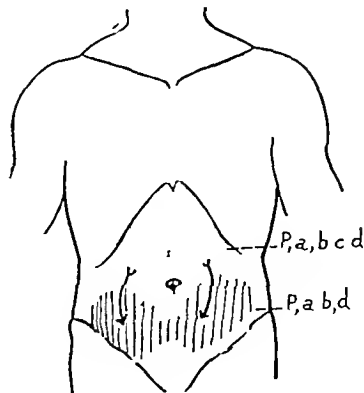


Fig 6 Case 6

TABLE VI —PAIN STUDY,  
CASE 6

	Location	Quality
P Clinical pain	Epigastric radiating to back and to both lower quadrants	Deep seated dull, aching
Experimental pain		
a From common duct distention with fluid	Same as P including radiation	Same
b From common duct distention with balloon	Same as P including radiation	Same
c From pylorus and duodenum	Same as P with radiation to back but without radiation to lower quadrants	Same
d From lower esophagus	Same as P including all radiation	Same

Except for the duodenum or pylorus stimulation of all areas produced identical pain which was similar to the clinical pain. Duodenal or pyloric distention pain was different only in its lack of radiation to the lower quadrants.

common duct contained no stones but was found to be dilated. The pancreas was indurated with fat necrosis present near the ligament of Treitz. The ampulla was dilated to a diameter of 8 millimeters and a T tube was inserted into the common duct. Cholangiogram on the 14th postoperative day showed filling of Wirsung's duct with simultaneous reproduction of patient's "old pain", there was no obstruction to the flow of the dye into the duodenum. Diagnosis: chronic pancreatitis. It was decided to use prolonged choledochal drainage. The patient was asymptomatic until the T tube was accidentally removed 2 months later by the patient, after this time the "old pain" has recurred at irregular intervals. Pain studies were performed on April 23, 1946 and are shown in Figure 5 and Table V.

*Experiment 6 CASE 6 KP (MGH No 507593)* A 68 year old housewife entered the hospital on October 23, 1945, with intermittent upper midabdominal pain of 19 months' duration with occasional nausea, but no vomiting, food intolerance, jaundice, or acholic stools. The pain radiated to the lower abdomen and back when severe. Physical examination was negative except for a right mid-abdominal scar as a result of an old appendectomy, and slight generalized abdominal tenderness. Urinalysis, blood counts, hemoglobin, blood chemistry, prothrombin time, and gastrointestinal roentgenogram were essentially normal. Two Graham tests showed no dye in the region of the gall bladder. Pre-operative balloon distention of the esophagus, duodenum, and upper jejunum reproduced pain which was identical in location and character, and which



also was similar to the clinical pain which the patient suffered

Choledochostomy was performed on November 15, 1945. No gall bladder, cystic duct, or gall bladder fossa were found. The common duct was found to be dilated and contained multiple large stones which were removed. The ampulla of Vater was dilated. A T tube was inserted into the common duct. Cholangiogram was done on the 12th postoperative day and no evidence of obstruction was seen.

Diagnosis: Choledocholithiasis, agenesis of the gall bladder.

The patient was asymptomatic throughout an 18 month postoperative period. Pain studies were performed on November 28, 1945 and are shown in Figure 6 and Table VI.

*Experiment 7* CASE 7 M W (MGH No 102749) A 78 year old veteran of the French Foreign Legion entered the hospital on May 2, 1946, with epigastric pain coming on after eating and present for 2 weeks, sometimes associated with chills and fever. Five months previously he had had a cholecystostomy following 1 week of similar pain. From then up to the present illness he had been discharging stones and bile intermittently from a persistent sinus tract in the right upper abdomen, but this tract had remained closed for the 10 days preceding readmission.

Physical examination revealed slight icterus, ankle edema, orthopnea, and slight right upper quadrant abdominal tenderness. There also was a right subcostal operative scar with a hernia and a subcutaneous stone. The white blood count was normal, serum amylase, 150 units, van den Bergh, 0.6/10 milligram per cent.

Cholecystectomy and choledochostomy were done on May 7, 1946. The gall bladder was shrunken, had fat necrosis on its surface and contained several small stones. The common duct was enlarged but contained no stones. The pancreas was swollen and edematous. The ampulla was dilated. A T tube and a ureteral catheter with balloon were inserted into the common duct. On the 12th postoperative day cholangiography reproduced the patient's preoperative pain but was otherwise negative.

Diagnosis: cholelithiasis, cholecystitis and pancreatitis.

Eight months following operation the patient had recurrence of high epigastric pain at which time a 1.5 centimeter gastric ulcer was demonstrated on the posterior aspect of the body of the stomach. His symptoms responded favorably to medical treatment, and the ulcer was no longer visible on gastrointestinal roentgenogram. His status at 16 months following operation is not known. Pain studies were performed on May 20, 1946 and are shown in Figure 7 and Table VII.

*Experiment 8* CASE 8 A D'A (MGH No 20456) A 54 year old male entered the hospital on June 4, 1946, with recurrent left epigastric pain for which he had a subtotal gastric resection 7 years previously. Pathological report was "carcinoma in

situ." In addition a sterile abscess had been found in the head of the pancreas and a diagnosis of pancreatitis had been established. His pain continued intermittently until the present admission. No history of jaundice, clay-colored stools, or icterus could be elicited.

Physical examination was negative except for a left upper paramedian scar and slight tenderness in the left upper quadrant. Laboratory study revealed intermittent elevation of white blood count and van den Bergh. A gastrointestinal roentgenogram showed calcification of the pancreas but no other lesion. Several Graham tests were inconclusive. Serum amylase, blood lipase, and urine diastase were elevated.

Cholecystectomy and choledochostomy were performed on June 18, 1946. The gall bladder was normal. The common duct contained no stones, was 2.5 centimeters in diameter and had a constriction in its distal end. The pancreas was markedly indurated. A 3 millimeter diameter dilator was passed through the ampulla with difficulty and a T tube with an indwelling ureteral catheter balloon was left in the dilated portion of the common duct.

Diagnosis: chronic calcified pancreatitis.

Eight months after operation the patient continued to have pain until he underwent a left thoracolumbar sympathectomy on January 18, 1947. Following sympathectomy he has remained free of pain for 22 months. Pain studies were performed on July 14, 1946 prior to the sympathectomy and are shown in Figure 8 and Table VIII.

*Experiment 9* CASE 9 M A (MGH No 256225) A 49 year old housewife entered the hospital on December 12, 1944, with intermittent epigastric pain, anorexia, nausea and vomiting of 15 years' duration. Twenty-six years previously, for this same complaint, she had had a cholecystostomy, then a cholecystectomy and choledochostomy without relief. Stones were said to have been found in the common duct. Because of the same symptoms since then she had had two more operations for pyloroplasty and choledochostomy without any abnormal condition being found in the common duct, and a T tube had been left in the common duct for 6 months without improvement.

Physical examination was negative, essentially, except for tenderness in the right epigastrium and several abdominal surgical scars. Serum examinations, blood chemistry, electrocardiogram, roentgenogram of spine, barium enema, gastrointestinal roentgenogram, and intravenous pyelogram were within normal limits except for a duodenal diverticulum and "fixation" of the duodenum.

Diagnosis: biliary dyskinesia.

Bilateral sympathectomy (D9 to D12 inclusive), with removal and resection of the great splanchnic nerves was performed on January 24, 1945. Nine months later the patient had had four mild attacks of left upper quadrant pain, although the previous right-sided pain had not recurred. Pain studies were performed on January 4, 1945 prior to sympathectomy and are shown in Figure 9 and Table IX.

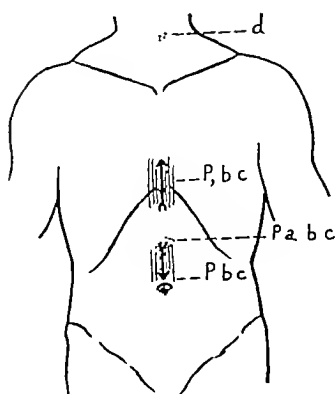


Fig 7 Case 7

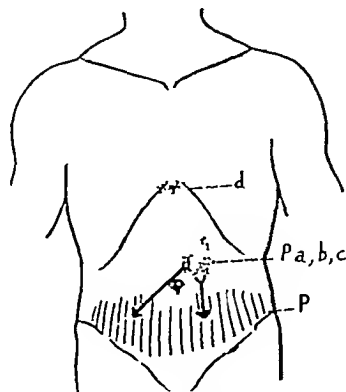


Fig 8 Case 8

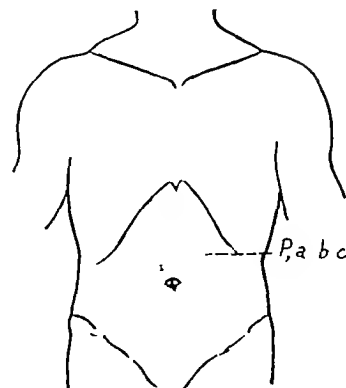


Fig 9 Case 9

TABLE VII —PAIN STUDY,  
CASE 7

	Location	Quality
P Clinical pain	Epigastric radiating up to 3rd inter costal space substernally and down to umbilicus	Deep seated acute burning pain
Experimental pain		
a From common duct distention with fluid	Same as P without radiation	Same
b From common duct distention with balloon	Same as P with radiation	Same
c From duodenum	Same as P with radiation	Same
d From lower esophagus	In throat only	'Choking and tugging'

Distention of the common duct with the ureteral balloon and of the duodenum reproduced identical pain which was similar to the patient's pain. Lower esophageal stimulation gave rise only to choking sensation in throat.

TABLE VIII —PAIN STUDY,  
CASE 8

	Location	Quality
P Clinical pain	Left epigastric radiating down to both lower quadrants	Deep seated burning
Experimental pain		
a From common duct distention with fluid	Same as P without radiation	Same
b From common duct distention with balloon	Same as P without radiation	Same
c From upper jejunum distal to gastro-enterostomy	Same as P without radiation	Same
d From lower esophagus	Substernal	Same

All areas stimulated except the lower esophagus gave rise to the same pain which was identical with the clinical pain except for the absence of radiation.

TABLE IX —PAIN STUDY,  
CASE 9

	Location	Quality
P Clinical pain	Epigastric to right of midline	Deep seated sharp aching pain
Experimental pain		
a From common duct	Same as P	Same
b From duodenum	Same as P	Same
c From esophagus	Same as P	Same

Stimulation of all areas reproduced identical pain which was similar in type to the clinical pain.

## SUMMARY OF RESULTS

*A Comparison of pain experimentally induced from the lower esophagus, common duct and upper small intestine.* As shown in the individual charts and as summarized in Table X it was found that there were certain similarities in the pain induced by distention of different viscera in the same patient in terms of location, radiation, quality, and intensity. It should be pointed out, however, that the amount of distention necessary to elicit pain of comparable intensity varied considerably from patient to patient.

Distention of the duodenum and of the upper jejunum produced an identical type of pain in all 5 patients so tested. By identical pain is meant discomfort which was indistinguishable as regards quality, location, intensity and radiation. Distention of the upper small intestine (duodenum or jejunum) and of the common bile duct produced identical pain in 7 out of 9 patients. In the 2 remaining patients the difference was one of radiation only. When distention of the lower esophagus was included in the comparison, the similarity of the pain was less striking. Five patients

TABLE X — COMPARISON OF PAIN EXPERIMENTALLY PRODUCED IN UPPER ABDOMINAL VISCERA

Viscera stimulated	Total cases	No of cases where pains were indistinguishable*	No of cases where pains were different
Esophagus upper small intestine and common duct	9	3	6
Esophagus and upper small intestine	9	3	6
Esophagus and common duct	9	5	4
Upper small intestine and common duct	9	7	2†
Duodenum and jejunum	5	5	0

\*Indistinguishable as to quality location intensity, radiation  
†Pain was the same except for a difference in radiation

felt that pain produced from the common duct and from the lower esophagus was indistinguishable, and 4 patients felt that the pain was different. Pain induced by lower esophageal distention was the same as that produced in the upper small intestine in 3 patients and was different in 6 patients. Thus it can be seen that pain from stimulation of all three areas was the same in 3 patients, while in the 6 other patients the pain was not comparable.

*B Comparison of the patients' clinical pain with the experimentally induced pain.* Pain in 6 patients was presumably due to disease of the biliary tract and in 2 patients it was apparently due to pancreatitis. One patient, Case 9, was having a recurrence of epigastric pain for which she states that she had a gall stone removed 26 years previously.

Seven patients felt that their clinical pain was reproducible both by distention of the common duct and by distention of the upper small intestine (Table XI). By reproducibility is meant pain which was similar as to quality, location, and radiation. In certain instances, possible damage to the structures did not warrant our attempting to induce pain of comparable intensity to the clinical pain. Two patients felt that pain from distention of the common duct and upper small intestine areas was the same as their clinical pain except for its radiation. In 4 of 9 patients distention of the lower end of the esophagus produced pain similar to the clinical pain. The chief difference in the esophageal distention

TABLE XI — REPRODUCTION OF CLINICAL PAIN OF BILIARY TRACT AND PANCREATIC ORIGIN BY MECHANICAL STIMULATION OF COMMON DUCT, DUODENUM, JEJUNUM, AND LOWER ESOPHAGUS

Viscera stimulated	Total cases	No of cases where experimental pain was same as clinical pain*	No of cases where experimental pain was different from clinical pain
Common duct	9	7	2†
Upper small intestine	9	7	2†
Esophagus	9	4	5

\*Same in quality, location and radiation  
†Pain was the same except for a difference in radiation

pain from the clinical pain noted in the 5 other patients was one of location, the discomfort from the balloon distention being located somewhat higher in the epigastrium than their own pain complaint.

*Discussion.* Data have been presented which compare the results of stimulating the common duct, upper small intestine, and esophagus in each of 9 patients who had had an exploration of the common duct. The discomfort from distention of these various viscera has also been compared to the clinical pain in these patients, in 7 of whom the pain was apparently due to a disturbance of the biliary tract and in 2, to pancreatitis. These studies have confirmed the results of Zollinger, McGowan and associates, of Layne and Bergh and others which have shown that epigastric and right upper quadrant pain with radiation to the back are produced by distention of the common duct (15, 16, 22). By distention of the common duct we were able to produce pain in the midepigastrium and in the right upper quadrant as well as discomfort radiating to the back. The fact that distention of the common duct could produce pain identical to that caused by distention of the duodenum or jejunum in a majority of our cases has not, so far as we are aware, been previously reported.

These studies have also shown that while distention of the lower end of the esophagus usually produces subxiphoid or high epigastric pain, as demonstrated by Jones (11), this procedure may in some patients give rise to pain lower in the epigastrium which is indistinguishable from the pain experienced from dis-

tention of the common duct or upper small intestine. It may be that this lower reference of pain from distention of the lower esophagus could be accounted for by the fact that our patients had organic disease.

We have also shown that our patients' clinical pain could be reproduced experimentally in all respects (in 7 of 9 patients) by distention of the common bile duct or of the upper small bowel and in some patients even by distention of the lower esophagus.

The striking degree of similarity between each of the 9 patients with respect to pain experienced from distention of the common duct and upper small intestine emphasizes how difficult it may be to distinguish on the basis of the pain reference or from the quality of the pain whether upper abdominal discomfort is arising from the biliary tract or from the upper small bowel. The fact that 2 patients with pancreatitis had their pain reproduced by stimulation of these structures emphasizes that this disease entity is likewise difficult to distinguish from disturbances of biliary and upper gastrointestinal tracts on the basis of the pain reference and quality of pain. It is worthy of note that the clinical pain, presumably from the biliary tract, in Case 1, was located in the right lower quadrant somewhat below the level of the umbilicus and that it was reproducible by balloon distention of the common duct and of the duodenum. This localization though atypical probably represents pain of biliary tract origin inasmuch as the patient has been asymptomatic for 15 months following cholecystectomy and inasmuch as the pain was reproducible by distention of the common duct.

A possible explanation for the similarity in the pain elicited from stimulation of the common duct and upper small intestine is that these structures as well as the pancreas have final common sensory pathways, namely, the visceral afferent fibers traveling in the great splanchnic nerves and over the lower thoracic sympathetic ganglia (14, 21). Smithwick and White, Craig, Archibald, Scrimger, and Grimson have all been able to abolish pain of the so called postcholecystectomy syndrome which is assumed to have its origin in the biliary tract by resection of the great splanchnic

nerves and of the lower thoracic ganglia (1, 8, 9, 17, 19). It has also been shown that section of these pathways likewise abolishes pain from balloon distention of the duodenum and upper jejunum (2). To what extent the great splanchnic nerves and the lower thoracic sympathetic ganglia conduct pain from the lower esophagus will be the subject of a subsequent communication.

It is appreciated that pain of visceral origin may be ill-defined and difficult of localization. However, the regularity with which each patient recognized the similarity of pains induced experimentally in different structures and their close resemblance to the clinical pain made us feel that the balloon distention procedure is a reliable method of investigating visceral pain mechanisms. Moreover, in certain instances the balloon procedure may help to clarify difficult diagnostic problems. Recently a patient came to our attention who complained of midepigastric pain which had recurred following a cholecystectomy. There was no clinical or laboratory evidence of common duct pathology. The only positive finding was a hiatus hernia. Balloon distention of the duodenum reproduced the exact location of the pain whereas distention of the cardiac end of the esophagus produced epigastric pain about 1 inch higher than the patient's complaint. At operation a stone was found and removed from the common duct. The relief of pain since operation is highly suggestive that the origin of the discomfort in this patient was from the common duct and not the hiatus hernia. The balloon distention procedure was felt to be helpful in identifying the origin of pain in this patient.

#### SUMMARY

1. A comparison of pain experimentally induced by distention of the lower esophagus, common bile duct, and upper small intestine has been made in each of 9 patients. The experimentally induced pain from these structures was also compared to the clinical pain in these patients, 7 having biliary tract disease and 2, pancreatitis.

2. Pain from distention of the common duct and upper small intestine was the same in 7 patients and different in 2 patients. When the

lower esophagus was included in the comparison, the similarity of pain was less striking, distention of all three viscera produced identical pain in only 3 patients

3 Distention of the common duct and upper small intestine reproduced the clinical pain in 7 of 9 patients, distention of the lower esophagus, in 3 of 9 patients

4 The striking similarity of pain induced from stimulation of (1) the common duct and upper small intestine and of (2) the experimentally induced pain to the pain of biliary tract disease and pancreatitis emphasizes how difficult it may be to distinguish between disturbances of these upper abdominal structures on the basis of the pain symptoms alone

5 It is suggested that the similarity of the pain from the viscera studied may be due to their having a common sensory supply, the great splanchnic and lower thoracic sympathetic nerves

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# THE LOCAL AND SYSTEMIC EFFECTS OF CHRONIC ULCERATIONS

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THE care and management of acute, chronic, and recurrent skin ulcers constitute a surgical problem complicated by numerous physiologic and clinical variations. The successful therapeutic approach and well planned surgical procedure depend largely upon the understanding and attempted correction of these fundamental disturbances. Infection, general debilitation, hypoproteinemia, anemia, and chronic shock occur as complications. The most vigorous treatment, aimed at the prevention and correction of these factors, in many instances will retard rather than stop the patient's downward course. The only satisfactory final solution to the ulcer problem is the attainment of a well healed wound at the earliest possible moment (Table I).

Ulcers result commonly from burns, circulatory lesions, chronic bacterial infections, neurogenic disturbances, malignancies, and various forms of trauma. The wounds of a patient with full thickness loss of skin over a large area may react in one of the following ways (1) (1) The wound may show extreme epithelial activity in that there is a piling up of keratin at the margin without progress, or there is a hopelessly slow extension of the epithelial edge across the wound (Fig 1) (2) The wound may show no epithelial response whatever to the wound stimulus, and with the continual loss of body fluids and increasing debilitation, the outcome may be fatal (Fig 2) (3) The wound may heal completely only to break down repeatedly following insignificant trauma or limited activity of the patient. The constant wound stimulus of tension and inflammation sometimes causes excessive keratin formation. While this type of wound rarely becomes malignant, it may do so but at a late date (Fig 3) (4) Even small deep wounds, if allowed to remain in a dirty condi-

tion and if pain is permitted to go uncontrolled, may cause debilitation and marked disability may result. The loss of a small area of full thickness skin over a critical area, such as an eyelid or hand, may produce a serious deformity. The small unhealed ulcer resulting from circulatory disturbances or chronic infection, commonly seen on the lower extremity, may result in a major economic and physical handicap to the patient (Fig 4). Observation of many patients who have received dilatory treatment has emphasized the hopelessness of such management (Fig 5), an understanding of the systemic and local factors involved does much to further this realization.

## LOCAL FACTORS IN WOUND HEALING

Loss of a partial thickness of skin should be followed by quick healing, since epithelial regeneration takes places from the deeper elements which persist. This type of healing must not be confused with the problem involved when a full thickness of skin has been lost. In such cases healing progresses by 2 processes. First there is an epithelial ingrowth from the remaining intact skin at the margins of the wound. Initial epithelization is rapid. However, progress is slowed as the epithelial border gets farther and farther from the margin of normal skin. The first regenerated epithelium may be of fair quality, but it becomes progressively poorer, eventually it is only a few cells in thickness, its base is not attached to derma, and none of the normal skin elements, such as hair follicles and sebaceous glands, are present. In the large wound epithelization often fails entirely after a time (Fig 5). Also, proceeding simultaneously with epithelial growth, granulation tissue is forming from the base of the wound and this tissue is converted into scar which contracts. The base of the wound is thus pulled together and is reduced in size so that the area which must be epithelized is thereby diminished.

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TABLE I—SUMMARY OF PERTINENT DATA ON PATIENT WITH BURN ULCER SEEN AFTER 6 MONTHS OF DILATORY TREATMENT

Period	c.c. Administered			RBC	Hb		Patient's blood plasma		
	Blood	Plasma	Amigen		gm	%	Total protein gm %	Albumin gm. %	Globulin gm %
(a) Entry	(Am't prior to entry indefinite)			3 9	9 4	—61	5 8	2 7	3 1
(a b) Preceding popliteal grafts	2 500	1 250	0	3 1	8 4	—55	—	—	—
(b-c) Before skin grafting entire wound	3 500	0	40 000	3 56	9 7	—63	5 7	3 3	2 4
(d) One month after healed wound	0	0	0	4 86	14 3	—93	6 4	3 3	3 1

- (a) Upon entry two-thirds of the lower extremities (37% of the body surface) covered by filthy edematous granulations. Both legs in acute flexion.  
 (b) First operation—popliteal adhesions severed, spaces grafted.  
 (c) Second operation—granulating wounds completely covered with free split thickness skin grafts.  
 (d) Only after a well healed wound had been obtained were the anemia, hypoproteinemia, chronic shock, etc., controlled.

Although this process may be life saving, it is also deforming especially in larger wounds or in wounds which involve critical areas, it causes the contracture, the ectropion of the eyelid, or the distortion of an extremity (Fig 6). Such a granulating wound is underlain with an inflammatory area. It is this attending inflammation which penetrates to the superficial joints, such as those of the finger, with the result that a partial or complete, and often permanent, ankylosis may follow even though the joint itself was not injured at the time of the tissue loss. If all factors are favorable, such a wound will heal, but if the area is large or subjected to trauma, oftentimes it will tend to break down. Under less favorable circumstances the wound will not heal, the epithelial ingrowth stops and the formation of scar tissue continues. The more dense the scar tissue and the greater its age, the less vascular it becomes. Thus, the chronic ulcer is soon surrounded by a cortex of dense, avascular scar which prevents further healing (Fig 5). An ulcer which at its onset may have been caused by varicosities, syphilis, or trauma, after a period of time can no longer be classified as a varicose ulcer, luetic ulcer, etc., but only as an ulcer per se (Figs 4 and 8). A varicose ulcer of this sort does not heal following apparently adequate control of varicosities. To continue to treat such an ulcer on the basis of its original etiology is to treat it for what it once was and not for what it is at the present time. Following the correction of circulatory or other persisting initial factors, the only adequate approach is excision of the

entire ulcer. The regenerated epithelium and underlying and surrounding scar must be removed down to tissue of adequate vascularity. This newly created wound should be covered with skin, preferably at the time of excision, in order to produce immediate healing of the area with tissue of good quality (Figs 3, 5).

#### LOCAL AND SYSTEMIC EFFECTS

**Anemia.** Three to 5 days after an acute burn, an anemia of severe degree may develop. This has been studied by Moore, who suggests that the following factors may participate in producing red cell loss: early hemolysis, increased cell fragility, blood destruction by unneutralized plasma antibodies, blood loss through an open wound, infection, metabolic disorders, and depressed bone marrow function, as well as the actual destruction of the blood contained in the burned tissues. From this point on until the wound is healed, anemia is a constant problem. Its production and continuation are tied up with all those factors producing general debilitation. All too often one is misled as to the patient's condition by reliance on laboratory determinations. The anemia of the chronically ill patient may be so masked by reduction in plasma volume that the red count, hemoglobin, and hematocrit fail to give an accurate measurement of real deficiency of hemoglobin and red blood cells.

**Hypoproteinemia.** Patients with at least 10 per cent of the body surface involved in third degree burns become serious nutritional problems because of the loss of nitrogen in the urine and from the denuded surface area (7). The

increased caloric requirements resulting from fever, infection and a higher metabolic rate further magnify the nutritional problem. Many workers have studied nitrogen balance and loss in patients with large ulcerative lesions. Particular attention has been focused on the burn ulcer. Taylor found as much as 45 grams of nitrogen excreted by 1 patient in a 24 hour period and directed attention to the inevitable result of the accumulated loss. Co Tui determined quantitatively the nitrogen loss in body exudates. He used slabs of fine pored cellulose sponges to collect the exudates. In a 24 hour period 1 patient exuded 0.42 milligram of nitrogen per square centimeter, while another exuded 2.26 milligrams of nitrogen per square centimeter from a denuded surface resulting from an avulsion. The significance of this loss is forcefully pointed out. If half of the body surface of a man weighing 70 kilograms and measuring 170 centimeters in height were to be involved in a burn, the 9,050 square centimeters so involved would lose per day according to one rate 23.75 grams of protein or the equivalent of 4,000 cubic centimeters of plasma or of 113 milligrams of meat, and according to the other rate 124 grams of protein or over 20,000 cubic centimeters of plasma or 600 grams of meat.

Ravdin suggested that "if the means to determine it were available, the first effect of protein undernutrition is a reduction in the amount of protein stored in the tissues of the body since every attempt is made to maintain the serum protein concentration at a nearly normal level." Localio has shown that there is actually a depletion of the fascial protein, while the serum protein concentration remains within normal limits. Subnormal serum protein determinations denote body protein deficiency, but the converse is not necessarily true. Multiple blood transfusions may bring blood proteins up to normal or near normal levels without restoring the body's protein reserves, giving a misleading idea as to the patient's condition. The excessive loss of nitrogenous products in the urine and from denuded surfaces and progressive regression in protein concentration indicate that the body protein stores are depleted in the patient with a chronic ulcer.



Fig 1 a, left Ulcer of 36 weeks' duration, patient having had 36 dressings under anesthesia during this period. Almost no epithelial growth has taken place. In addition to scar tissue contracture, there is shortening of hamstring tendons and sciatic nerve. b, Useful leg restored in small part of the time of previous disability. Correction obtained at 2 skin grafting operations, the first involving release of popliteal scar, application of split thickness skin grafts to the posterior surface of the leg and use of skeletal traction to overcome secondary contractures. At second operation anterior surface of leg was grafted.

**Chronic shock** This term has been provided by Clark, who presents a working concept of chronic shock. "A reduced total quantity of circulating blood in patients with nutritional deficiency was reported by Chang in 1932. Similar observations in hypoproteinemic animals have been recorded in the reports of the experiments of Holman, Mahoney and Whipple. In a study of patients with persistently unhealed war wounds attention was directed to a syndrome characterized by weight loss, reduced blood volume and increased interstitial fluid volume. All of these reports emphasize the coincidence of protein depletion and diminished blood volume. The surgically significant feature of reduced blood volume is an increased susceptibility of shock correctable by transfusion replacement of the blood volume deficit." It is on this basis that the syndrome has been designated as chronic shock.

**Infection** The chronic skin ulcer is always associated with contamination and with some degree of infection. So long as the contaminating bacteria are allowed to flourish, the ensuing infection will be a deterrent to wound



TABLE I—SUMMARY OF PERTINENT DATA ON PATIENT WITH BURN ULCER  
OPEN AFTER 6 MONTHS OF DILATORY TREATMENT

Period	cc. Administered			RBC	Hb		Patient's blood picture		
	Blood	Plasma	AmLan		gm	%	Total protein gm %	Albumin gm %	Chloride gm %
(a) Entry	(Amt prior to entry indefinite)			3.0	0.4	-61	5.8	3.7	1.1
(a-b) Prior to epiploic grafts	1,500	1,150	0	3.1	8.4	-55	—	—	—
(b-c) Before skin grafting entire wound	3,500	0	40,000	3.56	0.7	-63	5.7	3.3	2.4
(d) One month after healed wound	0	0	0	4.86	14.3	-03	6.4	3.1	3.1

(a) Upon entry two-thirds of the lower extremities (2 % of the body surface) covered by edematous granulations. Both legs in acute flexion.

(b) First operation—epiploic adhesions secured, spaces grafted.

(c) Second operation—granulating wounds completely covered with free split thickness skin grafts.

(d) Only after a well healed wound had been obtained were the anemia, hypoproteinemia, chronic shock, etc., controlled.

Although this process may be life saving, it is also deforming especially in larger wounds or in wounds which involve critical areas, it causes the contracture, the ectropion of the eyelid, or the distortion of an extremity (Fig. 6). Such a granulating wound is underlain with an inflammatory area. It is this attending inflammation which penetrates to the superficial joints, such as those of the finger, with the result that a partial or complete, and often permanent, ankylosis may follow even though the joint itself was not injured at the time of the tissue loss. If all factors are favorable, such a wound will heal, but if the area is large or subjected to trauma, oftentimes it will tend to break down. Under less favorable circumstances the wound will not heal, the epithelial ingrowth stops and the formation of scar tissue continues. The more dense the scar tissue and the greater its age, the less vascular it becomes. Thus, the chronic ulcer is soon surrounded by a cortex of dense, avascular scar which prevents further healing (Fig. 5). An ulcer which at its onset may have been caused by varicosities, syphilis, or trauma, after a period of time can no longer be classified as a varicose ulcer, luetic ulcer, etc., but only as an ulcer per se (Figs. 4 and 8). A varicose ulcer of this sort does not heal following apparently adequate control of varicosities. To continue to treat such an ulcer on the basis of its original etiology is to treat it for what it once was and not for what it is at the present time. Following the correction of circulatory or other persisting initial factors the only adequate approach is excision of the

entire ulcer. The regenerated epithelium of underlying and surrounding scar must be moved down to tissue of adequate vascularity. This newly created wound should be covered with skin, preferably at the time of excision, in order to produce immediate healing of area with tissue of good quality (Figs. 3,

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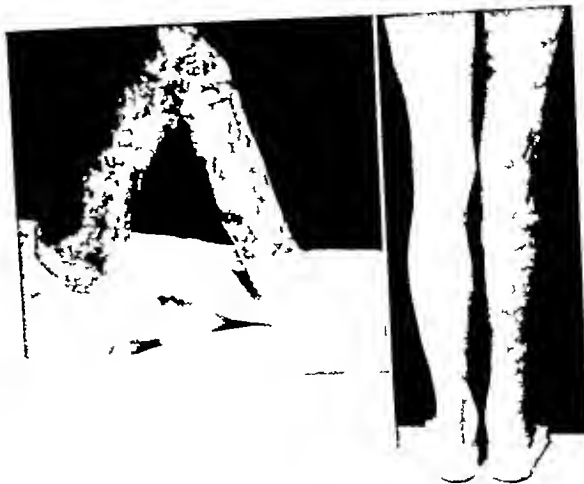


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Fig 2 a, Huge granulating wound, nearly encircling trunk, as it appeared after being prepared for grafting by saline soaks, pressure dressings, and frequent mechanical cleansing. Patient debilitated and rapidly failing despite heroic supportive treatment. Pinch grafts applied to such a patient often do not prevent death because epithelization is too slow to check failure of vital processes. b, Intermediate result after covering approximately 50 per cent of open wounds with such split skin grafts as could be obtained from such an emaciated patient, plus homografts of split skin from 3 donors. Reduction of the wound by 50 per cent carried the patient over a critical period and initiated spontaneous epithelization. Homografts in this instance persisted up to  $7\frac{1}{2}$  months, the longest survival in any of our cases. c, Complete healing without marked contractures finally obtained by further use of split skin grafts from patient's own body.

healing. Bacteria grow and multiply unless something is done to starve, remove, or annihilate them. Starvation may be accomplished by the mechanical removal of devitalized tissue. All serum exudate, necrotic tissue, and blood clots should be removed by gentle but thorough cleansing. Copious washing and irrigation of the wound will reduce the bacterial count. The changing of pus soaked dressings will mechanically remove masses of germ containing material. The frequent change of dressings and proper cleansing of the wound, rather than damaging the ingrowing epithelium, as is sometimes stated, aids its development through reducing tissue destruction by infection (Figs 2 and 3b).

Many agents have been advocated to control and destroy bacterial growth but none has been completely successful. All too frequently the substances used have proved more lethal

to viable cells than to bacteria. The control of such infections may be strengthened by the use of penicillin, streptomycin, and the sulfonamides and by bolstering the immune processes of the host, its eradication depends upon the careful surgical care of the local lesion. This implies the prevention of contamination, starvation of the bacteria by the removal of slough and secretion, and by the actual mechanical removal of the organisms which come with the proper application of surgical dressings, and the use of open drainage and wet dressings.

*General debilitation.* Marked weight loss and general debilitation have long been recognized as serious complications in patients with large chronic ulcerating wounds. This term simply serves to summarize the combined effect of infection, hypoproteinemia, anemia, pain, fever, inability to take and metabolize



Fig 3 a, Carcinoma developing in ulceration from burn repeatedly recurrent over a 53 year period b, Wound from cautery excision of carcinoma properly prepared to receive split skin graft Note firm, compact, clean granulations resulting from pressure dressings and frequent cleansing Edematous granulations respond to such care and should never be destroyed with escharotic agents such as silver nitrate, which delays wound healing c, Healing by primary intention by application of split thickness skin grafts in 1 operation Patient eventually died of intra-abdominal metastases

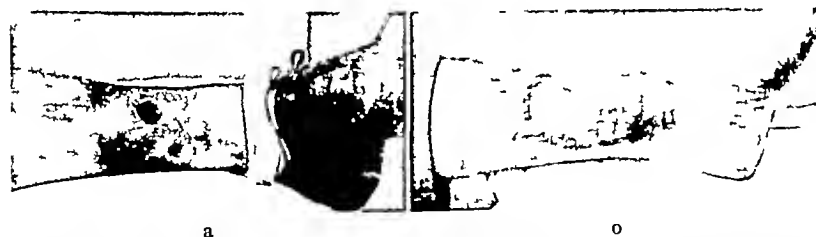


Fig 4 a, An ulcer per se, initially caused by trauma The surrounding and underlying scar has prevented healing over a 3 year period b, Immediate healing obtained by deep and wide excision of the ulcer and application of thick split skin graft Has remained healed to date, 5 years, permitting normal use of the leg

adequate amounts of food, and loss of morale through pain and disability General debilitation can be prevented only by attaining a healed state From every standpoint a concerted effort should be made to obtain wound healing prior to this degree of debilitation (Fig 2)

#### TOPICAL APPLICATIONS TO SPEED WOUND HEALING

An understanding of the many problems involved leads one to believe that the search

for a magic drug which may be applied topically to eliminate scarring and speed healing will be of no avail In the past many agents have been acclaimed The wound characterized by part thickness loss of skin should heal either without scarring or with minimal scarring unless further loss of tissue is produced through the use of topical applications, improper dressings, or infection With the full thickness loss of skin, especially over large areas, healing must be by slower body processes Treatment which holds infection to a



Fig 5 a, left Ulcer caused by a burn 17 months previously, patient having been hospitalized at public expense for this period. Vertical scar edges indicate that spontaneous epithelization has ceased, although production of underlying scar is continuing, reducing the vascularity of the area. Poor quality of the spontaneously formed epithelium is apparent. b, Patient returned to productive activity 6 weeks after excision of ulcer and poor epithelium, relaxation of contracture by dissection, and application of split thickness skin graft.

minimum, supports the general condition of the patient, and does not injure tissue will result in the most rapid spontaneous healing

possible. No topical agent alone can achieve these results.

#### SURGICAL COVERING OF THE OPEN WOUND

Large areas of skin loss by avulsion may be replaced immediately (Fig 7). The more critical the area or organ involved, the greater the importance of immediate restoration of the skin surface. Emergency grafting of the fresh wound will prevent the deleterious local and systemic effects of chronic ulceration, deformity will be minimized and function will be restored at the earliest possible moment. In other types of tissue loss such immediate treatment may be impossible or not available. Nevertheless, the principle of rapid healing by means of skin grafts is just as applicable (5). Especially in the burned patient, the heroic procedures which were necessary to save the individual at the time of the acute burn must be continued, life saving measures must be carried on through the period when the medical and nursing staff may be tempted to relax because the crisis is over. A clean wound receptive to a skin graft should be quickly obtained. In from 3 to 5 weeks after injury large sheets of split thickness skin must be applied to the ulcerated area. Thus, the patient is restored to health in a matter of weeks rather than years. Pinch grafts are frequently used on such patients and may perhaps im-



Fig 6 a, left Distortion resulting from contracture of scar of spontaneously healed ulcer. b, Correction in 2 operations: (1) release of contracture by dissection and application of free full thickness skin graft, (2) interdigitation of local flaps across tight margins of grafts.

some instances be life saving by eventually healing the wound. With large areas, however, this type of graft simply alters the equation of the patient's tenacity of life versus slow wound healing, but does not solve the problem. The pinch graft does not give immediate healing. The procedure may be likened to the process of acquiring a lawn by planting seed versus sodding. Obviously, some patients present such large areas of ulceration that they themselves cannot supply enough skin for immediate coverage and therefore will rapidly lose ground. In many of them it appears that death is inevitable. It is in such individuals that the use of homografts, sheets of skin of split thickness taken from other individuals, may be life saving. Such skin has never been proved to persist except in the case of identical twins. However, it does convert a huge open wound with its many relentlessly destructive systemic effects into at least a temporarily healed area, with its many advantages. The use of such grafts is an emergency procedure to meet a crisis and in this respect may be likened to a blood transfusion where the donor's cells do not persist but do tide the recipient over a critical period of need. Such homografts in our experience "take" with the same readiness as the patient's own skin. Homografts have persisted with all the appearance of normal skin from 3 weeks to, in one instance,  $7\frac{1}{2}$  months. The patient in each instance is thereby given a much needed reprieve (Fig 2). The maximum effort to produce healing in the critically burned patient must be made at the first operation (2).

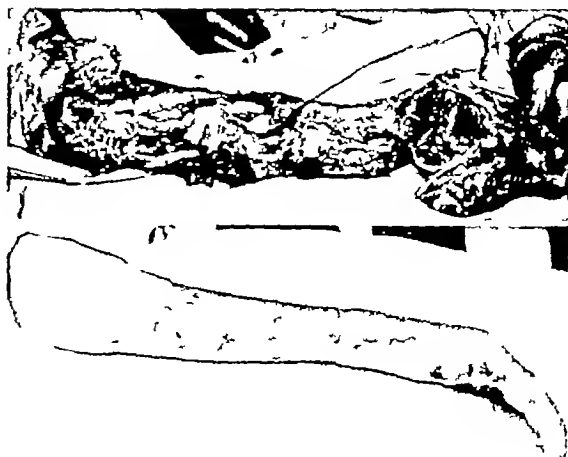


Fig 7 a, above Avulsion of major portion of integument of forearm and hand presenting question of amputation, secondary repair with additional damage from inflammation attending delay, or immediate débridement and grafting b, Early result obtained by immediate grafting with small secondary graft to areas of further skin necrosis. Patient treated in conjunction with Dr. Oscar Hampton.

*The small chronic ulcer.* The leg ulcer constitutes a "sore spot" on any charity service or clinic. Such individuals rapidly lose their status as wage earners. Most surgical practices include a number of cases of such ulcerations which have proved intractable to the usual treatments. The most direct, quickest, and best approach to such problems is the adequate excision of the ulcer with its surrounding thin scar epithelium and underlying dense avascular scar. The defect is then covered immediately with a skin graft of intermediate thickness (3). Although such ulcers are often the result of faulty circulation

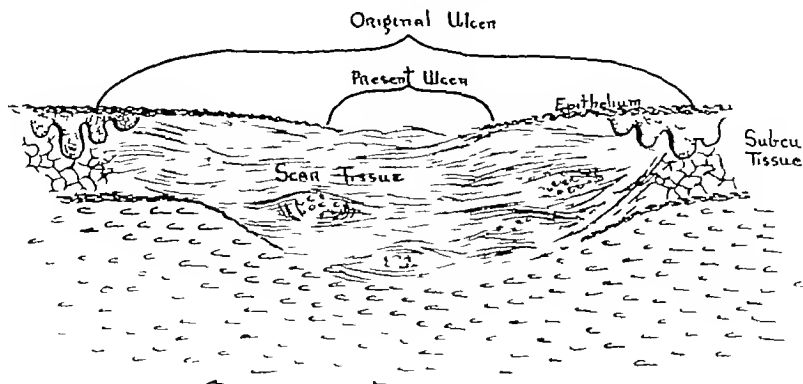


Fig 8 Diagram of the chronic ulcer, per se

in an extremity, after a period of time they persist either because of entirely local conditions or because of a combination of both general and local factors. Frequently, the general circulation of the extremity cannot be improved beyond a certain point. However, with the elimination of the local lesion, healing may often be maintained with limited use of the leg and the wearing of elastic bandages or supports. Long standing ulcerations resulting from osteomyelitis or compound fracture may likewise often be permanently eliminated (Fig. 4).

#### SUMMARY

The basic principles in the management of chronic ulcerative skin lesions are discussed. Special emphasis is placed upon the local and systemic effects of such ulcers. Factors in wound healing and the local pathological status are outlined. Topical applications to speed wound healing are discounted. A permanently healed wound is the only satisfactory solution of the chronic ulcer problem, this may be obtained at the earliest possible

moment by the use of split thickness grafts.

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# THE REGIONAL LYMPH NODE DISSECTION IN CANCER OF THE EXTREMITIES

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**M**ALIGNANT neoplastic disease takes an annual toll of more than 180,000 persons in the United States. The mystery of malignancy is yet to be solved, but while research continues and is gaining momentum, radical surgical removal of the lesion appears to yield the best results for life expectancy. The extirpation of the regional lymph nodes in block dissection is a procedure designed to eradicate the first collection spot, where malignant cells lodge, after traversing the lymphatic vessels from the primary site. These procedures, the radical groin dissection and the radical axillary dissection, are frequently indicated in malignant lesions of the extremities and are to be used in conjunction with the radical local excision. Fifty-one of such dissections, done at the New York Post-Graduate Hospital, Tumor Division, for squamous cell carcinoma and malignant melanoma of the upper and lower extremities, were recently reviewed. Certain conclusions were reached:

## THE LESION

Malignant neoplasms of the extremities may arise from any of the tissues present. They are the squamous cell carcinoma, the malignant melanoma (melanocarcinoma, melanosisarcoma), and the sarcomas (fibrosarcoma, myxosarcoma, liposarcoma, osteogenic sarcoma, leiomyosarcoma, rhabdosarcoma). The sarcomas were not studied in this series.

*The squamous cell carcinoma.* The epidermoid or squamous cell carcinoma of the extremities appears as ulcerated, encrusted, irregularly-shaped or round, raised masses usually with firm, indurated, rolled borders. The appearance depends greatly on the duration of the lesion and the predisposing factor or precancerous lesion namely, thermal or traumatic scars, senile keratoses, arsenical keratoses,

verrucae, irradiative, bacterial, and chemical dermatoses, osteomyelitic sinuses, and varicose and luetic ulcers. In 35 cases of squamous cell carcinoma studied, 8 patients or 23 per cent gave a history of a previous burn, 5 in old burn scars and 3 in scars of less than 1 year's duration. Two of the 35 patients had received intensive x-ray therapy, and 2, electrolysis for the removal of hair. The carcinoma arose in an area of lupus vulgaris in 2 cases, in an area of arsenical dermatitis in 2 cases, and in a birthmark in 1 case. Three had no predisposing factor other than an incident of trauma. No cause was mentioned in the other cases.

In general, this type is slow growing with a low grade of malignancy. The average age in this series was found to be 56 with the youngest at 30 and the oldest, 84 years. Seven or 44 per cent of 16 regional lymph node dissections showed metastatic lymph nodes. Taylor and Nathanson found the likelihood of metastasis increased with greater duration, larger size, and higher grades of malignancy. They found axillary metastasis in 36 per cent of 45 patients who had squamous cell carcinoma of the upper extremity for less than 1 year, and in 52 per cent of 45 cases of involvement of the lower extremity. DeBell and Stevenson thought that the duration of the lesion seemed not to influence the rate of metastasis but that the larger lesions, over 3 centimeters in diameter, had a greater tendency to metastasize than the smaller ones. In 6 cases studied in which regional lymph node metastasis and a fairly reliable history were present, the duration since onset varied from 8 to 36 months with an average of 19 months. Pack and Rekers report this time interval in the Memorial Hospital series of cases to be 30 months. Data in this regard are apt to be inaccurate because of the difficulty in ascertaining when the carcinoma began, especially when a precancerous lesion was present. In

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Fig. 1. Squamous cell carcinoma of the hand of 4 months' duration. This lesion followed the burn described

the case of a 67 year old hat labeler, who sustained small burns on the dorsum of the hand by molten particles of gold, all the little burns healed but one, and at this site there grew a squamous cell carcinoma (Fig 1). Here, the history of 4 months could be considered accurate. Other inaccuracies regarding rate of metastasis may result from the failure to section and recognize the area of metastasis or the metastatic lymph node. It would be necessary for the pathologist to take thousands of serial sections of the block of tissue removed in order to avoid missing microscopic areas of metastasis.

Metastasis is common in squamous cell carcinoma of the extremities.

*The malignant melanoma.* This neoplasm and the squamous cell carcinoma have many characteristics in common but also differ greatly. The lesion often develops in a pigmented spot on the skin, grows as a mass, usually ulcerated, encrusted, pigmented, friable and indurated, raised, and rounded (Fig 2). It often appears as an innocuous little pigmented mass, irregular in shape, flat or slightly raised, and increasing slowly in size. Both sexes are equally affected, as are the young and the old. In 38 cases of malignant melanoma of the extremities, the average age was 46 years, the youngest being 18 and the oldest 69 years. DeCholnoky reported the malignant condition present in a child 15 months and 1, 5 years of age. The diagnosis in

children is apt to be made with difficulty because of the confusing microscopic picture. In 9 or 24 per cent of the 38 cases reviewed there was a history of trauma to a pigmented lesion previously present. The malignant melanoma, histologically appears carcinomatous or sarcomatous, and often both. It metastasizes freely by way of the lymphatic vessels and the blood stream. Metastatic lymph nodes were found in 23 or 66 per cent of the 35 lymph node dissections performed for malignant melanoma of the extremities. In these cases observed at this clinic the time interval since onset was  $13\frac{1}{2}$  months. The shortest interval in this series was 3 months. Pack and Rekers in their series found this average interval to be 13 months. Again the inaccuracies previously cited regarding such statistical data would be present.

Metastasis is common in malignant melanoma of the extremities and may occur rapidly, especially in the larger lesions, which are easily irritated and traumatized, which increase in size rapidly, and which have been treated with various medications.

#### THE LYMPHATIC ROUTE

Lymph is derived from the interstitial fluids and enters a closed system of capillary loops which are composed of a single layer of endothelial cells. From groups of these loops, the reticula, emerge the finest lymphatic vessels which contain valves. As the vessels grow larger, they decrease in number, are provided with a smooth muscle layer, and are contractile. The lymph flows to the lymph nodes via these afferent vessels, which are more numerous than the efferent ones. In traversing the sinuses which partly surround the lymphocytic follicles of the lymph node, the flow is slowed. This slowing, together with the mechanical action of the meshwork of reticulum, renders the lymph node a highly efficient center of filtration, which removes emboli of malignant cells, bacteria, and foreign particles.

The rate of flow is increased by the increased formation of lymph and by the massage of the vessels. The smooth musculature in the larger vessels may aid the flow along with the pumping action of the diaphragm and the negative

pressure in the thorax and the negative pressure in the venous system at the jugular subclavian junction. The valves make certain of the forward motion of the flow. Thus exercise, massage, heat, motion, and bandaging an extremity will increase the drainage of lymph. An extremity which is quiet and dependent has an almost negligible lymphatic flow.

Lymph node metastasis is the result of an embolus of cancer cells which enters the lymphatic vessels and travels to the regional lymph node via the afferent lymphatic vessel. Occasionally, the metastasis is established by permeation, but most often by the embolic route. Once the malignant neoplasm is present in the lymph node, it may spread to other lymph nodes in the region by secondary embolism or by permeation, and when near veins, blood stream invasion may follow. Occasionally, blood stream emboli occur due to invasion of veins by the primary tumor.

Occlusion of the lymphatic vessels may reverse the direction of the flow of lymph which is normally proximal and centralward. This occlusion may be due to tumor emboli, to the blockage of lymph nodes by neoplastic tissue, to surgical removal, and to inflammatory processes. The stagnation of lymph results in distention of the lymphatic vessels and incompetency of the valves. Retrograde lymphatic neoplastic permeation may follow with edema of the extremity and the rapid appearance of metastatic nodules in the superficial lymphatics. This phenomenon has been evident in the malignant melanoma following regional lymph node dissection.

The lymph nodes of the axilla are in close relation to the chief veins of the axilla and receive afferent vessels which drain areas that coincide roughly with the distribution of these veins. The main lymphatic trunks of the arm are superficial, roughly parallel but anastomose freely on the flexor surface of the forearm. They tend to direct themselves medially toward the epitrochlear area and ascend on the medial aspect of the upper arm. A number of these trunks are interrupted by epitrochlear lymph nodes, commonly two or three lymph nodes superficially placed on the medial aspect of the arm above the internal epicondyle of the humerus. These nodes receive afferents chief-



Fig. 2 Malignant melanoma of the arm, a birthmark, which at the age of 38 began to increase in size. Here it is seen after 6 months of growth. Axillary dissection revealed metastatic lymph nodes.

ly from the ulnar aspect of the forearm and hand, but the anastomoses of these vessels are numerous. The efferents of the epitrochlear nodes as well as the other primary trunks pass to the lowest axillary vein group of lymph nodes. A few vessels go directly to the supraclavicular area while others go to higher groups in the axilla. Some of the trunks accompany the cephalic vein, and may be interrupted by intercalated lymph nodes in the deltoid pectoral groove or may pass to apical lymph nodes, or may go directly to the supraclavicular area. There are a few deep lymphatic vessels of the arm which accompany the deep blood vessels and are interrupted by inconsistent intercalated lymph nodes, the deep epitrochlear lymph nodes in relation to the brachial vessels, or the lymph nodes of the axilla.

The lymphatic vessels of the lower extremity are chiefly superficial and tend to follow the course of the veins. From the sole of the foot, the posterolateral aspect of the leg, and from the deep structures of the leg, the lymphatic vessels follow the short saphenous vein or the deep veins to reach the popliteal lymph nodes or pass directly to the deep femoral lymph nodes. From other parts of the leg and thigh, the lymphatic drainage passes to the superficial nodes of the long saphenous vein or directly to the deep femoral or external iliac lymph nodes. From the buttocks, the drain-

age accompanies the superficial circumflex iliac vessels to the groin and rarely to the hypogastric lymph nodes via the lymphatic trunks which accompany the gluteal vessels

#### THE OPERATION

*The radical axillary dissection* With the arm abducted to a right angle to the body, an incision is made on the anterior chest along the free border of the pectoralis major muscle. At the apex of the axilla, the incision is one-third of the distance from the free border of the muscle to the clavicle. It then curves and is continued down the arm to the point of the insertion of the pectoralis major. The skin flaps are widely dissected with only a minimum of subcutaneous fat remaining on the skin. The landmarks used to limit the extent of the dissection are the latissimus dorsi muscle posteriorly, the tendon of the pectoralis major muscle at the arm, the cephalic vein at the upper border, and the lateral border of the pectoralis major muscle which forms the anterior margin of the axilla. The skin is dissected to this line. The landmarks are exposed and the dissection is outlined. Progress is then made on the distal side of the cephalic vein with the sheath reflected mesially through nearly the whole length. The tendon of the pectoralis major is exposed and is transected so that there is enough stump remaining to allow resuture of the tendon later. The pectoralis minor is retracted. The muscle may be sacrificed if it appears to be involved in the pathologic process. The axillary fascia is then incised at the nearest possible point to the clavicle and the axillary vein is exposed. Working from the lateral to the vessel side, the thin fascia of the coracobrachialis and biceps muscles is removed and carried over the musculocutaneous nerve, median nerve, and brachial artery to the axillary vein without disturbing the fatty tissues around the nerves. The sheath of the axillary vein is incised. The vessels and nerves to the pectoralis major are ligated. The subscapular vessels, which enter the axillary vein from behind, are preserved. The dissection is carried over the brachial plexus. The subscapular space is cleaned out by blunt dissection, and the exposed long thoracic nerve of Bell is preserved. The speci-

men is then removed from the margin of the latissimus dorsi muscle mesially to the chest. The tendon of the pectoralis major is sutured to the tendinous insertion. A stab wound is made in the outer flap in front of the latissimus dorsi muscle to allow two small split rubber tube drains to be inserted to the summit of the axilla. The skin edges are approximated. All air and fluid is expressed, and a pressure type of dressing is applied. The dressing is usually not disturbed for 5 days. The drains are then removed and function of the arm is encouraged.

*The epitrochlear lymph node dissection* is occasionally performed along with the radical axillary dissection.

A longitudinal incision is made over the epitrochlear region, usually over palpable lymph nodes, from the middle of the arm downward to the region of the internal epicondyle. The skin flaps are widely raised. The biceps muscle is exposed in front and the triceps and flexor muscles of the forearm posteriorly. On the fascia of these muscles the dissection is then carried centrally toward the brachial vessels and nerves. The medial antebrachial cutaneous nerve and the basilic vein are divided as incisions are made in the fat. The brachial vessels and the median and ulnar nerves are exposed as the biceps and triceps muscles are retracted outwardly. The dissection is carried distally along these structures and the muscles until the antecubital or epicondylar region is reached. The fat is cut across and the basilic vein again ligated. The wound is closed and a firm dressing is applied to the elbow.

*The radical groin dissection* With the thigh on the involved side abducted and externally rotated with the knee slightly flexed over a sandbag, the incisions are made starting 2 inches above and 1 inch medial to the anterior superior iliac spine, sweeping downward in a wide ellipse to terminate in the mid thigh over Hunter's canal. The amount of skin removed varies with the amount of subcutaneous fatty tissue, the looseness of the skin, and the nodal involvement. With the skin divided, the margins of the wound are widely undercut and thus the skin flaps are carefully prepared. The thickness of subcutaneous fat remaining under the skin varies from 3 to 5 millimeters.

The subcutaneous fat is dissected to include the upper one-third of the anterior thigh, the inguinal region, and the lower abdominal wall over the iliac quadrant. The dissection is deepened to the underlying muscles to include the fascia with the fat in a block from above downward. The inguinal canal is exposed by incising the aponeurosis of the external oblique parallel to the inguinal ligament from the external to the internal inguinal rings. The adventitia of the femoral artery and vein is stripped. The great saphenous vein is ligated at the saphenous femoral junction and again where the dissected block overlies the middle segment of the sartorius muscle. The inguinal ligament may then be transected or allowed to remain intact and raised by dissecting it from the underlying attachment. The inguinal canal is further opened by incising the transversalis muscle down to the extraperitoneal areolar tissue. The fatty tissue about the iliac vessels, is swept downward and removed as part of the specimen. The node of Cloquet may be found anteriorly on the femoral vessels and is also included. Tissue overlying the obturator foramen is also included in the specimen. The deep epigastric vessels coming off at right angles from the external iliac artery and vein are ligated. The dissection is performed sharply. The inguinal canal is repaired as in a herniorrhaphy. It is possible to remove the entire specimen in one block which is theoretically better than dividing this potential neoplastic tissue into deep and superficial blocks. The dead space of Scarpa's triangle is obliterated by suturing the sartorius medially. The femoral vessels are thus protected. A spica type of dressing is applied by employing refined mechanic's waste in the groin and upper thigh for even pressure, with the thigh slightly flexed to lessen the tension on the wound and to permit the natural fold of the groin to form. This position is continued for 3 weeks. Any collections of serum are aspirated.

*The popliteal lymph node dissection* is rarely performed along with the radical groin dissection.

A vertical incision is made over the popliteal area. The skin flaps are prepared widely and a diamond-shaped area between the ham-

string muscles above and the two heads of the gastrocnemius muscle below is exposed as the dissection is deepened by two lateral incisions in the fat which converge and unite.

The floor of the dissection is formed by the fascia. The popliteal vessels and peroneal nerves are identified near the upper angle and are preserved. The short saphenous vein is ligated at the junction with the popliteal vein and as the dissection is carried distally, is again ligated at the lower angle of the operative field. After removal of this mass of tissue, the wound is closed and a pressure dressing is applied and the limb splinted. The pressure and splinting is maintained for 2 weeks.

#### COMPLICATIONS

There was no postoperative mortality in the 51 axillary and groin dissections studied. Pack and Rekers report 2 (1.6 per cent) postoperative deaths in a series of 122 groin dissections, 41 of which were bilateral. Taylor and Nathanson report 2 postoperative deaths or 3 per cent in 71 axillary dissections. They also report 10 or 5 per cent postoperative deaths in 199 cases of groin dissections, 5 of which deaths occurred in those who had bilateral groin dissections. The complications expected in any major surgical procedure are to be expected here, namely, pneumonia, atelectasis, cardiac failure, hemorrhage, thrombosis, and sepsis. Complications pertaining to the wound are fairly common. Eight or 16 per cent of the 51 patients in this series developed serious wound infections, slough and necrosis of wound edges with separation. There were several with minor delays in wound healing. The most frequent complication is edema of the extremity. Edema was present in varying degrees but fairly marked in 10 or 20 per cent. Five of these 10 patients had developed postoperative wound complications. Of these 10, the edema disappeared within 6 to 8 months in all but 1, who had fairly marked elephantiasis of the upper extremity following axillary and epitrochlear dissections. After 12 months there was marked improvement and the extremity was functionally good. Occasionally lymph and serum collect under the skin for long periods of time in large quantities.

TABLE I — FOLLOW-UP STUDY OF RADICAL AXILLARY AND GROIN DISSECTIONS

	Malignant melanoma	Squamous cell carcinoma
No patients	25	13
No with metastatic lymph nodes	15	4
No evidence of reappearance		
0-1 years	5	2
1-2	3	4
2-3	2	1
over 5	5 (20%)	5 (31%)
No evidence of reappearance with metastatic lymph nodes		
0-1 years	1	1
1-2	1	
over 5	3 (20%)	2 (50%)
Died of malignant lesion		
0-1 years	5	
1-2	4	1
2-3	1	

## THE RESULTS

The follow-up has not been satisfactory (Table I). Thirty-eight or 74.5 per cent were examined periodically for varying lengths of time. The results obtained must be surveyed with certain reservations. There were differences in operative technique. Some of the dissections were not as radically performed as others. Histopathologic techniques vary also and certainly metastases have been missed by overlooking a lymph node too small to be recognized or by failure to section the involved portion of the lymph node.

Thus, 3 of the 15 patients who had dissections which showed metastatic malignant melanoma have no evidence of reappearance after 5 years. Two of 4 cases showing metastatic squamous cell carcinoma were free of positive signs after 5 years. Of those who died of the malignant lesion, all showed metastatic lymph nodes.

In the local excision of 35 squamous cell carcinomas, 4 or 11 per cent reappeared locally. In 38 malignant melanomas of the extremities, there were no local reappearances, but in 6 cases there were reappearances near the original excision or between the site of the original lesion and the regional lymph nodes which, in these cases, had been removed.

Nathanson and Taylor report 2 year cures in 12 or 29 per cent of 52 regional lymph node dissections for squamous cell carcinoma of the extremities which showed metastatic lymph nodes. They also report 7 of 40 positive dissections for malignant melanoma of the extremities free of reappearances for 5 years. DeCholnoky reports 3 of 16 positive dissections for malignant melanoma who have 5 year cures.

## MANAGEMENT

A tumor of the extremities which is gradually increasing in size is to be handled with suspicion of neoplastic malignancy.

The most certain method of arriving at a diagnosis is the biopsy. If the lesion presents characteristics of a malignancy, then the frozen histopathological section may be performed, followed promptly by radical local excision if positive. In the case of the melanoma, no biopsy should be taken unless one is prepared to continue immediately with a radical excision. The excision of the malignant melanoma is to include a wide area around the tumor of normal-appearing tissue, subcutaneous fat, and an even larger area of underlying fascia with more removed on the drainage side. It is frequently necessary that the resulting defect be filled with a flap or with a skin graft, usually the split thickness dermatome graft. It is unnecessary to excise as radically with the squamous cell carcinoma. Usually, excision of the tumor with normal-appearing skin and subcutaneous fat is sufficient.

With the diagnosis of malignant melanoma of a toe or finger confirmed, amputation of that part of the extremity is indicated. With lesions of the extremities, an attempt should be made to excise the lesion but also to make certain of offering the patient a functional limb. The radical groin or radical axillary dissection should be performed in every case of malignant melanoma of the extremities. The local excision and dissection of the regional lymph nodes in continuity at the time of the initial operation offers more likelihood of arrest, when the primary site is so situated as to offer the advantages of a continuity procedure.

With the squamous cell carcinoma of the extremities, the dissection of the regional lymph nodes is advised regardless of the duration and appearance of the lesion, of the degree of malignancy, and of the state of the regional lymph nodes.

The lymph node dissection is postponed approximately 2 weeks after the local excision or after the local wound is healed and there has been active motion in the extremity. Any malignant emboli en route would then have the opportunity to reach the regional lymph nodes.

The epitrochlear and popliteal dissections are to be performed along with the axillary or groin dissection when highly suspicious lymph nodes are found in the region and when lymphatic drainage is expected to occur to these regions because of the particular location of the primary site. There would be a greater tendency to perform these dissections with the malignant melanoma than with the squamous cell carcinoma.

The follow-up of these patients is considered most important. The extremity must be carefully observed for reappearance locally, in the regional lymph nodes or anywhere in the limb. Suspicious lesions must be removed as they appear. These patients should be seen monthly during the first postoperative year. The follow-up should continue as long as the patient lives.

The complication, edema of the extremity, which is probably the result of lymphatic blockage and vasospasm, is handled by rest, elevation, and elastic bandaging. If the edema persists, the sympathectomy or stellate ganglion blocks, or intravenous procaine may be of value in relieving the vasospastic element.

#### RATIONALE

Surgically, the regional lymph nodes are accessible. The malignant lesion when accessible is to be eradicated. There can be no certainty that emboli of the primary lesion have not arrived at the regional lymph nodes. It has been shown that palpation of a lymph node is not to be considered reliable in diagnosing metastasis. Regional lymph nodes were not palpable in 12 of the 30 dissections in which metastatic nodes were present. The

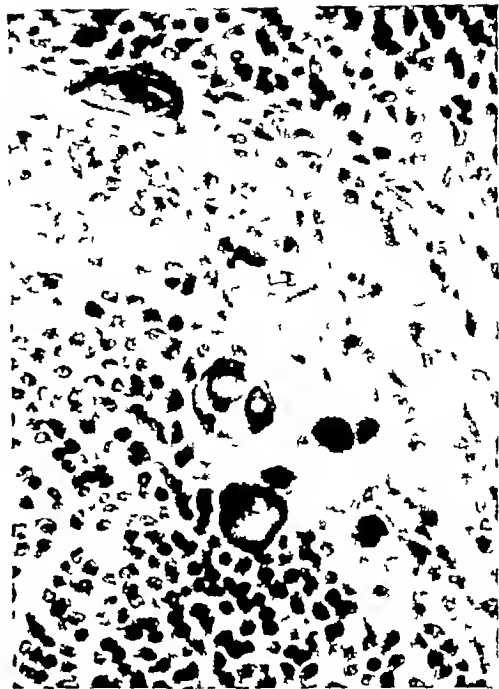


Fig. 3 Photomicrograph of section of axillary lymph node which contains metastatic malignant melanoma cells, as indicated with arrows.

axillary and inguinal nodes are often enlarged, the result of a previous inflammatory process in the extremity.

A 37 year old white female presented herself to the Tumor Clinic with a lesion which had been present on her finger for about 1 year. There was a bluish discoloration and slight ulceration. Biopsy revealed malignant melanoma and an amputation of the finger was performed, and 3 weeks later an axillary dissection was done. No nodes had been palpable previously. Review of the sections revealed one section to contain a few isolated pigmented metastatic cells free in the sinuses of the lymph nodes (Fig. 3). The embolic theory is supported. There is no evidence of reappearance after 6 months.

It may be said that many of the dissections were performed and no metastatic nodes were found. A few of these negative dissections were probably positive but there is another value even though metastases were not found. The squamous cell carcinoma and the malignant melanoma disseminate most often by

the lymphatics. The interruption and removal of the main drainage trunks and collection areas provide a block to further dissemination. Other emboli may occur especially following the operative procedure, but the emboli will be trapped in the extremity and may appear to be surgically eradicated unless a collateral vessel is traversed. Lymphatic vessels regenerate slowly.

Occasionally an embolic shower as previously described occurs following local removal and regional lymph node dissection for malignant melanoma, when many malignant metastatic skin nodules appear between the site of local excision and the regional dissection. When such an incident occurs, prompt amputation or disarticulation might be indicated.

The procedures are not difficult to perform. The complications encountered are few in number and are not serious in nature.

#### CONCLUSION

Fifty-one radical axillary and groin dissections were performed for squamous cell carcinoma and malignant melanoma of the extremities.

Metastasis is found to be common to the regional lymph nodes via the lymphatic route. Regional lymph node dissections are usually indicated and are to follow the radical local excision of the primary lesion.

Careful, frequent follow-up observation is essential.

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# TRANSTHORACIC NEPHRECTOMY (RIGHT) FOR TUBERCULOSIS OF THE KIDNEY

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**S**URGEONS primarily interested in thoracic and upper abdominal surgery have been approaching lesions of the esophagus and stomach through the left diaphragm with increasing frequency during the past few years. This thoracicoabdominal approach has in the main been no more hazardous to the patient than a simple abdominal one and has offered much facility in anatomical exposure. Those who have been especially concerned with surgical procedures on the kidneys and adrenals have been traditionally fearful of injuring the diaphragm or of entering the pleural cavity.

The continuing advance in the technique of thoracic surgery was put to a most rigid test in the treatment of thoracic and upper abdominal wounds in the recent war. The records of these surgical accomplishments, which have not yet been completed, testify to the fact that the diaphragm can no longer be considered as a barrier to anatomical approach to the structures lying directly beneath it.

In discussing "The Thoraco-Abdominal Casualty," Wylie, Hoffman, Williams and Rose have recorded a series of 903 patients in whom thoracic and abdominal wounds were dealt with through a transdiaphragmatic approach. A portion of their excellent report will be of interest to urological surgeons. Transdiaphragmatic procedures in which thoracotomy alone was employed and the kidney was injured were tabulated in Table I.

These authors point out that through the transdiaphragmatic approach on the right side, the field of exploration of the abdomen was limited to the superior surface of the liver, the right kidney, and the hepatic flexure of the colon.

On the left side, the problem is somewhat different, the absence of the liver mass, and

the relationship of the fundus and body of the stomach, spleen, splenic flexure of colon, body and tail of pancreas, and the left kidney to the anterior surface of the diaphragm, not only makes for easy accessibility to these organs through the diaphragm, but also permits greater facility of exploration and suture from below. The exposure which gave the best approach to transdiaphragmatic work was the posterolateral one, in the region of the ninth and tenth ribs.

Marshall, in his discussion on this subject, states that exposure of the left kidney is made easy through an enlarged incision in wounds of complicated thoracorenal-abdominal injury and that these patients tolerate nephrectomy, or repair of kidney, extremely well by the transdiaphragmatic approach.

Fox, in a review of 270 cases of thoracicoabdominal wounds, reported the removal of an injured right kidney through a transdiaphragmatic approach in 2 patients. These were primary emergency operations done in a forward hospital and later treated at a General Hospital. Both patients recovered.

Harper has called attention to the great advantages experienced in the removal of a tumor of the *left* adrenal gland by a transdiaphragmatic retroperitoneal approach. In response to a personal query, Harper stated that he had not known of a similar case ap-

TABLE I

	Number of patients	Deaths
Right nephrectomy and liver drainage	6	2
Left nephrectomy and splenectomy	5	0
Left nephrectomy, stomach and jejunal repair	1	0
Left nephrectomy, splenectomy, and colostomy	1	0
Left nephrectomy and stomach suture	1	1
Left nephrectomy	1	0
Left nephrectomy, stomach suture, and colostomy	1	1
Left nephrectomy, jejunal suture, and colostomy	1	0

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Fig 1 Roentgenogram June 15, 1948 of patient with marked deformity of spine



Fig 2 The kidneys overshadowed the right diaphragm and lungs June 16, 1948

proached through the right diaphragm and wondered if the body of the liver would interfere with a free retroperitoneal exposure of the adrenal and kidney

The authors, being confronted with the necessity of attempting to remove the right kidney by transthoracic approach, made a careful survey of the literature and could find no recorded instance of a planned *right* transthoracic nephrectomy except in the cases of emergency war surgery already cited

Huggins, of Chicago, Mortensen, of Melbourne, Australia, and Chute, of Boston, have all reported on the advantages of left transthoracic nephrectomy in massive tumors of the kidney. Chute, in reporting to the 1948 meeting of the American Association of Genito-Urinary Surgeons, stressed the great advantage conferred by the wide exposure afforded by this route when dealing with large left renal tumors. He described three such operations and was of the opinion that, in addition to facilitating the removal of the kidney, the exposure permitted dissection under vision of malignant nodes about the

kidney pedicle. Since the medial aspect of the wound was prolonged past the end of the diaphragm and into the abdomen, Chute prefers to describe his procedure as "thoracoabdominal" instead of "transthoracic." Chute, Mortensen, and Huggins have purposely made no attempt to keep the procedure retroperitoneal in their operations through the left diaphragm.

The following case report is unique, both in the unusual anatomical condition occasioned by the patient's deformity and in the surgical procedure utilized to remove the right kidney.

Olga P., housewife, age 36 years, was referred by Dr. S. Abrahams on June 21, 1946. She complained of marked urgency and frequency of urination with pain over the suprapubic region. The frequency had been gradually increasing for the past 2 months. At that time she voided every 30 minutes day and night, although at times she would have nocturia only one to two times. The past history was that of a tuberculous infection of the spine beginning at the age of 2 years. This condition had left her with a marked kyphosis but her general health had been satisfactory until the onset of her urinary symptoms. Aside from the marked deformity occasioned by the kyphosis the patient's general condition was negative on



Fig 3 Marked deformity of spine is present in dorsal region



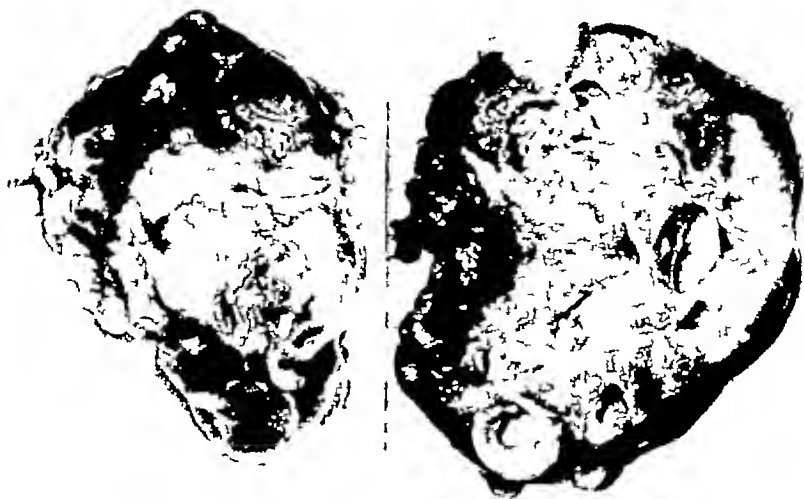
Fig 4 Superior calyx of right kidney narrowed, middle and lower calyces appear normal

examination, and the heart and lungs were normal to ordinary physical examination. The blood pressure was 150/110. The abdomen could not be palpated because the thoracic cage was so displaced that the lower ribs lay below both iliac crests. The breathing, therefore, seemed to be mostly abdominal. There was some suprapubic tenderness. All reflexes were normal. The blood count showed 4,470,000 red cells, 91 per cent hemoglobin, 10,700 white cells, normal differential. The urea nitrogen was 18.3 milligrams per cent. The urine on numerous examinations showed large numbers of leucocytes and clumps of pus. The catheterized specimen of the urine showed no growth on ordinary culture media after 48 hours. Acid fast bacilli were present on direct smear of the bladder urine.

Cystoscopic examination, under pentothal anesthesia, showed that the bladder capacity was contracted to 90 cubic centimeters. Both ureteral orifices were rather wide and gaping, but not typically 'golf hole' in appearance. Definite tubercles were seen in the region of the bladder fundus and in scattered areas of the bladder wall. Both ureters were readily catheterized 30 centimeters with No. 6 French catheters. Cloudy urine was obtained from the right and clear urine from the left. After the injection of phenolsulfonephthalein there was a prompt appearance of the dye in 3 minutes from the left and a marked delay in appearance from the right. After 20 minutes the dye was heavily concentrated from the left and about a two plus output from the right. Urine



Fig 5 Retrograde pyelogram showed marked destruction of superior pole of right kidney



Figs 6 and 7 Specimen of right kidney

was taken from the bladder and both kidneys for acid-fast stain and guinea pig inoculation. X ray examination was carried out with considerable difficulty because of the marked deformity of the spine (Fig 1). The kidneys overshadowed the right diaphragm and lungs (Fig 2). A marked deformity of the spine is present in the dorsal region as a result of an old tuberculous process (Fig 3). There is no shadow suggestive of stone in the kidneys, ureters, or bladder. Retrograde pyelograms showed normal pelvic and ureteral outline on the left side. The right pyelogram showed a narrowing of the superior calyx with a moth-eaten appearance of the major superior calyx. The middle and lower calyces on the right appeared normal in outline. There is a suggestion of a narrowing of the upper end of the ureter at the junction of the renal pelvis (Fig 4). The patient was afebrile during her stay in the hospital. The guinea pig inoculation from the bladder and right kidney was positive for acid-fast bacilli. No acid fast bacilli were found from the left kidney and repeated smears from the left kidney were negative. Due to the unusual anatomical situation in this patient further observation was advised.

The patient returned to the hospital on December 1, 1946, stating that the urgency and frequency were less bothersome than on previous admission. She had been resting at home and had gained 25 pounds. The physical findings at this time were essentially the same except that cystoscopy revealed a more active tuberculous involvement of the bladder than previously found. At this time there was some question as to whether there was a tuberculous infection of the left kidney although the pyelograms revealed normal outlines and several smears of the urine were negative for acid-fast bacilli. Repeated injections of guinea pigs with urine from the left kidney showed no acid fast bacilli. Surgical approach to the right kidney seemed out of the ques-

tion at this time and she was advised to have streptomycin therapy. She received 50 grams of streptomycin, 1 gram daily for 50 successive days. This was followed by immediate improvement in the frequency and the patient was able to go as long as 1½ to 2 hours without voiding.

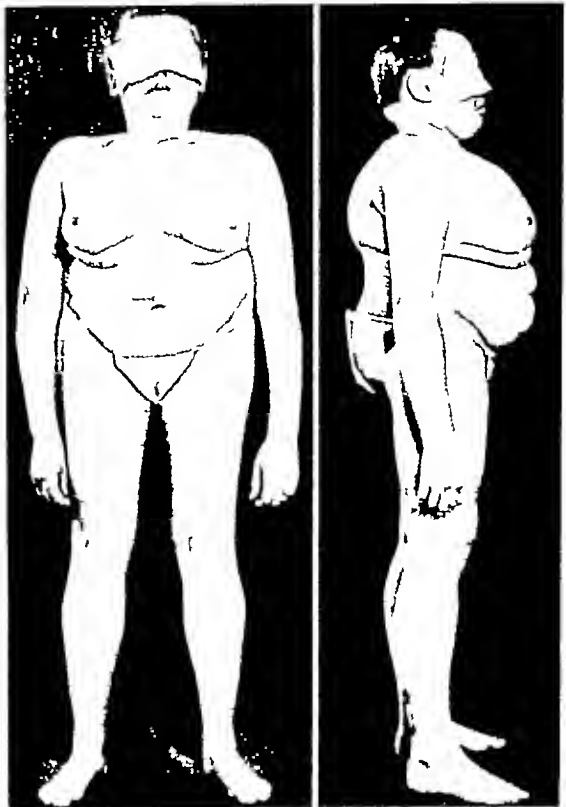
The patient was not again seen until June 14, 1948, at which time she re-entered the hospital complaining of a marked remission of urinary frequency, burning, and suprapubic pain. Physical findings at this time were essentially the same except the patient had gained weight and aside from her urinary symptoms seemed to be enjoying excellent health. Cystoscopic examination at this time revealed inflammatory lesions scattered throughout the floor and lateral walls of the bladder but no evidence of tubercle formation as previously had been seen at cystoscopy. Both ureters were catheterized and the urine from the right was turbid, urine from the left crystal clear. After the intravenous injection of phenolsulfonephthalein only a small amount of dye was obtained from the right kidney in a 30 minute period. The dye from the left concentrated normally and appeared in 3 minutes. Retrograde pyelogram on the right (Fig 5) showed marked destruction of the superior pole of the right kidney with apparent erosion of the middle and superior calyces. After careful study of the patient it was decided that an attempt should be made to remove the right kidney through a transthoracic approach. The patient was placed on streptomycin, 1 gram daily, for 1 week prior to operation. The operation was done June 22, 1948.

In this patient, as the result of extreme kyphosis, the thoracic cage dropped down over the pelvis so that there was no space posteriorly for a classical kidney incision.

and no space anteriorly for an abdominal approach. Study of the pyelogram showed that the right kidney lay at the level of the tenth rib posteriorly. Accordingly, this was chosen as the site for the approach. Intratracheal ether and oxygen anesthesia was administered and the patient was placed on her left side. Through an incision extending laterally from the spine, over and in the direction of the tenth rib, a long segment of the rib was resected outward from the transverse process. Incision through the rib bed led into a free pleural cavity just above the reflection of the diaphragm onto the thoracic wall. To permit a wider separation of the ribs, the eleventh rib was transected posteriorly. The diaphragm was then incised parallel to its insertion into the chest wall. This led into the retroperitoneal space and into the perirenal fat. The kidney could be easily palpated and was located directly beneath the incision. The rib spreader was inserted and the ribs spread to secure a wider exposure. The general pleural cavity was packed off with laparotomy pads. The incision through the diaphragm was well below the lower posterior border of the liver and at no time during the operation did the liver come into view.

The kidney, together with all attached perirenal fat, was readily freed and careful visual separation of adhesions and several enlarged lymph nodes was most satisfactorily accomplished under direct vision. The renal pedicle was first tied, without clamping, with No. 2 chromic catgut. A pedicle clamp was applied and the pedicle was severed. The ureter was freed as far down as possible and was divided between clamps. After removal of the kidney the ureteral stump was transfixed and ligated with No. 1 chromic and the cut end was cauterized with phenol and alcohol. The exposure permitted a rapid and easy procedure.

The incision in the diaphragm was closed with a continuous suture of No. 1 chromic catgut. A mushroom catheter was inserted into the pleural cavity through a stab wound above the incision. The rib bed was closed with a continuous suture of No. 1 chromic catgut and the muscles, fascia, and skin with interrupted silk sutures. Following the operation the drainage catheter was attached to a water



Figs. 8 and 9. Front and profile views of patient, September 30, 1948.

trap to permit the escape of fluid and air. A roentgenogram taken the day following the operation showed that the lung had completely expanded and that there was no fluid or air in the pleural cavity. The drainage catheter was removed the following day.

**Pathology report.** Right kidney (Figs. 6 and 7). The gross specimen preserved in formalin consists of a kidney and numerous irregularly shaped pieces of fibroadipose tissue. The kidney weighs 95 grams and measures 7.5 by 4.5 centimeters. The capsule is thickened and strips with difficulty exposing a nodular gray and tan granular surface. The kidney is moderately decreased in consistency and resistance to section. The cut surfaces reveal the cortical and medullary markings to be indistinct. The parenchyma has been replaced for the most part by necrotic cysts which have a rough gray wall and are filled with pale yellow material. In other places the tissue is yellow and firm. The fibroadipose tissue is gray and yellow and is not remarkable in appearance, consistency, and resistance to section. Within the adipose tissue is a blood vessel which has a lumen almost occluded by yellow firm tissue.

Microscopic section of the kidney reveals the usual architecture to be distorted. The glomeruli for the most part have degenerated into fibrotic tufts. The capsules of Bowman are moderately to markedly thickened. The arterioles and arterial arteries reveal marked arterio-sclerosis with minimal thickening, hyalinization, and cholesterol deposition. The parenchyma is markedly infiltrated with lymphocytes and plasma cells. Moderate hyperemia is present. The parenchyma is compressed. The remaining area is occupied by areas of necrosis surrounded by loose connective tissue. There is marked lymphoid infiltration about the periphery of these lesions and an occasional giant cell. Section of the ureter reveals the muscular wall to be thin and markedly infiltrated with lymphoid cells, frequent neutrophils, and eosinophils. The mucosa is absent and flanked by loose connective tissue in which the cellular infiltration is moderate. The central portion of the wall consists of necrotic tissue. The fibroadipose tissue adjacent to the ureter shows slight focal hemorrhage, but otherwise the structure appears as usual. Sections from the distal part of the ureter which is included with the specimen show the wall to contain many lymphocytes and large mononuclear cells. In the lumen there is necrotic material. Sections of the kidney stained by the Ziehl-Neelsen technique show no acid fast bacilli.

Diagnosis Tuberculous poly nephritis, tuberculous ureteritis

The patient's convalescence was completely uneventful. The temperature rose to 101 degrees with a pulse of 100, 48 hours after operation. During the following 3 days the temperature gradually returned to normal and the pulse stabilized at 80. From the fifth postoperative day on there was no elevation of temperature. The wound healed per primam and the stitches were removed on the eighth day. The patient was discharged on the seventeenth postoperative day. She had been up and about after the third postoperative day. Her urinary symptoms improved spectacularly from the day of operation onward and when the patient left the hospital she was

voiding every 3 hours and without pain as against painful frequent urination every 30 minutes before operation. One gram of streptomycin daily was continued during the 17 postoperative days. This patient has continued to enjoy improved health and when last seen on June 1, 1949, the urine was sparkling clear and contained no pus and was negative for acid-fast bacilli. The bladder capacity was 220 cubic centimeters and the nocturia had decreased to one or two times

#### SUMMARY

A right transthoracic nephrectomy is reported. A tuberculous kidney was removed in a patient with such an extreme kyphosis that access to the kidney through a lumbar or abdominal incision was impossible. The exposure obtained was even more satisfactory than that usually developed through an ideal lumbar incision. The position of the liver offered no interference and the operation was entirely retroperitoneal. Convalescence was as rapid and smooth as in patients who have had the conventional operation.

So far as we can ascertain, this is the first recorded *planned* operative procedure for removal of the *right* kidney by the transthoracic route.

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# THE USE OF FREE PERITONEAL GRAFTS IN INTESTINAL ANASTOMOSES

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RECENTLY Devine reported a method for the prevention of leakage in intestinal anastomoses. In a group of dogs, the colon was divided and anastomosed with a single, continuous, through-and-through silk suture which transversed all layers of the intestine. This obviously inadequate method invariably resulted in fatal peritonitis in the control animals. In another group of dogs, the anastomoses were covered with grafts of free peritoneum which were fixed to the intestine with plasma-thrombin clots. The grafts were held in position with pressure applied for 5 minutes, no sutures were used. All grafts remained adherent and only 1 of the animals died of peritonitis, this being one in which a perforation was made in the graft at operation. The grafts were firmly fixed in 24 hours, and after 4 days, the margins could not be lifted. Devine also placed a free peritoneal graft around an exteriorized loop of human intestine and obtained similar results.

Further information about the use of free peritoneal grafts to cover intestinal anastomoses was sought in the following experiments.

Sixteen dogs were anesthetized with sodium pentobarbital and the abdomen opened through a low vertical abdominal incision. A rectangular graft of peritoneum 1 by 3 inches in size (which included some or all of the thin fascia of the posterior rectus sheath) was removed from the lateral aspect of the laparotomy incision (Fig 1). A loop of colon was divided and a closed end-to-end anastomosis performed with a layer of single interrupted No 40 cotton sutures (Fig 2). The free

peritoneal graft was placed around the anastomosis, peritoneal side down, after the graft had been moistened with thrombin solution (500 units per cubic centimeter of physiological saline) and the intestine at the site of anastomosis was moistened with serum. The graft was then sutured in position with interrupted sutures of No 100 cotton (Fig 3). Bubbles of air were removed from beneath the graft. The laparotomy incision was closed with interrupted sutures.

There were no deaths, and no evidence of peritonitis in the 16 experiments. In these experiments the grafts probably did not contribute significantly to the prevention of peritonitis as there was no mortality or evidence of peritonitis in a group of 8 similarly anastomosed, but ungrafted control animals.

The grafts of 11 of the animals were examined 3, 5, 7, 9, 12 and 14 days postoperatively, and those in the remaining 5 animals were seen 44 to 120 days postoperatively. The grafts remained completely viable in every animal and the outer raw surface was covered with epithelium as early as the twelfth postoperative day. Adhesions around the graft were observed in 10 of the 11 dogs which were examined in the first 14 days, and in most of these 90 to 100 per cent of the graft was covered with omentum, small intestine, or with mesentery.

In the 5 animals whose grafts were seen in 44 to 120 days postoperatively, 2 had adhesions, and in these cases they covered approximately 40 per cent of the surface of the grafts. These grafts were firmly adherent to the intestine and appeared to be covered with endothelium. There was no evidence of stricture at the site of anastomosis or of dilatation or hypertrophy of the intestine proximal to the anastomosis in any of the animals. There was some tendency for the grafts to contract transversely after being in place several weeks,

From the Experimental Surgery Laboratories, University of California Medical School. This work was aided by a grant from funds provided by the State of California for cancer research.

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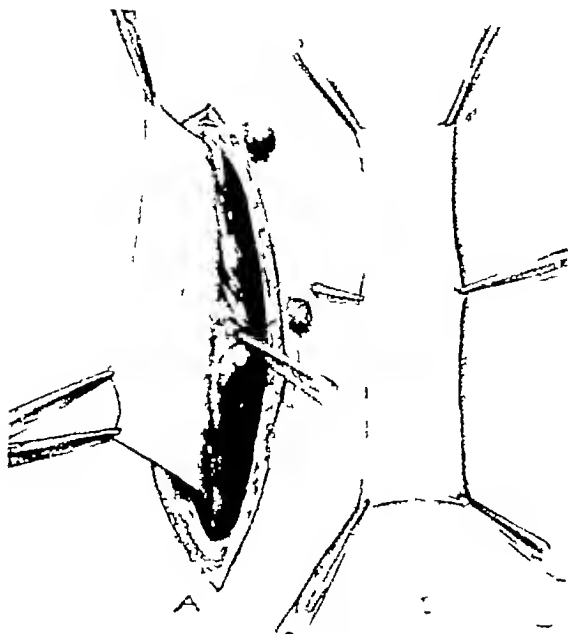


Fig. 1 A, Removal of peritoneal graft from lateral edge of laparotomy wound B, Peritoneal graft after removal from the abdominal wall

but this was not evident in the first 2 post-operative weeks

Microscopic examination of the grafted intestine removed 3 days postoperatively showed the graft to be thick, edematous, and infiltrated with an acute inflammatory exudate which consisted mainly of polymorphonuclear neutrophil cells. The space between the graft and the intestine was filled with acute inflammatory exudate. There was no evidence of vascularization or fibroblastic infiltration. The serosa and subserosa of the colon showed marked vascular congestion. Microscopic examination of the grafted area removed on the fifth postoperative day revealed vascularization of the edematous graft due to the ingrowth of capillaries. At this time fibroblasts were present and the acute inflammatory exudate had disappeared. The space between the graft and intestine was filled with early granulation tissue containing many dilated capillaries and fibroblasts. The acute inflammatory exudate had disappeared except in areas immediately surrounding the cotton sutures. The serosa and subserosa of the intestine showed vascular congestion and capillaries and fibroblasts projected from this re-

gion into the space between the graft and the intestine. At 7 days the granulation tissue between the graft and intestine showed more evidence of organization and the capillaries and the fibroblasts tended to run perpendicularly from the intestine to the graft, and the beginning of collagen formation was seen. At 9 days the graft was still vascular and thickened and showed collagen deposition, and vascularization and fibroblastic proliferation were less evident. At 14 days the graft was still thick but the granulation tissue was much less evident. The collagen deposition was unchanged. The outer surface of the graft was covered with endothelium. The area between the graft and intestine was not distinguishable from graft or intestinal wall.

The specimens removed 44 to 115 days postoperatively showed the grafted area still thickened but otherwise indistinguishable from the normal serosa and subserosa of the intestine, and sutures were surrounded by fibrous tissue.

In these experiments, a serum-thrombin solution was used instead of a plasma-thrombin clot. This was not intentional but was due to an oversight at the onset of the experiment. However, because the results were satisfactory, the serum-thrombin solution was used for the entire series. This serum-thrombin mixture does not clot, nor does it have any immediate adhesive properties of note, it is slightly "sticky" to touch, but this is not sufficient to hold a graft in place without sutures. Thus, these experiments demonstrate the part free graft alone plays in sealing off the anastomosis site. It is well known that the opposing serosal surfaces of the peritoneum are the important structures sealing off a gastrointestinal anastomosis and that this sealing process takes place within 12 hours after the anastomosis. It appears reasonable to expect a peritoneal graft to behave similarly, especially if it is held against the intestinal wall with the slight tension produced by suturing it in position. It is conceded that these grafts might have taken just as well without the use of the serum-thrombin mixture. However, it appears preferable to seal free peritoneal grafts by the plasma-thrombin clot method because of the immediate sealing and



Fig 2

Fig 2 A, Site of division of colon B, One layer closed end-to-end anastomosis, interrupted No. 40 cotton sutures were used

Fig 3 A, Placing of graft around site of anastomosis B, Free peritoneal graft sutured in position around site of anastomosis

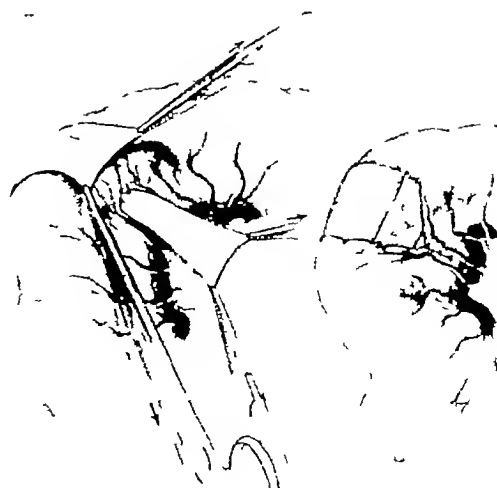


Fig 3



fixing effect and also because of the possible value of the use of the serum thrombin mixture in the early nutrition of the free peritoneal graft

Another point for consideration is the fact that the peritoneal side of the graft was placed next to the anastomosis leaving the raw surface facing the peritoneal cavity. The reason for doing this has been indicated in the preceding paragraph. Also it was the method used by Devine. The main objection to this procedure is the fact that adhesions form on the exposed unperitonealized surface. They were found in 90 per cent of animals in the first 2 weeks and in 40 per cent after 6 weeks. Experiments to study a similar procedure in which the raw surface of the graft is placed next to the intestine against the anastomosis

are being carried out at the present time in the laboratory

The use of sutures in place of pressure to hold the grafts in place appears preferable as sutures diminish the tendency for the graft to slip

#### SUMMARY

Free peritoneal grafts were applied to anastomoses of the colon in 16 experimental animals. Gross and microscopic studies indicated that the grafts remained completely viable and adherent. Such grafts caused no constriction at the site of intestinal anastomoses.

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# THE EFFECT OF INTRAMEDULLARY NAILING ON THE HEALING OF FRACTURES

## An Experimental Study

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**S**URGEONS have long sought a safe method of treating fractures that would effect complete immobilization of the bone fragments, allow complete mobilization of the rest of the body, and yet not retard bone healing. Intramedullary nailing, introduced by Kuentscher (2, 3, 4) of Germany in 1940, has been advocated as approaching this goal. Although the method was used extensively by European surgeons during World War II, it has only recently begun to attract much attention in the United States (5, 7).

Considerable dispute has arisen over the efficacy of nailing, and many surgeons have emphasized the risk of complications from its use, notably shock during operation, and post-operative infection. Another controversial but fundamental issue is the effect of the nail on fracture healing. Kuentscher (3) himself stated unequivocally that the nail stimulates callus formation and speeds the healing process, which has been disputed by other investigators (1, 6). After extensive work with intramedullary nailing, Boehler concluded that the nail often inhibits callus formation and said, "This finding constitutes the greatest disappointment that I have experienced as a physician, because I had set the highest hopes upon the callus stimulating effects of the medullary nail."

So far as we have been able to determine, these opinions have been based either on clinical impressions or on uncontrolled experiments. Because it is probable that intra-

medullary nailing is the best method now available for the treatment of certain types of fractures and that its use will become more widespread, it seemed desirable to obtain more exact information concerning its effect on fracture healing. This we have attempted by a study of experimental fractures of the dog's ulna.

### METHOD

When a dog's ulna is fractured in the distal half, the fragments do not become significantly displaced or angulated due to the immobilizing effect of the intact radius and interosseous membrane. The fragments eventually unite in good position without any other form of immobilization and without restriction of the dog's activity. Such a fracture is excellent for testing the effect of variables on healing.

In our experiments the ulna was exposed bilaterally under aseptic precautions in dogs anesthetized with intravenous nembutal (250 mgm per kilogram). The ulnas were fractured transversely with a one strand Gigli saw at corresponding levels, usually at the junction of the middle and distal thirds. On one side a stainless steel Kirschner wire (diameter 1.2 mm) was inserted through the olecranon process into the medullary cavity and past the fracture site into the distal fragment. The wire usually filled the marrow cavity in the vicinity of the fracture. The opposite side was similarly drilled, but the wire was then removed, making the presence of the wire the only variable (Fig 1). Because each dog served as its own control, all systemic factors which might alter fracture healing—e.g., age, sex, nutrition, activity,—were eliminated. As a prophylactic measure against infection 300,000 units of penicillin in oil were injected intramuscularly at completion of operation.

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fixing effect and also because of the possible value of the use of the serum thrombin mixture in the early nutrition of the free peritoneal graft

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Fig 3 Steinmann pin inserted through the knee into medullary cavity of the dog's femur a, Roentgenogram taken immediately after operation b, Four weeks after fracture Periosteal callus noted opposite the two points where pin contacts inner cortex c, Eight weeks after fracture.

mm) were used (Fig 3) On the control sides the bones were drilled in a similar manner, but the pins were then removed In 1 dog the radius was fractured in its distal half while in the opposite leg the ulna was fractured and a Kirschner wire inserted through the olecranon (Fig 4)

#### RESULTS

In every instance extensive periosteal callus at a distance from the fracture site was noted on the pinned side That the reaction was not due to infection was indicated by freedom from clinical signs of infection and absence of infection when the dogs were later sacrificed Boehler has attributed some types of periosteal callus ("periosteal appositions") to rusting of the nail In these experiments no instance of rusting of wire occurred The periosteal reaction reached its peak roentgenologically at about 4 to 6 weeks after pinning and then gradually disappeared The reaction was most striking in dog No 7 (Figs 5 and 6)

We believe that an explanation for this callus is furnished by the experiments in which

Steinmann pins were inserted into unfractured femurs The periosteal reaction was found only opposite the points where the pin was in direct contact with the inner side of the cortex (Fig 3)

The results were generally consistent in the 8 dogs whose ulnas were fractured and a single Kirschner wire inserted on one side (Table I) In 1 instance the bone was fractured in the proximal third, and nonunion occurred on both sides In the remaining 7 dogs callus at the fracture site appeared earlier on the pinned side in every instance Two dogs died of distemper before union occurred In 4 of the remaining 5, union occurred more rapidly on the pinned side (Fig 7) In only 1 instance did union occur earlier on the unpinned side The average time for union on the pinned side was 4 months and on the unpinned side 6 months Although callus at the fracture site appeared sooner on the pinned side and although union was quicker on the pinned side, the maximum callus at the fracture site seen on the roentgenograms was usually greater on the unpinned side

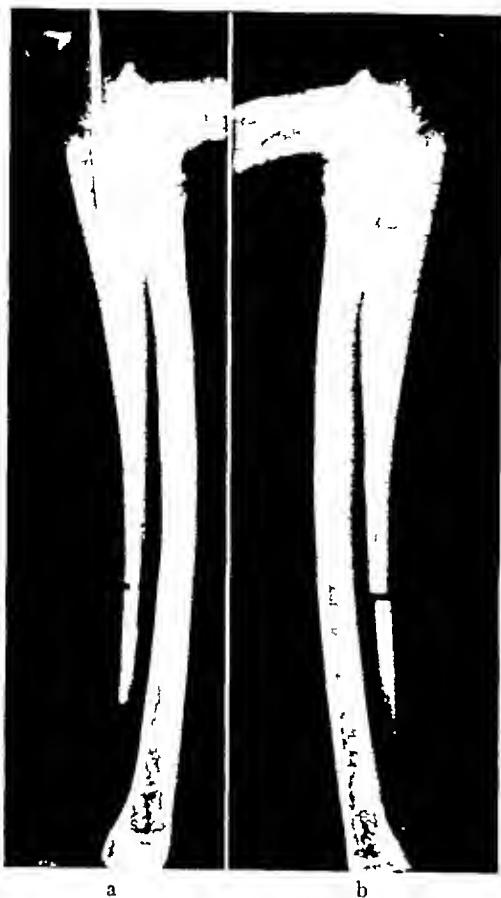


Fig 1 Dog's ulna fractured bilaterally at similar levels with a Gigli saw. Roentgenograms taken immediately after operation. a, Left leg, Kirschner wire inserted through the olecranon process and past the fracture site. b, Right leg medullary cavity drilled but wire removed.

A fracture of the type described is a severe test of healing. It is transverse, it is in a location where union is commonly slow, and the fragments are distracted for a distance equal to the width of the Gigli saw since the intact radius maintains the length of the leg. The distraction is readily apparent on all the roentgenograms. It is not surprising, therefore, that union was uniformly slow on both sides. The slow rate of healing tended to magnify minor differences on the two sides and thus make the method especially appropriate for experimental purposes.

The degree of immobilization was not exactly similar on the two sides. It was evident at operation that the wire gave more rigid



Fig 2 Dog's ulna fractured bilaterally at junction of middle and distal thirds. Roentgenograms were taken immediately after operation. a, Control side which was not drilled. b, Kirschner wire has been inserted into each fragment.

fixation of the fragments. However, rotary motion, which is thought to be one of the commonest causes of nonunion of the distal ulna in man (8), was retained on the pinned side because the wire was not flanged.

#### EXPERIMENTAL DATA

Fourteen mongrel dogs were operated on. In 8 dogs the operation was performed exactly as described above. In 3 dogs the Kirschner wire was divided at the fracture site in order to eliminate the factor of better immobilization by the wire and its effect on bone healing (Fig 2). In 2 dogs large pins were inserted into unfractured long bones of the hind leg. Stainless steel Steinmann pins (diameter 4 o



Fig 6 Same dog as Figure 5 Roentgenograms taken 5 months after fracture Good union on both sides The periosteal callus has nearly disappeared



Fig 7 Dog's ulna (Dog 2) which had been fractured bilaterally at similar levels with a Gigli saw Roentgenograms were taken 3½ months after receipt of fracture a, Delayed union on unpinned side b, Union on pinned side

TABLE I —A COMPARISON OF FRACTURE HEALING IN PINNED AND UNPINNED BONES

Dog No	Time of first appearance of callus by roentgenogram		Time of bony union by roentgenogram		Maximum callus developed at fracture site (on basis 1 to 4)	
	Unpinned side wks	Pinned side wks	Unpinned side mos	Pinned side mos	Unpinned side	Pinned side
1	3		6	8	++	+
2	2	1 1/2	7	3	++	++
3*	Nonunion		Nonunion		Nonunion	
4		1 1/2	4	3	+++	++
5	4	3	9	4	++	+
6	2	1	3	2	+++	++
	2	1	Dog died of distemper between second and third week			
8	None at 2 weeks		Dog died of distemper at second week			

Ulna of 5 dogs fractured bilaterally at similar levels with a Kirschner wire inserted through the olecranon One side pinned  
\*1 fracture in proximal ulna



Fig 8 Photomicrograph of a longitudinal section through fracture site of pinned ulna of Dog No. 1 8 months after fracture and immediately after removal of wire Note good bony union and absence of marrow elements No significant reaction to the wire is seen

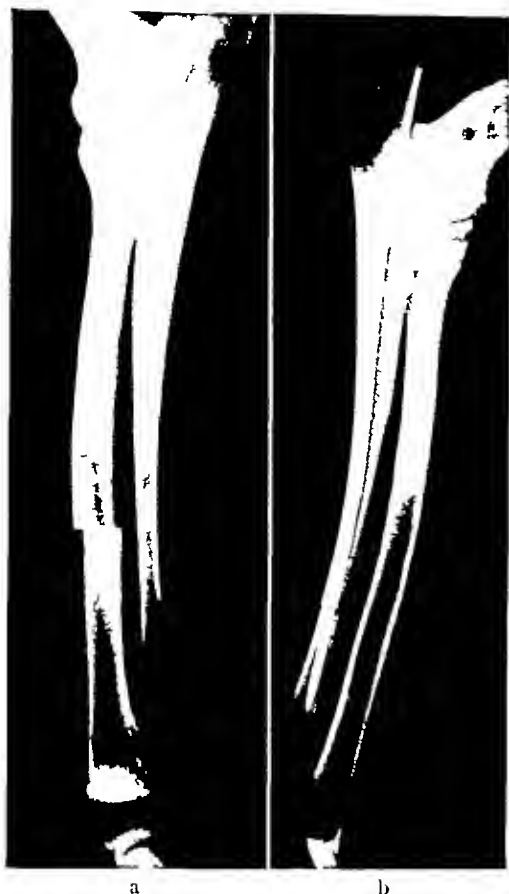


Fig 4 Bilateral foreleg fractures with a Gigli saw. Roentgenograms taken immediately after operation. a, Right leg radius fractured just distal to middle. Note that the ulna does not prevent shortening. b, Left leg ulna fractured and Kirschner wire inserted. Note that the stronger radius prevents shortening and maintains distraction.

In 3 dogs the Kirschner wire was cut at the fracture site in order to eliminate the factor of immobilization by the wire. One dog died from pneumonia  $2\frac{1}{2}$  weeks after operation but of the 2 which survived both had more rapid union on the unpinned side (Fig 9).

At autopsy no difference could be noted at the fracture site between the pinned and the unpinned sides of the dogs whose ulnas united. Infection was not found by gross examination in any instance. Microscopic examination showed only minimal signs of reaction to the wire (Fig 8).

Results were most interesting in the dog whose radius was fractured (Fig 4). When



Fig 5 Dog's ulna fractured bilaterally with a Gigli saw. Roentgenograms taken 4 weeks after fracture. a, Control side. b, Pinned side showing extensive periosteal callus involving almost the entire shaft.

this dog bore weight, the intact ulna, not being strong enough to support the weight of the dog, broke at the level of the radial fracture. The effect of distraction on the rate of healing was then strikingly demonstrated. Figure 10 shows the abundant callus seen at 3 weeks in this leg. Union took place in 6 weeks without any form of immobilization and with both bones broken (Fig 11) whereas the opposite ulna distracted by the intact radius united only after 36 weeks.

#### COMMENT

The fact that callus appeared more rapidly and union took place more quickly on the

pinned side in the first group of experiments suggested that the presence of the wire stimulated healing. Yet when the wire was divided at the fracture site, the pinned side healed less rapidly. In this case it was noted at operation that immobilization was better on the unpinned side. This was due to the fact that the insertion of the pins from the fracture site required temporary displacement of the fragments and consequent damage to the interosseous membrane. It appears that in each instance the factor determining more rapid union is the degree of immobilization and not the presence or absence of the wire per se. Periosteal callus formation at a distance from the fracture was definitely associated with the presence of the intramedullary wire. The mere destruction of the marrow cavity by the insertion of a wire, which was then removed, did not produce a periosteal reaction, nor was periosteal reaction caused by rusting of the wire.

In the third group of experiments, when a pin was inserted into the unfractured femur, periosteal callus appeared only opposite the points where the pin contacted the inner side of the cortex. This strongly suggests that the periosteal callus is produced by a pressure phenomenon. Such an explanation fits in well with the fact that in our experiments the periosteal reaction subsided concomitantly with the loosening of the wire and release of the pressure stimulus.

#### SUMMARY AND CONCLUSIONS

1 The insertion of an intramedullary wire into the dog's ulna fractured experimentally

produces periosteal callus over an area often far removed from the fracture site. This callus reaches its maximum on the roentgenogram at 4 to 6 weeks and is gradually absorbed. It appears to have little effect on the healing of the fracture and is not the result of destruction of the marrow. We postulate that this callus is caused by pressure of the wire on the inner cortex and that its disappearance is due to absorption of bone and the release of pressure.

2 Fractures of the distal half of the ulna heal more rapidly if a wire is inserted through the medullary cavity past the fracture. The more rapid union is probably due to the better immobilization which is effected by the wire and not to any callus stimulating effect of its presence.

3 It is probable that the presence of an inert foreign body in the medullary cavity does not significantly delay or speed fracture healing.

4 The deleterious effect on fracture healing produced by distraction is strikingly shown by these experiments.

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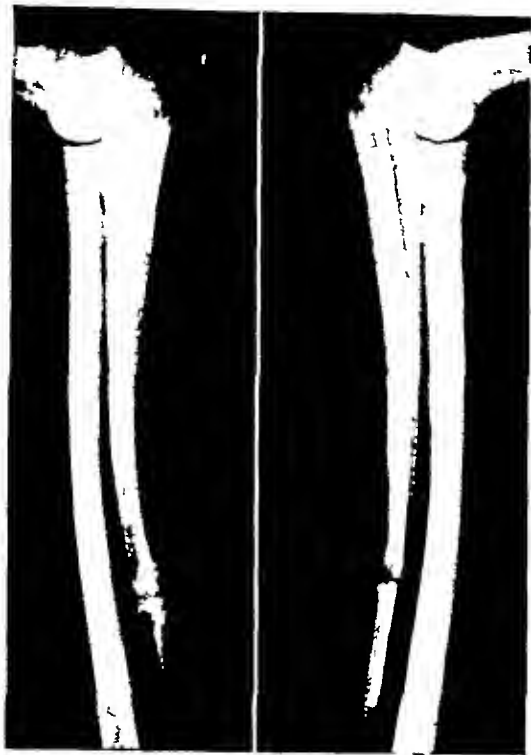


Fig 9

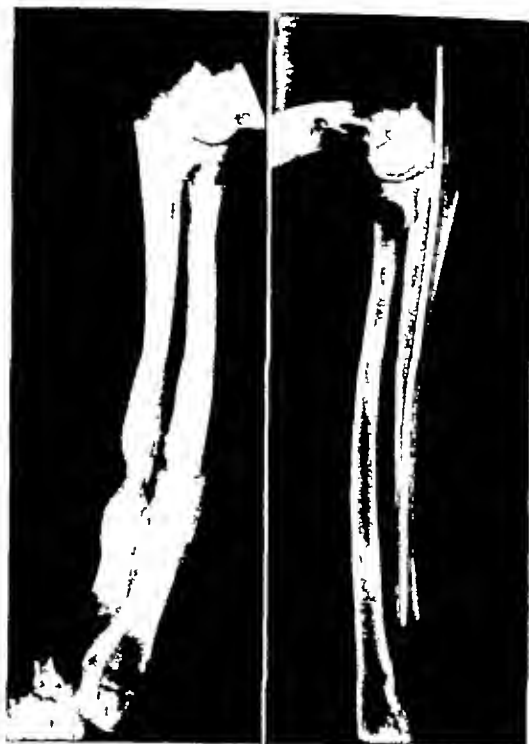


Fig 10



Fig 11

Fig 9 Roentgenogram of dog shown in Figure 2 taken 4 months after fracture Kirschner wire divided at fracture site a, Union on unpinned side b, Delayed union on pinned side

Fig 10 Dog pictured in Figure 4 3 weeks after fracture a, The ulna broke spontaneously within the first week Note exuberant callus about both fractures on impacted, unpinned side b Delayed union on distracted, pinned side

Fig 11 Same dog as in Figures 4 and 10 Roentgenograms 6 weeks after fracture a Good union on impacted, unpinned side b, Delayed union on distracted pinned side



Fig 1 Periodic acid Schiff's reagent (PAS) technique applied to normal cervical epithelium. The basement membrane is seen to stain heavily. The basal cells contain no glycogen. Large amounts of heavily staining glycogen are seen in the more superficial cells.



Fig 2 Case 2. On the left, PAS reaction applied to intraepithelial carcinoma at its point of junction with normal epithelium. The short oblique line of Schiller is well demonstrated. On the right, PAS reaction applied after digestion with malt diastase. This identifies the heavily staining intracellular granules seen in the left hand picture as glycogen.

carcinoma of the cervix earlier and thereby improve therapeutic results, the diagnosis being made without invasion. It is not by any means clear that carcinoma in situ is actually carcinoma. For this reason the present series of cases of carcinoma in situ and allied lesions of the cervix have been studied histologically and histochemically. The histochemical study allows another approach to a subject that has been well worked previously. We believe that it does add some information and may assist in the interpretation of several types of lesions of the cervix uteri.

#### MATERIALS AND METHODS

The material included in this report comprises the cervical biopsies and surgical specimens from the charity service of the Jefferson-Hillman Hospital during the period July 1, 1947 to August 1, 1948. During this time there were 2,697 biopsies and surgical specimens of all types. Eight cases had been definitely diagnosed as carcinoma in situ and showed the typical intraepithelial changes. The original slides were reviewed, additional sections cut and stained by the period acid (PAS) Schiff's method. It was found that glycogen could be demonstrated by PAS after formalin fixation and autotechnicon handling.

Six patients were colored and 2 were white. The average age was 35 years. Two women were pregnant, 1 was an intrauterine preg-

nancy, the other a tubal pregnancy. An outline of these 8 cases is presented in Table I.

Three typical cases are reported in some detail.

#### CASE REPORTS

**CASE 1.** C. R., a 37 year old colored female was admitted with the chief complaint of a heavy feeling in the abdomen associated with a mild low abdominal pain. Menstrual history was negative except for prolonged bleeding (2 weeks) during her last menstrual period. Physical examination revealed an irregular firm mass filling the lower abdomen and extending up to 3 fingerbreadths below the umbilicus. On pelvic examination this mass was thought to be continuous with the uterus. Laboratory work revealed a red blood cell count of 3,000,000 with a hemoglobin of 10.5 grams. White blood cell count and differential were essentially normal as was the urinalysis. The Kahn was reported positive. The clinical impression was multiple fibromyomas of the uterus, and after one 500 cubic centimeters whole blood transfusion a total hysterectomy was performed without difficulty. Postoperative course was entirely uneventful.

Routine section of the cervix showed an almost complete loss of the normal stratification in the stratified squamous epithelium. The cells had the same appearance from the basement membrane out to the most superficial cells. For the most part they were round and somewhat hyperchromatic. Occasional very large nuclei could be found and a few multilobed nuclei were noted. Mitotic figures were noted occasionally. A few polymorphonuclear leucocytes were seen scattered between the epithelial cells. In an additional section a segment of seemingly normal stratified squamous epithelium was noted. At one point there was a rather abrupt transition to epithelium that was definitely hyperactive. The cells here showed no stratification. The nuclei were hyperchromatic, they showed considerable variation in size and shape and sometimes tended to line up in spindle cell formation (Fig. 3).

# HISTOCHEMICAL STUDIES ON GLYCOGEN IN CARCINOMA IN SITU OF THE CERVIX UTERI

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**A** DESCRIPTION of the staining of glycogen in paraffin sections of carcinoma in situ and other lesions of the cervix uteri is presented in this paper. It includes a brief discussion of carcinoma in situ based upon the morphological and chemical features of the lesion.

Normal cervical squamous epithelium contains a large amount of glycogen. This is best shown (Fig 1) in section with the periodic acid Schiff's reagent (PAS) method (2,3) by which glycogen and the basement membrane of the epithelium color purple. The identity of the intraepithelial granules as glycogen can be proved by digestion with malt-diastase by the method of Lillie and Greco (Fig 2). Glycogen is lacking in carcinoma of the cervix (5).

Carcinoma in situ of the cervix uteri denotes atypical epithelial cell masses which are still within the basement membrane although otherwise resembling carcinoma. The term is used synonymously with intraepithelial carcinoma, preinvasive carcinoma, and Bowen's disease of the cervix. The concept of carcinoma, recognizable without invasion, dates from Schiller's report of 1933 in which he describes the advancing margin of florid carcinoma of the cervix as sometimes having points of junction with the normal squamous epithelium. These points of junction show the atypical carcinomatous cells retained within the basement membrane and not actually invading.

A series of 19 cases are reported by Schiller in which atypical areas, corresponding to the advancing margin of carcinoma, are seen in otherwise normal cervixes and are taken to be early carcinoma (6). In none was there clinical evidence of cancer. Eight patients of the 19, or 42 per cent, are less than 40 years of age. Points of junction between normal and abnormal epithelium resemble those seen in frank carcinoma.

The concept of Schiller is then that cancer of the cervix may be preceded by a noninvasive stage. Meyer has studied the matter and suggests some doubt that the preinvasive stage always progresses to definite cancer. TeLinde and Galvin believe that there may be a lapse of quite some time, perhaps years, before frank cancer develops from such lesions. They have studied and described a series of early carcinoma cases in some detail.

TeLinde and Galvin describe hyperactivity beginning in the basal layer of the cervical epithelium, then progressing more superficially to involve the entire thickness of the epithelium (7). This produces a disturbance in the architecture of the epithelium so that normal stratification is lost. The cells become more numerous and they show variation in size, shape, and staining quality, much like invasive cancer cells. At this stage the lesion is Schiller's early carcinoma, or carcinoma in situ. It is thought that the entire thickness of the epithelium is taken over by the hyperactive basal cells before invasion begins. Cervical glands are described as a favorite route of the beginning invasion.

Types of junction between normal and hyperactive epithelium are described by TeLinde and Galvin. The hyperactive and normal epithelium may be demarcated by a short oblique line of Schiller. In other cases a long oblique line can be made out demarcating the hyperactive basal layers below from the normal upper epithelium.

These authors report 11 cases of extremely early carcinoma in which the average age of the patient is 36 years as compared with the average age of 48 years for carcinoma of the cervix in general. It is believed that this indicates the possibility of a surface lesion existing for years before the development of invasion.

The whole emphasis on intraepithelial carcinoma is based upon attempts to recognize



Fig 1 Pseudo-periodic acid Schiff's reagent (PAS) technique applied to normal cervical epithelium. The basement membrane is seen to stain heavily. The basal cells contain no glycogen. Large amounts of heavily staining glycogen are seen in the more superficial cells.

carcinoma of the cervix earlier and thereby improve therapeutic results, the diagnosis being made without invasion. It is not by any means clear that carcinoma in situ is actually carcinoma. For this reason the present series of cases of carcinoma in situ and allied lesions of the cervix have been studied histologically and histochemically. The histochemical study allows another approach to a subject that has been well worked previously. We believe that it does add some information and may assist in the interpretation of several types of lesions of the cervix uteri.

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Three typical cases are reported in some detail.

#### CASE REPORTS

**CASE 1.** C R, a 37 year old colored female was admitted with the chief complaint of a heavy feeling in the abdomen associated with a mild low abdominal pain. Menstrual history was negative except for prolonged bleeding (2 weeks) during her last menstrual period. Physical examination revealed an irregular firm mass filling the lower abdomen and extending up to 3 fingerbreadths below the umbilicus. On pelvic examination this mass was thought to be continuous with the uterus. Laboratory work revealed a red blood cell count of 3,900,000 with a hemoglobin of 10.5 grams. White blood cell count and differential were essentially normal as was the urinalysis. The Kahn was reported positive. The clinical impression was multiple fibromyomas of the uterus, and after one 500 cubic centimeters whole blood transfusion a total hysterectomy was performed without difficulty. Postoperative course was entirely uneventful.

Routine section of the cervix showed an almost complete loss of the normal stratification in the stratified squamous epithelium. The cells had the same appearance from the basement membrane out to the most superficial cells. For the most part they were round and somewhat hyperchromatic. Occasional very large nuclei could be found and a few multilobed nuclei were noted. Mitotic figures were noted occasionally. A few polymorphonuclear leucocytes were seen scattered between the epithelial cells. In an additional section a segment of seemingly normal stratified squamous epithelium was noted. At one point there was a rather abrupt transition to epithelium that was definitely hyperplastic. The cells here showed no stratification. The nuclei were hyperchromatic, they showed considerable variation in size and shape and sometimes tended to line up in spindle cell formation (Fig. 3).

TABLE I

Case No	Patient	Age years	Date	Presurgical biopsy	Surgical procedure	Date	Pathologic examination of surgical specimen
1	C R	37		None	Total hysterectomy	11-20-47	(1) Squamous cell carcinoma of cervix in situ (2) Fibromyomas of uterus intramural subserous and submucous (3) Endometrial polyp
2	M P	48	7-12-48	Carcinoma in situ	Total hysterectomy	7-19-48	(1) Carcinoma in situ of cervix (2) Subserous intramural and submucous fibromyomas of uterus (3) Chronic cystic cervicitis (4) Adhesions on peritoneal surface of uterus (5) Proliferative endometrium
3	C L	33	11-26-47	(1) Chronic cervicitis (2) Chronic cervicitis (see comment) (3) Carcinoma in situ of cervix chronic cervicitis	Total hysterectomy and right salpingo-oophorectomy	20-48	(1) Hyperplasia and atypicalities of growth in cervical epithelium* (2) Carcinoma in situ (previous biopsy) (3) Multiple intramural fibromyomas of uterus (4) Benign endometrial polyp (5) Hemorrhagic corpus luteal cyst (6) Healed chronic follicular salpingitis (7) Fibrous peritoneal tags and adhesions on uterus
4	L H	41	5-10-48	(1) Possible carcinoma of cervix (2) Squamous cell carcinoma in situ of cervix (3) Squamous cell carcinoma from vagina	Insertion of radium in to uterus, cervix and vagina (5760 mgm hours)	6-25-48	None
5	R O	35	11-10-47	(1) Squamous cell carcinoma of cervix**	Total hysterectomy bilateral salpingo-oophorectomy	12-1-47	(1) Squamous cell carcinoma of cervix in situ (2) Fibromyomas of uterus intramural subserous (3) Normal tubes and ovaries
6	Mrs V W	33	12-23-47 12-30-47	(1) Carcinoma in situ	Total hysterectomy right salpingectomy appendectomy	1-10-48	(1) History of biopsy showing carcinoma in situ (2) Right tubal pregnancy with hemorrhage (3) Chronic cervicitis (4) Proliferative endometrium
7	Mrs E F	23	6-19-47	(1) Chronic cervicitis metaplasia of endocervical glands single epithelial mass with atypical features (2) Possible squamous cell carcinoma of cervix (3) Severe chronic cervicitis marked squamous metaplasia with atypical areas	Total hysterectomy appendectomy	6-6-47	(1) Chronic cervicitis with probable carcinoma in situ
8	P S	30	6-4-47 6-9-47	(1) Probable carcinoma of cervix, small nabothian cyst (2) Probably squamous cell carcinoma (in situ) of cervix	Total hysterectomy	6-28-47	(1) Squamous cell carcinoma of cervix Grade I (hist.) (2) Uterus with 12 cm fetus

\*See detailed report Case 3

\*\*The surface epithelium in this biopsy showed a loss of stratification with considerable variation in nuclear size. Occasional mitotic figures were noted. There is invasion in the cervical glands, but nowhere can invasion beneath the basement membrane be discovered. Periodic acid stain reveals an absence of glycogen in all this hyperactive epithelium. Sections of the cervix after surgery shows essentially the same picture. We are of the opinion that this represents early carcinoma with beginning invasion.

PAS technique revealed a complete absence of glycogen in the hyperactive epithelium just described (Fig 4)

CASE 2 M P, a 45 year old colored female, sextigravida, quintipara, one abortion, admitted with the chief complaint of a mass in the abdomen. She had had profuse bleeding with her menstrual periods for the past 7 months. Physical examination revealed a firm nodular mass filling the lower abdomen and extending up to 2 fingerbreadths above the umbilicus. On pelvic examination this mass was thought to be continuous with the uterus. The cervix

was said to be clean. All laboratory work was essentially negative.

Biopsy of this cervix showed only a small portion of epithelium appearing normal. The remaining epithelium showed a complete loss of normal stratification. Large hyperchromatic cells resembling the basal cells filled the entire thickness of the epithelium. Mitotic figures were fairly numerous and polymorphonuclear leucocytes were noted between the epithelial cells. The transition between this hyperactive epithelium and the normal epithelium was noted to be rather abrupt.



Fig 3 Case 1 Hematoxylin and eosin stain. The carcinoma in situ is seen to the right, the normal epithelium on the left. Demarcation is by the short oblique line of Schiller



Fig 4 Case 1 The PAS reaction has been applied to the field corresponding to Figure 3. The total absence of glycogen in the hyperactive area to the right is demonstrable.

A total hysterectomy was done and a large fibroid uterus removed without difficulty. The postoperative course was entirely uneventful. Microscopic examination of the cervix after hysterectomy showed the epithelium to be thickened in places. There were short blunt downgrowths but seemingly no extension past the basement membrane. The normal stratification was lost and the cells were markedly hyperchromatic. They varied considerably in size and shape, and mitotic figures were fairly numerous. In places the cells tended to line up in spindle cell formation. In one section large clumps of hyperactive epithelial cells were found deep in the fibrous tissue of the cervix. The picture here was identical with that described in the surface epithelium. In no place could extension beneath the basement membrane be found. PAS technique revealed a rather marked absence of glycogen in all the hyperactive epithelium.

CASE 3. C.L., a 33 year old colored female, primigravida, primipara, was seen in the out patient department with a complaint of low abdominal pain and backache which had been present for intervals for the past year. Physical examination was essentially negative except for a cervix that was enlarged two to three times and which appeared eroded. It was felt that the corpus of the uterus was pulled to the right and semifixed. There was a mass in the left adnexal region the size of a grapefruit. This patient had three cervical biopsies and was followed in the out patient department for a period of 3 months. During this time the adnexal mass gradually decreased in size until it was only about 4 centimeters in diameter.

The first biopsy showed a definite chronic cervicitis with large numbers of lymphocytes beneath the stratified squamous epithelium. The stratification of the epithelium was well preserved but an occasional large nuclear form was noted. PAS technique on this specimen showed glycogen to be present in the epi-

thelium but in somewhat smaller quantities than was usually seen in normal cervical epithelium. The second biopsy 10 days later showed occasional areas in the epithelium in which the normal stratification of the epithelium was not present. The cells in these areas were relatively uniform but did tend to line up in spindle cell formation. Mitotic figures were rare. In areas where the plane of section was definitely perpendicular to the surface the epithelium seemed about normal. PAS technique applied to this epithelium showed large amounts of glycogen in the definitely normal areas. Glycogen was absent in the abnormal areas but this was thought to be due to the plane of section passing through basal cells. The third biopsy showed the stratified squamous epithelium markedly thickened with a loss of the normal stratification. Large nuclear forms were present and rather frequent mitotic figures were seen. In places the epithelium projected downward in short ball-like processes. In no place, however, could there be found any invasion beyond the basement membrane. This specimen was diagnosed as carcinoma in situ.

The patient was admitted to the hospital and a total hysterectomy and right salpingo oophorectomy performed. Pathological examination of the surgical specimen showed multiple intramural fibromyomas, large hemorrhagic corpus luteal cysts, a healed chronic follicular salpingitis and numerous old fibrous tags and adhesions about the right tube and ovary. Microscopic examination of the cervix revealed a thickened epithelium made up of hyperchromatic cells that sometimes lined up in spindle cell formation. There was noted considerable variation in size and shape and mitotic figures were not unusual. Large masses of this hyperactive epithelium were seen growing downward into the cervical glands. Between the cervical glands the epithelium projected downward in short downgrowths. There were also noted several large isolated islands of

epithelial cells deep in the fibrous tissue of the cervix. As the epithelium was followed laterally the evidence of invasion disappeared and the hyperactivity was found to be limited to the epithelium, that is, the surface epithelium. The appearances here were typical of carcinoma in situ. At the margin of the lesion there was a rather abrupt transition to seemingly normal epithelium. PAS technique showed the epithelium thought to be normal to contain large amounts of glycogen. At the point of transition to hyperactive epithelium there was noted an abrupt loss of glycogen. Throughout all the hyperactive epithelium there were occasional small patches of glycogen in the more superficial cells but for the most part there was a striking absence. One cervical gland showed squamous metaplasia, the squamous cells of which showed no glycogen.

#### DISCUSSION

Surrounding the ulcerated portion of the cervical carcinoma which stains with iodine there is a clear nonstaining zone. Schiller interprets this pale zone as identical with the lesion described microscopically as advancing margin of the carcinoma. We have shown that carcinoma in situ does not contain glycogen. In sections in which we found the normal and hyperactive epithelium demarcated by the short oblique line of Schiller, the picture is striking. If the entire thickness of the epithelium is not taken over by glycogen-free and hyperactive basal cells, glycogen is noted to be present in the more superficial cells.

In a small series other lesions of the cervix producing hyperactivity (such as regenerating epithelium) may contain no glycogen or normal amounts of glycogen in different instances. A further study is in progress. It seems possible that conditions that do not show glycogen may contain some tendency to neoplasia which becomes permanent and fixed in carcinoma.

Six of the 8 patients whose cases were studied are under 40 years of age. The average age of 35 years agrees closely with the average age reported by Schiller, and TeLinde and Galvin, being considerably below the average age of carcinoma of the cervix in general. If carcinoma in situ is actually early carcinoma then the early age at which it occurs would seem to lead to the idea that it may exist for quite some time before invasive cancer develops, as TeLinde suggests.

It is hoped that this study may suggest a new approach to an old problem, and that the findings may be of practical aid in the interpretation of some lesions of the cervix. A study of the cervical smear by the periodic acid Schiff's method is proposed while regenerating epithelium of the cervix is being reviewed in continuation of this preliminary report.

#### SUMMARY

The clinical and pathological features of 8 cases of carcinoma in situ are presented. Three of these are discussed in some detail.

The cases have been studied histologically and histochemically. The periodic acid Schiff's reagent technique has been applied to this material. In all cases glycogen is absent from the hyperactive epithelium. It has also been shown that glycogen can be demonstrated in formalin fixed material. The findings are discussed briefly.

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# SIMULTANEOUS PROSTATECTOMY AND INGUINAL HERNIORRHAPHY

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AS a complication of other surgical procedures in older males postoperative retention of urine due to benign prostatic hypertrophy is frequently encountered. This is particularly common following operations for the cure of inguinal hernia. It is the purpose of this article to call attention to the fact that simultaneous herniorrhaphy and prostatectomy are well tolerated and constitute a practical procedure. Not only does the combined operation obviate an unexpected retention which frequently develops after herniorrhaphy, it also decreases the number of periods of anesthesia required to effect the desired result and usually results in a shorter hospital stay with a more rapid convalescence than when, following inguinal herniorrhaphy, postoperative urinary retention and infection develop and prostatectomy must be done. In 100 consecutive cases of prostatic hypertrophy the incidence of an associated inguinal hernia was 15 per cent.

## METHODS

An analysis was made of 100 consecutive cases of prostatectomy performed on the urology service at the Albert Merritt Billings Hospital during a 12 month period. Cases were grouped according to the technique of prostatectomy used, suprapubic by Freyer's method using the hemostatic bag of Foley, retropubic by Millen's technique, perineal by Belt, Ebert, and Surber's method, and transurethral according to Nesbit. One injection of procaine spinal anesthesia was used in all but 3 cases in which ethylene and ether were employed. Further grouping was made according to operations performed at the same time as prostatectomy, and finally as to the presence of hernia and time of hernia repair with respect to prostatectomy. Herniorrhaphy was performed according to the techniques of Bassini and Halsted. Hernia repairs were al-

ways done first, and separate incisions were always made. Sealing-off of the herniorrhaphy incision with waterproof adhesive dressings was considered desirable to prevent possible contamination from infected urine.

## RESULTS

Of the 100 prostatectomies 59 were done suprapubically, 54 one stage and 5 two stage. There were 35 transurethral prostatic resections, 3 retropubic, and 3 total perineal prostatectomies.

In the course of 26 of these prostatectomies 31 other surgical procedures were performed simultaneously, exclusive of bilateral vasotomy which is done routinely to prevent retrograde pyogenic epididymitis. A tabulation of the 28 cases of multiple simultaneous operations shows 5 inguinal herniorrhaphies, 9 orchietomies for carcinoma of prostate, 1 for tumor of testis, 5 excisions or fulgurations of carcinoma of bladder, 5 removals of vesical calculus, 2 hydrocelectomies, 1 hemorrhoidectomy. The maximum number of additional operations at one time was two.

The total period of hospitalization for all patients who had the one stage suprapubic prostatectomies averaged 18.8 days, for two stage suprapubic prostatectomies 28.4 days. The average period of hospitalization for patients who had simple one stage suprapubic prostatectomy was 17.2 days. In cases of one stage prostatectomy with additional simultaneous surgical procedures it was found that the average hospital stay was 18.0 days. The period of hospitalization in cases of transurethral prostatic resection averaged 8.9 days, and for radical total perineal prostatectomy it was 21 days. There were 17 cases of carcinoma of the prostate gland included in this series.

Five of the 100 patients had a simultaneous Halsted type herniorrhaphy and suprapubic prostatectomy. Four of these patients had



uneventful postoperative courses and were discharged from the hospital in 13, 15, 18, and 19 days. The fifth patient developed a myocardial infarction postoperatively and stayed 54 days. Four patients with acute retention of urine following herniorrhaphy which had been done by other surgeons were referred for prostatectomy and are included in this series of 100 cases. Three of these 4 developed urinary retention on the day of operation, and the fourth had acute retention on the eighth postoperative day. All 4 failed to respond to conservative measures and all required prostatectomy. These patients all underwent distressing periods of urinary tract infection and trials without catheter before it was agreed that prostatectomy should be done. In 1 case intolerance to the indwelling urethral catheter made a two stage prostatectomy necessary. In another the patient's poor general condition prompted delay of prostatectomy for 10 months during which time residual urine and infection persisted with distressing symptoms. The total hospital stay for these 4 patients was 16, 25, 27, and 30 days. Six of the 100 patients had asymptomatic inguinal hernias, and herniorrhaphy was not performed simultaneously with prostatectomy.

#### DISCUSSION

Simultaneous herniorrhaphy and prostatectomy are a well tolerated procedure and save the patient with borderline prostatic obstruction from distressing postoperative retention of urine which may follow inguinal herniorrhaphy. The patient with obstruction to the free outflow of urine may strain to void with such force that he tends to produce inguinal hernias. Thus many of the hernias seen in men of prostatic hypertrophy age may be regarded as secondary to the straining re-

quired to pass urine. Then what is more logical than correction of the primary condition, prostatic hypertrophy, and its secondary effects, vesical calculi, vesical diverticula, or inguinal hernias, simultaneously when the condition of the patient is good?

The herniorrhaphy incisions all healed satisfactorily and it was not difficult to keep the incisions clean and dry by use of waterproof adhesive dressings. Postoperative ambulation was not delayed by the multiple procedures. Patients were allowed up in a chair the first day after the combined procedure. It is to be noted that there were no deaths and only 1 serious complication in this series of 100 cases.

#### SUMMARY

The incidence of inguinal hernia in patients with prostatic hypertrophy was 15 per cent. In a series of 100 prostatectomies, simultaneous one stage suprapubic prostatectomy with inguinal herniorrhaphy through separate incisions was performed in 5 cases. Also there were 4 additional cases in which herniorrhaphy was followed by urinary retention necessitating subsequent prostatectomy. In most cases the simultaneous operations were followed by a smooth, rapid, and comfortable convalescence. The advantages of simultaneous herniorrhaphy and prostatectomy should be more widely appreciated.

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# REMOVAL OF THE AURICULAR APPENDAGE IN THE DOG

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THE purpose in studying the auricle has been twofold. It stands as a portal to the interior of the heart, and, therefore, it is of interest to know the effect of surgery on this portion of that organ. In addition the auricle as well as the ventricle is involved in cardiac disease, and it is possible that operating on the auricle may be effective therapeutically in certain cases of chronic auricular fibrillation. It is important not only to know the effect of opening the auricle and removing a portion of it but also to determine how the excision may best be done. In this investigation the problem has been worked out in the laboratory, on dogs. The information so obtained should prove useful when entrance through the auricle is a portion of another operation and when the operation is used alone as well.

The auricle has been used as a route to the chambers of the heart (1, 6, 9) because the muscle is thin, because there is little danger of injury to the coronary vessels, and because displacement of the heart from its normal position is less likely. Allen and Graham (1, 2) have studied this problem in connection with their work on surgery of the cardiac valves and found that entrance through the auricular appendage was not detrimental, whereas mortality in dogs was higher when the approach was through the ventricle. However, it was not their primary purpose to devise an operation for removal of a portion of the auricle alone and to determine the effect of such a procedure.

Embolic phenomena are not unusual in auricular fibrillation. The reservoir for these emboli is the auricle, since the factors favoring clotting are operative in the auricle which is not contracting effectively. Although quinidine and digitalis are effective in many patients, it is possible that there is a group of

refractory cases with chronic fibrillation which might derive benefit from removal of the auricular appendages and adjacent auricle. After removal of the thrombus the sac in which they originate could be extirpated. It is also possible that the fibrillation itself may be altered by such a procedure (v1). This occurred to the author during the course of some preliminary experiments on intracardiac surgery at Yale University in 1943. It was not possible to start the experiment until July, 1946, however. Since that time a suitable surgical technique has been worked out for removal of the more redundant portion of the auricle which at the same time reveals the effect of using this part of the heart simply as a route to the interior.

## METHODS

Adult, mongrel dogs were used. Each animal was examined and the heart sounds were noted, after which an x-ray picture and electrocardiogram were taken. This was repeated at intervals after each operation. In addition to leads I, II, III, and CF<sub>4</sub>, the V leads were taken in a special manner with the electrode at the level of the auricle. Intravenous sodium nembutal was used to anesthetize the dogs, and an intratracheal catheter was passed and connected to a source of positive pressure which made it possible to deliver air enriched with oxygen while the chest was open. The thorax was entered through the third or fourth intercostal space, and the ribs were separated with a self-retaining retractor (Fig 1). The lungs were packed away from the field with moist gauze and the pericardium was opened. After the tip of the auricular appendage was grasped with a small hemostat, the walls of the base of the appendage including a portion of the auricle itself were sutured together with interrupted mattress sutures resulting in a linear closure. Adjacent sutures were then tied to each other, and a small incision was made in the appendage distal to the suture line. On the rare occasion when this showed

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that the sutures were not effective, a hemostat proximal to this point stopped the bleeding and the suture line was re-enforced. This was rarely necessary. The proximal hemostat was removed, and, after bleeding had ceased, the appendage was excised. The pericardium and chest wall were closed and air was withdrawn from the thoracic cavity with a needle and syringe fitted with a three-way stopcock at the end of the operation. Respiration resumed spontaneously after the respirator was disconnected. In the postoperative period it was not found necessary to administer chemotherapeutic or antibiotic agents.

After recovery from the first operation, the appendage was removed from the opposite side. In 4 animals both sides were operated on in one stage, the usual incisions were used on either side of the chest. The animals were killed and autopsy was performed at intervals up to 2 years. Sections were taken through the stump of the auricular appendage for microscopic study, and the animals were carefully examined for signs of emboli.

#### RESULTS

The auricular appendage was removed on both sides in 16 dogs in 2 stages at least 2 weeks apart. All survived removal of one appendage and 15 survived removal of both. One animal died immediately after operation on the second side, probably due to an overdose of nembutal. Operation was performed on the left side first in 8 dogs and on the right side first in a similar number.

The appendages were removed at one stage in each of 4 dogs. Of these, 3 died in the immediate postoperative period, and the fourth survived. Autopsy of the 3 dogs which died revealed atelectasis and in 1 dog, pneumonia of the left lower lobe. In the fourth animal, which survived, more care was taken in removing the air from the pleural cavity at the close of the procedure than in the first 3, which died. Knowing the conditions at the operating table and the results of autopsy, it is thought that perhaps diminished aeration in the postoperative period rather than the operation on the heart itself may account for the deaths of these animals. Until further work is done, performing the bilateral proce-

dures in one stage should be viewed with some reservation, however.

In setting up the equipment for intratracheal positive pressure combined with intravenous nembutal, it was found that the addition of oxygen was necessary for best results. Also, some difficulty was experienced in calculating the proper dose of nembutal to be administered. Occasionally it was necessary to supplement the initial intravenous dose during the operation, but as the procedure became standardized and less time was required for its execution, the original amount given was usually sufficient. The operation required from 40 minutes for each of the stages in the two stage procedure to a maximum of 2 hours and 45 minutes when both appendages were removed at one operation.

The incision was at first made in the fourth anterior interspace. In some of the dogs this was slightly too low. The third interspace was used in the last half of the animals operated on, and this seemed to be too high only once. The anterior approach gave very good exposure. In the last group of 10 animals the length of the incision was about three-fourths as long as that originally used and was quite adequate. It was found most advantageous to enter the pericardium posterior to the phrenic nerve on the left and anterior to the nerve on the right because of the rotation of the heart. A removable, stay suture was used to encircle the phrenic nerve and retract it out of the way.

The type of closure of the auricular stump which first came to mind was a pursestring suture, but it did not prove useful because it required an encircling ligature to make a tight closure and the adjacent auricular wall became puckered, inviting stasis and thrombosis. Also utilization of a single suture was not as safe as a number of sutures. The procedure which was adopted proved to be quite safe, and, even though the suture line was not competent at first, this could be checked before the appendage was removed. Non-absorbable sutures were used throughout. The auricular appendage was sutured with No 0000 Deknatel braided silk. Sutures of No 00000 silk were tried but the heavier grade was found more satisfactory for this purpose.

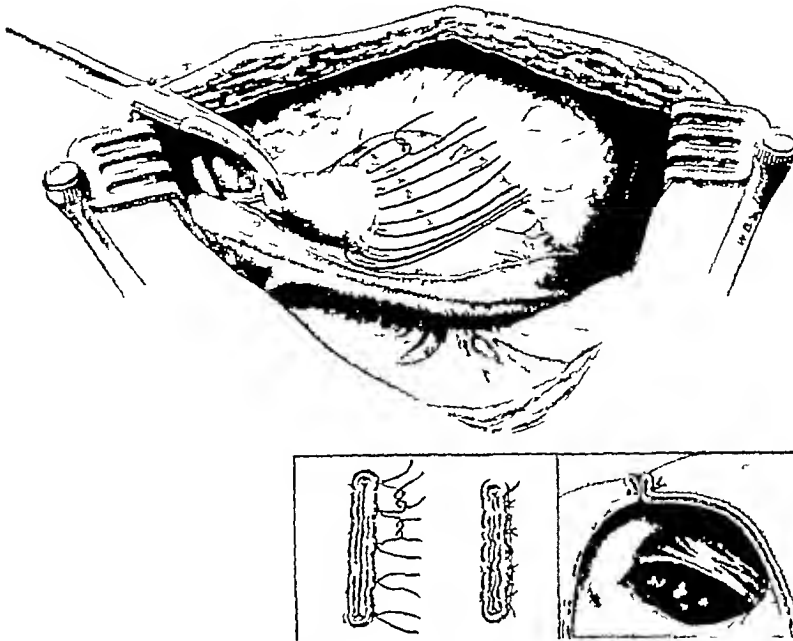


Fig 1 After the chest is entered through the third intercostal space, interrupted mattress sutures of silk are placed through the base of the appendage and adjacent auricle. These are then tied as illustrated. A small opening is made in the appendage to test the suture line, after which the appendage is removed. The drawing shows the operation on the right side.

Less bleeding, of course, was encountered when atraumatic needles were used. The pericardium was approximated with interrupted sutures. Whether or not the pericardium was completely closed did not influence the results.

When the tip of the auricular appendage was first grasped with a hemostat, arrhythmia resulted, but lasted only a few seconds as a rule. This occurred also while the base of the appendage was being sutured but was less frequent at that time. After the operation was completed, no arrhythmia which was not present preoperatively was noted. This change in rhythm was not enough of a problem to warrant the use of procaine. Careful auscultation on numerous occasions failed to reveal the presence of any murmurs.

Since all the deaths which could be attributed to the operation occurred in the immediate postoperative period, it seems that when once the decreased volume of the auricle is established there are no detectable ill effects. Records show that all of the dogs gained

weight, which was not due to edema as proved at autopsy. One of the animals delivered a litter uneventfully after the two stage operation. It was assumed that the animal would probably survive its normal span after completing the first year without incident, and 1 dog was kept for 2 years at the end of which time no untoward effect from the operations was found. When the operation was done in two stages, all of the animals survived the first stage and it is reasonable to suppose that incision or removal of the right or left auricular appendage would carry little or no mortality except that connected with extracardiac complications.

Autopsy showed that the parietal pleura invariably became adherent to the visceral pleura at the point of entrance into the thoracic cavity. The pericardium was adherent to the lung at the suture line. Fibrinous adhesions between the pericardium and auricular stump also occurred in the animals, but adhesions to the base of the ventricle were

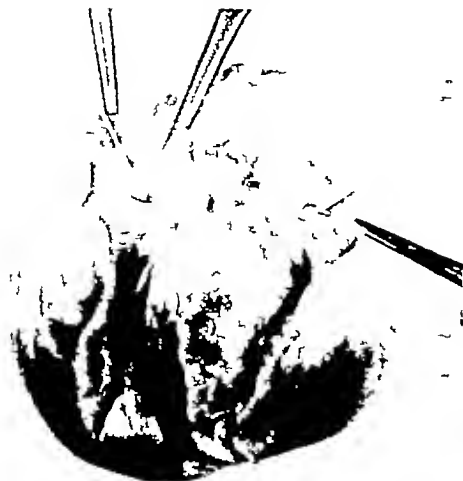


Fig 2 Endothelial surface of both auricles following removal of both appendages illustrating satisfactory healing



Fig 3 External suture line on the same heart as is shown in Figure 2

seen in only 2 animals. In all cases the auricular stump was well healed, and the luminal surface was smooth, glistening, and covered with endothelium (Figs 2 and 3). No antemortem thrombi were found within the heart. Microscopic sections showed the presence of a well healed scar with no sign of inflammation near the endocardium (Fig 4). There was some reaction around the silk which remained and consisted of an infiltration of small and large round cells. An interesting finding was the presence of considerable cartilage in two of the scars from different animals and bone in a similar number.

There were no signs of cardiac failure. The average weight of 10 of the hearts was 101.4 grams. The average, maximum thickness of the wall of the right ventricle was 7.4 millimeters and that of the left was 13.1 millimeters. The corresponding average, minimum thicknesses were 2.7 millimeters and 5.9 millimeters, respectively. This fact indicates that there was no hypertrophy, and examination of the organ showed no dilatation. The liver appeared to be normal, and there was no accumulation of fluid within the tissues or body cavities at the time of autopsy. Examination of the abdominal and thoracic viscera as well as section of the brain failed to reveal any evidence of infarction due to emboli. Autopsies were done on 3 dogs which died in the im-

mediate postoperative period, the remaining autopsies were performed from 3 months to 2 years following operation.

The average weight of all right appendages removed was 756 milligrams and of all left appendages was 704 milligrams. The respective averages for the last 10 operations were 830 milligrams and 677 milligrams for right and left appendages. This represents 1.49 per cent of the average weight of the heart. In the early operations a greater amount of left appendage was removed, but later it was possible to remove more of the right auricular appendage including a portion of the auricular wall.

Roentgen studies before and after operation showed no change in contour of the heart in posteroanterior views. However, more detailed studies were not done and may possibly have shown the defect after operation. Certain electrocardiographic changes were noted. There was diminution of the *P* wave in limb lead I and also in the special *V<sub>3</sub>*, *V<sub>4</sub>*, and *V<sub>5</sub>* recordings. The negative deflection in leads *V<sub>1</sub>* and *V<sub>2</sub>* was decreased after removal of either or both auricular appendages. Care was taken to have the dog in the same position each time. A special study of the contribution of the auricular appendage to the electrocardiogram is being made and will be reported subsequently.

After this work was completed (5) the studies of two other groups came to our attention. Madden, at the suggestion of Dock, removed the left auricular appendage in 2 patients, one of whom died. Hellerstein and associates amputated the appendage in the dog, using a clamp and a ligature in all except 2 dogs. They reported no constant electrocardiographic changes except a transient intra-atrial block.

#### DISCUSSION

The results which have been obtained in this group of animals indicate that opening or even excising the auricular appendage on one side results in no demonstrable deleterious effect. It is well known that wounds of the ventricle may result in serious or even fatal consequences due to injury of the blood supply to the ventricular muscle. In addition, the closure of the ventricle presents a greater problem than closure of the auricular wall. However, Cutler and coworkers (7), on theoretical grounds, chose the ventricle as the site for introduction of the cardiovalvulotome in correcting mitral stenosis. They felt that because of increased pressure and dilatation of the auricle in mitral stenosis there would be danger of dislodging thrombi and tearing the distended wall. In a later paper (6) they say that further attempts through the auricle are justified and report that this approach was used in 3 of their cases because exposure was easier and less difficulty was encountered in guiding the tip of the instrument through the mitral orifice.

The results obtained in this experiment and those of Allen and Graham (1, 2) indicate that in approaching the interior of the heart for the purpose of correcting congenital anomalies or the effects of disease, the auricle is a route of choice. Harken and coworkers have also found it a better approach to the mitral valve than is the ventricle. At the present time such an approach has been attempted sporadically and without brilliant success because time is a limiting factor, visibility is poor or nonexistent, and special instruments are necessary. Certainly extracardiac reconstruction (3, 4, 14, 15) is safer and offers more at present than surgery within the heart it-



Fig 4 Section through the stump of the auricular appendage showing endothelium covering the scar  $\times 115$

self. However, this does not mean that the problems of intracardiac surgery are insurmountable, and it may become useful when more is known about the possibilities of circumventing the present difficulties with such surgery (8).

Auricular fibrillation is still a problem for the cardiologist, and perhaps the operation just described may have some application to the treatment of this disease. The treatment of fibrillation with quinidine is not altogether successful, and at times even if there is conversion to normal rhythm, emboli are dislodged. Anticoagulant therapy cannot be continued indefinitely, and of course thrombi already formed are not affected by such treatment. With no desire to alter or detract from treatment which is effective, it is reasonable to suppose that the operation described could help patients who do not respond to medical therapy. This work on the dog would indicate that it is possible first to remove thrombi and then to eliminate the reservoir in which the clots are formed by removing the portion of the auricle harboring them.

The operation proposed in the human would be to open the tip of the appendage and remove any clot present and then to use a hemostat both for closing the opening and for traction. After the row of sutures at the base of the auricular appendage is completed, as described for the dog, a small opening between hemostat and sutures or simply the release of the hemostat would indicate whether

a competent suture line were present. If bleeding occurred, the distal portion could be clamped again and the closure completed. The appendage would be removed only after the operator was certain the lumen of the auricle had been completely closed. It might be necessary to modify the method in the presence of mitral stenosis with a distended and thin left auricle, but by no means is this situation encountered in all cases of mitral stenosis (9).

Fibrillation is a continuous circus movement usually with a main pathway around the origin of the great veins. A wave of contraction progresses along this pathway, limited in its direction by the refractory period of the muscle, and perpetuated by an excitable strip ahead. Conditions which alter the situation and favor stopping the circus movement are a shorter pathway, more rapid conduction, and a longer refractory period (11, 12). Quinidine and digitalis are effective because they affect the refractory period and the conduction time. Removing a part of the auricular muscle conceivably could stop the fibrillation as well as remove the source of emboli by producing a shorter pathway. Theoretically, alternate longer circuits could be eliminated and even if the operation did not produce the desired results alone combined with quinidine it could add enough to the total situation for a favorable result. Unfortunately, it has not been possible to test this hypothesis in dogs. There is otherwise sufficient justification for the procedure in man, however, and the question as to whether the fibrillation itself will be altered can be determined in that manner.

The portion of the auricle removed at such an operation could serve a very useful purpose. Cardiac muscle has been studied extensively in other forms but for very obvious reasons there is no source for studies of metabolism, etc in man. Any muscle removed

should be utilized for that purpose and might help clarify some of the fundamental problems in human cardiac physiology and its alteration in disease.

#### CONCLUSIONS

1. A method for safely removing the auricular appendage in the dog has been devised.

2. All of 16 dogs survived the first of two stages and 1 dog died within 12 hours after the second stage of the bilateral auricular excision. This death was probably due to an overdose of nembutal.

3. Only 1 dog of 4 survived when the auricular appendages were removed in one stage. These deaths followed pulmonary complications in the immediate postoperative period.

4. Electrocardiographic changes occur after operation.

5. This operation has certain therapeutic possibilities in man.

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# SOME ASPECTS OF THE DEVELOPMENT OF INTRATHORACIC SURGERY

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IN this, the third Martin Memorial Lecture, it is my purpose to present some of the main problems encountered in the surgical service of the Sabbatsberg Hospital in Stockholm in the development of thoracic surgery. One problem, always of special interest to me, has been that cardiorespiratory dysfunction is encountered immediately upon the opening of the chest.

## FACTORS INFLUENCING THE DEVELOPMENT OF THORACIC SURGERY

Why has the development of major intrathoracic surgery been delayed several decades while that of general surgery has progressed? The most important causes of this delay I believe are lack (1) of adequately trained specialists, (2) of adequate teamwork, (3) of means of securing adequate anesthesia, (4) of knowledge concerning chemotherapy, and (5) of knowledge concerning cardiorespiratory disturbances produced by thoracotomy.

1 Thoracic surgery presents so many difficulties that I think we all agree it is necessary to entrust this branch of surgery to specially trained men. It is obvious that since this practice has become more and more the custom, the rapidity with which improvements in technique have developed has increased considerably.

2 In the early decades of this century, the importance of teamwork was little appreciated. The rapid advancements in medical science have made it evident that close cooperation between highly trained specialists in the different branches of medical practice is today even more necessary to secure further advancement. This is especially true regarding thoracic surgery.

3 A third factor in the delay in the development of thoracic surgery has been, without doubt, insufficient means of securing anesthesia. Not only has thoracic surgery but so also has every field in advanced surgical practice benefited enormously from the rapid strides made in anesthesiology, emanating from the Anglo-American countries and especially from the United States.

4 The fourth factor, the introduction of chemotherapy, has also in my opinion accelerated development and has been of significant value in thoracic surgery. In certain infections in which previously prognosis was very bad, patients can now be treated radically without undue risk.

5 There can be no argument regarding the fact that great importance in the delay in the development of thoracic surgery must be ascribed to insufficient knowledge of how to correct cardiorespiratory disturbances occurring immediately the thorax is widely opened.

Like many other specialties, thoracic surgery has branched off from the original family tree, general surgery, to become an independent specialty. Well trained general surgeons with a keen interest in exploring new fields were the first to attack thoracic surgical problems. While such workers achieved isolated brilliant results which demonstrated the potentialities in this branch of surgery, they were not able to repeat successfully in sequence the desired results because they did not fully appreciate the factors which are here outlined. Achievements by men such as Matas, Willy Meyer, Lihenthal, Torek, Graham, Meltzer, Auer and Elsberg, on this continent and by such men as Tiegel, Friedrich, Sauerbruch, Trendelenburg, Tufner, Rehn, Giertz, Delorme and Garre in Europe have later stimulated general surgeons interested in chest surgery to continue their efforts. During this period the importance of different factors afore-

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mentioned have gradually become increasingly recognized

#### SPECIAL TRAINING IS NECESSARY

A number of general surgeons soon realized that to achieve success in this branch of surgery they must devote themselves entirely to chest work. Special chest services have gradually been established and increasing numbers of younger men have devoted themselves to this specialty in an effort to obtain adequate training. Centers for the treatment of thoracic diseases have been established in many places in this country and in Europe. In Sweden we shall, in the near future, erect in connection with the University of Stockholm a separate hospital building exclusively for the treatment of chest diseases. It would thus seem that the lack of adequately trained surgeons specializing in thoracic diseases will be overcome in the very near future.

In this connection a new problem arises. How is the training of the younger men to be most satisfactorily arranged? I am definitely of the opinion that every chest surgeon must have as thorough training in general surgery as any man who wants to become a general surgeon, the training in thoracic work must be superimposed or added to his general surgical education. An additional short period of laboratory work should also be required. Some training in anesthesiology, in the use of the x-ray, in bronchoscopy, and in internal medicine is essential. With knowledge founded on such an education, I believe that the thoracic surgeon would be qualified to take up independent work in his special field.

It has been my observation that there is a tendency among the younger generation of surgeons who intend to specialize to commence practice without a broad foundation on which to stand. This tendency, I believe must be strongly opposed if a sound basis for successful practice is to be attained.

#### TEAMWORK

The second factor delaying progress in the development of thoracic surgery has been the previous lack of teamwork. In the medical profession co-operation or teamwork, had been rather unpopular until shortly before

World War II. For the most part our scientists have been "lone wolves" in their scientific work. The recent rapid development in the various branches of medicine has brought about a demand for collaboration, since it is often impossible for one single man to master even his own special field. In this respect also the United States has taken the initiative and has shown the world that close co-operation between skilled scientists in different fields is often necessary to obtain desired results within a reasonable length of time. For the solution of many problems in thoracic surgery we need the help of representatives well trained in the basic sciences as well as the help of members of the different branches within the medical field, for example, in the treatment of congenital heart malformations, the close co-operation between the surgeon, the x-ray specialists, the cardiologist, and the pediatrician has been invaluable in the development of this highly specialized form of therapy. To obtain accurate and practical equipment both for the diagnosis and for the actual surgical work the advice and help of theoretical institutions and of a skilled engineering department have been indispensable, to me at any rate.

In developing a team it must be borne in mind that many scientists are inherent individualists with strong will power. These qualities might be more pronounced in one member of the team than in others and he with the strong will power will probably be the organizer and leader of the team. It must therefore be emphasized that in every team each member has his part to play and that the contribution of each is necessary to accomplish the result, credit for the solution of a problem is due the team as such, not to any individual of the team. Should one member of the team take undue credit to himself, bad feelings can easily be aroused within the team, thus reducing its working capacity with loss in subsequent output.

#### ANESTHESIOLOGY

Considerable progress has been made in anesthesiology during the period in which thoracic surgery has been maturing into an independent specialty. Improved equipment and methods of inducing anesthesia as well

as new drugs have been of great benefit in thoracic surgery; it is my opinion, however, not so much the better equipment and the anesthetic agents but the method of their administration that has been helpful in securing better results in this branch of surgery. Another and most important factor is that qualified doctors are trained to be skillful specialized anesthetists who give their personal attention to every detail in often very long drawn out anesthetics necessary for difficult chest operations. One fundamental factor, however, remains amazing to me, namely, that the problem of how to correct continuously and effectively the disturbances in respiration in an open chest operation is not yet consciously and fully appreciated by the vast majority of our anesthetists and thoracic surgeons. This question will be discussed in some detail later.

#### CHEMOTHERAPY

The importance of chemotherapy, i.e., the use of the sulfa drugs, penicillin and streptomycin, separately or in combination, has been much discussed. Some authors believe that the value of these drugs in chest surgery has been overestimated. From my own experience I am of the opinion that the vast majority of infectious complications connected with thoracic disease are favorably affected by chemotherapy regardless of whether the complication preceded or followed operation. Chemotherapy has accelerated the development of the surgical treatment of infected chest disease and patients who previously could not be treated can now be given the benefit of surgery. Another fact worth mentioning is that chemotherapy has reduced to a minimum one of the most discussed technical problems in lung surgery, namely, the treatment of the bronchial stump after lung resection. Before the era of chemotherapy, in order to secure the lowest possible percentage of complications without fistulas in the healing of the bronchial stump, I found that a lengthy, somewhat difficult and meticulous technique, described by me in 1939, was necessary. Now, with chemotherapy, even though comparatively crude methods of closure of the bronchus appear to give satisfactory results I still

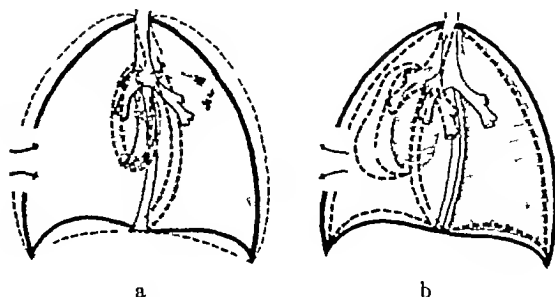


Fig 1 Alterations in respiration in open chest during inspiration, a, and expiration, b,

prefer my old meticulous technique which I consider to be the safest.

#### CARDIORESPIRATORY DISTURBANCES

Finally I come to what I regard as the most important factor in the delay in the development of thoracic surgery, the lack of adequate knowledge concerning cardiorespiratory disturbances produced when the chest is opened.

In 1939 I had the privilege of presenting here in Los Angeles to the American Association of Thoracic Surgery my views of respiratory disturbances in the open chest and how to overcome them. During the last decade the principles outlined at that time have been consistently followed in my clinic and we have never had occasion to change them. On the contrary accumulated experience has further convinced me of the superiority of our method over that of others. I shall briefly review the basic physiological changes in respiration when the chest is opened.

The diagrams in Figure 1 show the well known alterations which occur. In a, is shown the gas flowing from the outside through the trachea into the unopened thorax during the inspiratory phase of respiration. During this phase as the thorax expands the negative pressure on this side is increased which accounts for the flow in this direction. In addition, and because of the same negative pressure, one also finds gas from the opposite lung flowing into the lung on the unopened thorax, the mediastinum is pulled to this side and thus the volume of gas (tidal flow) flowing into this lung is reduced.

During expiration (Fig 1 b) the dynamics are reversed. The intrapleural pressure in the un-

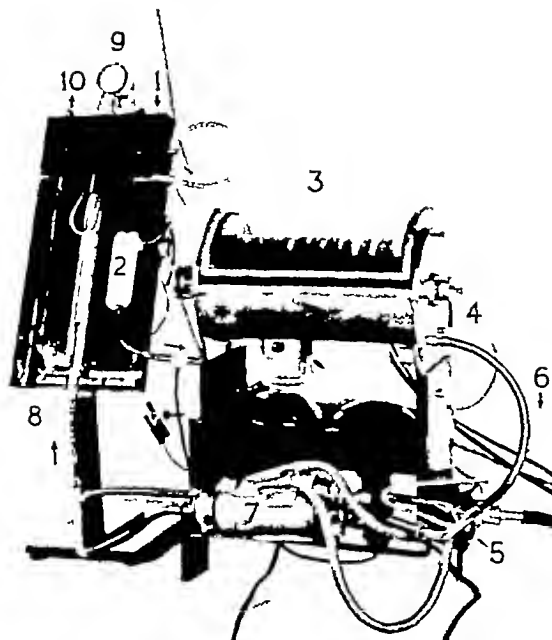


Fig. 2. Apparatus to oxygenize the blood. 1, Tube conveying venous blood, 2, flow meter, 3, the oxygenator, 4, tube in front of a photoelectric cell, regulating the speed of the pumps and thereby also the level of the blood, 5, pulsator, 6, tubes to the pumps, 7, the pumps, 8, contact thermometer, 9, manometer for blood pressure reading, 10, tube to the arteries.

opened thorax becomes less negative or even positive as the muscles of expiration contract. The gas leaving the lung on the unopened side goes in two ways as it reaches the bifurcation of the trachea, most of it into the trachea, a smaller part into the opposite lung (pendulum air). The result of this is that since the patient is breathing essentially with only one lung, the abnormal ("paradoxical") flow of gas and the abnormal ("paradoxical") movement of the mediastinum reduces tremendously the respiratory efficiency of that one lung. It follows, therefore, that the softer and more pliable the mediastinum the greater is this reduction.

In this connection it is interesting to note that prior to the endeavor to correct these disturbances of respiration in the open chest, only relatively few cases of successful intrathoracic operations were reported. It is true however that during the same period abdominal surgery had been rapidly progressing and large series of successful operations had been re-

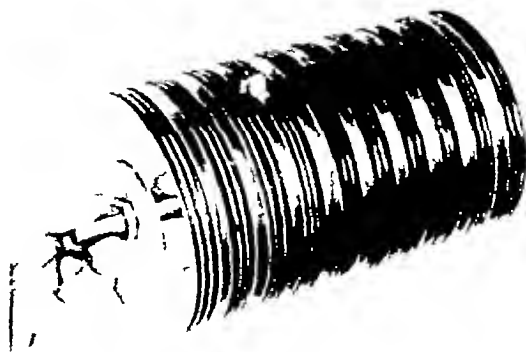


Fig. 3. Many small discs which rotate within cylinder in which blood is collected for oxygenation.

ported. By contrast, the fact remains, however, that surgical procedures below the diaphragm produce few significant cardiorespiratory changes.

Ferdinand Sauerbruch, one of the pioneers in thoracic surgery, was one of the first in Europe to understand the importance of correcting respiratory disturbances in the open chest. He was the first to develop a method for performing thoracic operations under continuous negative pressure and later on a method for the use of continuous positive pressure. My compatriot and former chief and teacher, Dr. K. H. Gierz, showed in 1914 to 1916 in thorough experiments on large dogs that from the physiological point of view there is no significant difference in cardiorespiratory efficiency between either the negative or positive pressure methods. At the same time he very clearly and conclusively demonstrated that rhythmic insufflation during the inspiratory phase of respiration and free outflow of the gas from the lungs against normal atmospheric pressure during the expiratory phase is superior to all other methods used to correct the respiratory disturbances in the open chest. This fact was already touched on by Matas in 1901.

The rapid development of thoracic surgery during the 1930's is above all due to the more and more extensive use of this type of respiration. This progress was attained regardless of whether the control of respiration was brought about mechanically, by the use of specially

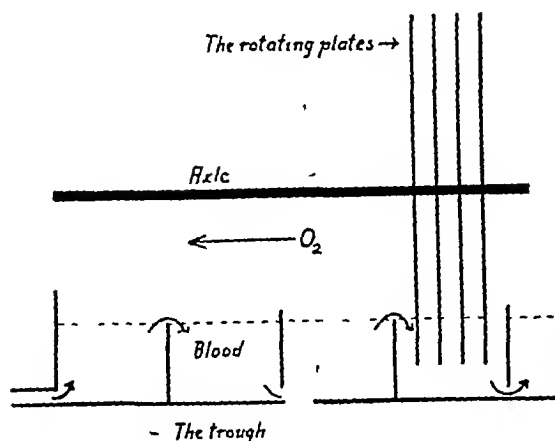


Fig 4 Diagram showing method of oxygenation

constructed machines such as the spiropulsator that we always use, or by hand by the anesthetist rhythmically compressing the anesthetic bag. Visits to a great number of chest centers at different times during the 1930's and 1940's establishes the fact that now the use of controlled respiration is becoming increasingly widespread. Nevertheless I consider the use of a machine for this purpose to be much safer and more reliable than any other method. It is possible with such a device to create rhythmical artificial respiration for an unlimited length of time at a rate and with a gaseous exchange that closely simulates normal physiological breathing. I am convinced that with the increasing use of curare in intrathoracic anesthesia a machine like the spiropulsator will become more necessary. I am glad to see that more thoracic clinics are adopting our method, with satisfactory results.

If one endeavors to correct the altered respiratory conditions in thoracotomy cases by using an ordinary positive pressure machine with constant flow, the mediastinum will be stabilized within certain limits by the positive pressure alone, but the flow of the so called pendulum gas between the lungs will continue. My impression is that the amount of the pendulum gas is certainly greater than is generally believed, in the case of thin walled big cavities I have been astonished to see how large the gas volume really is.

Ordinary positive pressure works to very great disadvantage in that it increases the diffi-

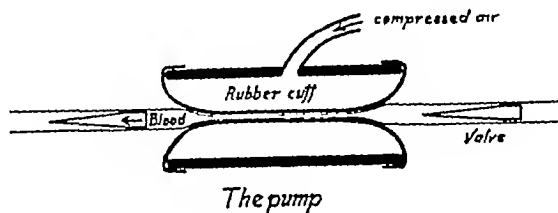


Fig 5 Mechanism of pump

culties of expiration. As you know, the expiratory muscles are not very well developed in man. Attempts to expire for a considerable length of time against slight positive pressure, will soon cause fatigue. I have found that expiratory difficulty results in an increase of carbon dioxide in the blood, after a certain length of time, and acidosis develops due to gradually increasing expiratory deficiency. The expiratory muscles endeavor as long as possible to overcome the increased expiratory resistance, but after a varying length of time, in different persons, fatigue makes them unable to fulfill the requirements for proper expiration even though low positive pressures are used. As the expiratory muscles become exhausted, the patient breathes with a more and more expanded thorax. In order to diminish these expiratory difficulties, it is generally considered that as low a positive pressure as possible should be used, on the other hand, with a low positive pressure there is more extensive paradoxical motion of the mediastinum, with all the consequent disadvantages of this motion.

If the tidal volume is insufficient, anovemia increases, and there is an increase in carbon dioxide in the blood. I am convinced that unless respiration is controlled the patient has a very small margin of safety since ventilatory exchange is then poor. In the majority of patients whom I have had the opportunity of observing in different chest clinics where controlled respiration is not used, the work of the respiratory muscle has been considerably increased during operations upon a patient's wide open chest cavity. Many times these respiratory movements have been increased to such an extent that they have been exhausting to the patient. In my opinion, however, this strained respiration adds considerably to the respiratory burden, since the muscular work

in itself increases the demand for oxygen and so a vicious circle is established

In my opinion it is not an exaggeration to state that in the use of mechanically arranged artificial respiration which simulates normal breathing when the chest is open, we are in possession of the most ideal method for ventilation during these operations. It gives the widest possible margin of safety and also permits the performance of very difficult and time-consuming intrathoracic operations without the necessity for haste.

The validity of this conclusion is confirmed not only by the large series of intrathoracic operations now reported from different clinics, but also, and perhaps still better, by the great improvement in results obtained by surgical treatment of thoracic injuries in World War II over World War I. Sauerbruch, who erected special surgical chest services close behind the fighting lines on the western front at the end of World War I, was unable to bring the mortality rate lower than about 20 per cent. In the American Army, where intratracheal intubation and controlled respiration, to my knowledge, were practically always used during World War II, the primary mortality was brought down to about 5 per cent. The use of more effective antishock treatment and of chemotherapy have naturally helped to decrease the mortality rate, but the use of adequate ventilation during operation in these cases has certainly been of great importance in bringing about improved results.

Another small group of patients operated upon also proves the importance of adequate ventilation during operation within the chest. Since Trendelenburg in 1908 experimentally showed the possibility of removing large emboli from the pulmonary artery, a considerable number of such patients were operated upon in Germany, but always with fatal result. All patients were operated upon through the opened left pleural cavity and with ordinary constant flowing positive pressure. In 1924 when this operative procedure had lost its foothold, the German surgeon Kirschner succeeded in removing a large embolus from the pulmonary artery and the patient survived. This success produced a new wave of activity but the results were as unsatisfactory as be-

fore. In 1927 A. W. Meyer, of Berlin, changed the technique to a transmediastinal approach without opening either pleural cavity and was able to report 4 successful cases within a short period. Using the same technique, Professor Nystrom, of Upsala, and I successfully performed pulmonary embolectomies in 7 patients. At that time I did not realize that it must have been the added demand on the function of the lungs and heart when operation was done through a transpleural incision without controlled respiration that explained the consistently high mortality; it was the improvement in function of the lungs and heart when operating transmediastinally that changed the prognosis.

In my clinic we have now started an investigation concerning the alterations in pulmonary arterial pressures under varying conditions. At the same time blood chemistry analyses are made and the cardiac output is determined. One of our aims is to learn how these factors vary when different types of ventilation are used during anesthesia in open chest operations. The evidence so far obtained does not permit definite conclusions. It would seem, however, that completely controlled artificial respiration maintains the normal pressures within the pulmonary artery, whereas continuous positive pressure breathing or spontaneous breathing with only small or no help from the anesthetist produces a very marked drop in this pressure followed by diminished cardiac output.

Intracardiac surgery has also had its problems. It is easy to understand that complete control of all respiratory disturbances is a prerequisite to the intricate steps of intracardiac surgery. Operations which do not hamper the heart action too much cause few respiratory problems—it is possible to remove foreign bodies from the heart in many cases and to operate successfully on some congenital malformations as well as upon the pericardium. However, if the heart function is disturbed too much by an operation close to or within the heart itself, it is my firm conviction that some means of replacing the heart action must be provided and that this is best done with some machine that can produce extracorporeal circulation, and at the same time

oxygenate the blood This, I believe, will be as important in securing good results in intracardiac surgery as has been the replacement of the patient's own breathing by mechanically controlled respiration in the development of ordinary intrathoracic surgery

In seeking a solution to this problem we have fully realized the great difficulty of constructing a machine with such capacity that it could take over the entire burden of the heart and at the same time be able to oxygenate enough blood for the needs of a large animal or of man We have, therefore, concentrated our efforts on devising a machine which could take over only the more vital demands upon the heart The most urgent demand on the heart, from a point of view of time, is made by the central nervous system, which cannot withstand deprivation of its arterial blood supply for more than 4 to 5 minutes without irreversible damage to the nerve cells It was my opinion, therefore, that if, during an operation upon the heart, satisfactory circulation could be artificially supplied to the brain, it would be possible to cut off the entire supply of blood to the heart, with the possible exception of the coronary circulation Operation then could be performed quietly and without haste and when completed the heart could once more take over the entire circulatory processes and the artificial cerebral circulation could be eliminated

Other organs of the body can be cut off from arterial circulation for a much longer period of time as was shown in a special group of cases of patent ductus arteriosus in which I performed division and suture of the large vessels In these cases—now 33 in number—the aorta was completely clamped, distal to the subclavian artery All arterial circulation was thus inhibited with the exception of that supplied by the large vessels originating directly from the arch of the aorta The time of clamping varied between 10 and 27 minutes, in the majority of cases for 20 to 25 minutes In none of these cases were there discernible disturbances in those organs supplied by arteries originating below the site of aortic occlusion In one other case technical difficulties unfortunately prolonged the time of occlusion to between 45 and 50 minutes In this case al-

though signs of circulatory disturbances in the spinal cord became apparent they were in the process of regression 3 weeks later when the patient died from another cause It thus seems that the collaterals to the spinal cord from the vertebral arteries are not adequate to maintain function for so long a period of time It appears, therefore, that we should have a period of approximately 25 minutes for surgical procedures within the heart itself with simultaneous inhibition of all blood supply to it, provided that artificial circulation can be supplied to the central nervous system during this period

In close co-operation with Mr Emil Anderson of Aga's experimental department and with Dr Viking Bjork, who during recent years has been my scientific assistant, and through generous financial grants from the Swedish Technical and Medical Research Councils, it has been possible for us to solve experimentally the problem of artificial cerebral circulation Mr Anderson has worked on the difficult technical problems of engineering construction To Dr Bjork was entrusted the task of analyzing the perfused blood in every conceivable way during the experiments The results of his analyses have gradually given rise to changes in the apparatus and the techniques of perfusion until at last we have reached the stage where it is possible to relieve the heart from its task of supplying the brain with oxygenated blood

The idea of constructing an apparatus for perfusing the organs with oxygenated blood is far from new Ever since Ludwig and Schmidt in 1868 attempted to add oxygen to the blood for the purposes of perfusion, simply by shaking the blood in the air, a number of workers have tried to solve the problem in various ways Nevertheless, until the end of the 1930's, no one had succeeded in constructing an apparatus in which alterations in the blood (hemolysis, coagulation, etc) were reduced to such an extent that in the presence of adequate oxygenation irreversible organic changes did not develop in the experimental animal John Gibbon Jr, of Philadelphia, was the first to succeed, by means of artificial circulation, in keeping his experimental animal—in this case a cat—alive for a prolonged

period Four cats, which had the pulmonary artery clamped for periods of 12 to 20 minutes, survived and were healthy His experiments have been resumed since the close of World War II

Earlier attempts to supply oxygen to the blood to be perfused were chiefly made in three different ways The first was to bubble oxygen through the blood The second consisted in an attempt to split up the blood into small drops in an oxygen atmosphere and then to recollect the blood The third method was to spread the blood in a very thin film over a large surface The last mentioned method was that used by Gibbon and he succeeded in supplying a greater quantity of oxygen per time unit than any other previous worker had done With a rate of flow of 400 to 500 cubic centimeters per minute through the apparatus, he was able to supply 30.5 cubic centimeters of oxygen per minute to the blood flowing through it This quantity of oxygen is nevertheless far from sufficient to respond to the needs of the human brain, which has been calculated to require between 90 and 100 cubic centimeters of oxygen per minute

In the lungs of mammals, the red blood corpuscles are exposed to the oxygen in the alveoli only for a very short time—even less than one second This length of time more than suffices, however, for the hemoglobin in the corpuscle to become saturated with oxygen, even if its original oxygen content was very low We considered that it was worth endeavoring to imitate this actual condition when constructing our apparatus through which the blood must flow in passing from the superior vena cava to the arteries which supply the brain

We, therefore, built an apparatus in such a way that the blood flowing through it is repeatedly and at short intervals brought up and spread out on a series of thin circular discs which are partially dipped into the blood flowing through the apparatus Figure 2 shows the apparatus for experimental use

The apparatus consists of a number of principal parts First, the artificial lung or oxygenator (3 in Figure 2) and, secondly, the artificial heart or pulsating pump (7 in Figure 2) Oxygenation is achieved by collecting the

blood from the venous system of the experimental animal in a recumbent half cylinder Many small circular discs on a rotating axle fit into this half cylinder (Fig 3) By rapid rotation of these discs, a thin blood film adhering to them is exposed to an atmosphere of oxygen (Fig 4) The optimum minute area of blood film exposed to oxygen in our present machine is about 50 square meters—in other words, an area equal to a fair sized room The oxygenated blood which amounts to approximately  $\frac{3}{4}$  of a liter per minute and to which can be added 70 to 80 cubic centimeters of oxygen is recollected and distributed to the experimental animal by a rhythmical pumping system This system consists simply of two modified de Laval pumps for milking cows The pump consists of a metal cylinder lined with a rubber cuff (Fig 5) The rubber tube conveying the blood passes through the center of this cuff and is rhythmically constricted by compressed air Valves on each side of the pump keep the blood flowing in only one direction There are two such pumps working parallel with alternating pulsations simulating systole and diastole and producing a blood pressure consistent with that found in the experimental animal

It is not, however, sufficient to saturate the blood that passes through the perfusion apparatus with oxygen before it is retransferred to the arterial system of the animal The blood to be delivered must be controlled in every possible way to ensure that it is as similar as possible to normal blood Frothing must be prevented else emboli may occur Heparin is used to counteract the clotting mechanism of the blood The carbon dioxide content must be kept constant in order to maintain the desired pH The blood sugar which has proved to be very unstable must be replaced Any tendency to hemolysis must be avoided and the temperature must be automatically kept at a constant normal level for the experimental animal These and still other less important factors all must be controlled in order for the blood to be serviceable<sup>1</sup>

We have now reached the stage where, by our perfusion method, after clamping the

<sup>1</sup>(Further details are given in *Acta chir scand* 1948 Vol 96 suppl. 137)

brachiocephalic artery in the dog and ligating the vertebral arteries, we are able to keep the brain alive for as long as  $1\frac{1}{2}$  hours. The blood from the artificial heart and the oxygenator is injected into the carotid arteries through the brachiocephalic and removed from the superior vena cava which is clamped proximally during the experiment. In our series of perfusion experiments we have also performed one on a dog, in which a right sided thoracotomy was done, the azygos vein was ligated and both cavae were clamped. Thus in this animal no blood from the systemic circulation was permitted to enter the heart and the only circulation which was maintained was the artificial brain perfusion. The cavae were clamped and the perfusion was maintained for 33 minutes. This animal survived and has been under observation for more than a year without any signs of damage.

During the last 3 months we have performed intracardiac operations on a small number of dogs but have not yet obtained successful results. Some dogs have survived from 1 to 10 hours. They have regained normal eye reflexes, moved their legs, made attempts to stand up, and have also discharged normal urine. During the time of survival they have shown a decrease in the blood pressure and an increase in the pulse and respiratory rate. In the majority of cases hemorrhage was found in the pleural cavities at autopsy. The cause of death was considered to be an excessive loss of blood. This bleeding is certainly due to the comparatively large dose of heparin necessary to avoid coagulation in the extracorporeal circulatory circuits.

We are now trying to diminish the amount of heparin as much as possible, we cover all surfaces in contact with the blood outside the body of the dog with a new plastic material named silicon and try to ascertain the adequate doses of protamine sulfate necessary to

neutralize the heparin in the blood of the experimental animals.

A number of dogs have also died of ventricular fibrillation. Following the suggestions of Dr. Beck, of Cleveland and Dr. Fauteux, of Montreal, we have been able to overcome this complication mainly by the use of their method of electric shock treatment of the heart.

We had hoped that once we had solved the problem of the safe perfusion of the central nervous system, which we had expected to be the main difficulty in attacking the bloodless heart, we should no longer be faced with any other major problem. This, unfortunately, so far has not proved to be the case, a number of unknown factors concerning the reaction of the heart itself still must be analyzed successively before intracardiac surgery can be fully developed.

To my knowledge this study is in progress at present in five places, i.e., in Philadelphia, in Minneapolis, and in Toronto on this Continent, and in Europe in Holland and in Sweden. One achievement that seems probable in the near future is the study of the metabolism of isolated organs in the living animal. Another is concerned with the possibilities to be anticipated when oxygen can be supplied temporarily by perfusion in order to supplement inadequate oxygenation on the part of the lungs.

I have attempted to set forth the present status of the development of thoracic surgery and have offered some suggestions concerning its further evolution. I have also outlined the evolution of controlled respiration and its significance in thoracic surgery. I hope I may be pardoned for attempting a parallelism between this and the development of what might be termed controlled circulation for I feel sure that here lies the solution of the problem of intracardiac surgery of tomorrow.



# A SIMPLIFIED TREATMENT OF INGROWN TOENAIL

R. W. NEWMAN, M.D., F.A.C.S., Iowa City, Iowa

**I**NGROWN toenail pathologically is a minor lesion, but symptomatically it is a major ailment. The cause commonly is an abnormality, not of the nail but of the soft tissues, of which there is an excessive growth at the end of the nail which obliterates a portion of the nail sulcus in which the lateral edge of the nail normally rests. It results from a combination of faulty trimming of the nails and crowding of the toes in ill fitting footwear. Treatment directed toward the soft tissue overgrowth should logically correct the ailment.

The widespread and commonly accepted treatment of this condition deals with the nail, a small strip of which extending from free end to root is removed with matrix.

The following treatment, dealing with the soft tissue only, corrects the underlying cause, is simple and rapid of performance, and yields prompt and permanent results. It may well be considered an office procedure.

It was first employed on troops aboard ship during maneuvers in preparation for the invasion of Sicily. It has since been used on a large number of patients by the author and his colleagues. The results have been uniformly satisfactory. Its object is to re-establish and maintain the nail sulcus and thus to provide the nail an open channel along which its growth may proceed unobstructed. This involves an incision through the soft tissues under novocain anesthesia and the application of a small metal plate with an under turned edge. An extensive inflammatory reaction should be cleared up by frequent hot soaks previous to surgery. The procedure is carried out without hesitancy in the presence of chronic well localized infection. The plate provides excellent drainage.

## THE OPERATION

The toe is prepared for surgery by the liberal use of soap and water, alcohol and an antiseptic such as tincture of zephiran or mercuriolate. A small quantity of novocain is in-

jected directly into the swollen prominent soft tissue over the tip of the ingrown portion of the nail at the end of the toe (Fig. 1, A). This is injected rapidly and under sufficient pressure to insure immediate anesthesia and provide absolute hemostasis. An incision is then made directly down through the overgrown soft tissues in line with and about the depth of the nail sulcus, revealing the lateral margin and the ingrown tip of the nail (Fig. 1, B). The nail plate (Fig. 1, C) is now put in place by first engaging the narrow, under-turned margin beneath the ingrown tip of the nail and then gently forcing the plate proximally on the nail (Fig. 1, D and E). It is not necessary to push the plate beyond the eponychium, for there is sufficient lateral nail margin remaining distal to this point (Fig. 1, B) to hold the plate securely. The free or distal end of the plate is allowed to project beyond the soft tissue at the site of the incision. This insures the formation of a normal nail sulcus along which the nail will eventually grow. The plate is held in place by two narrow pieces of adhesive tape (Fig. 1, F). It is essential that the tape be merely laid on, care being exercised not to subject the swollen soft tissue flap adjacent to the plate to undue pressure. A sterile piece of gauze is then applied and secured with narrow bandage and tape.

This entire procedure can be carried out in several minutes and well within the period of hemostasis afforded by the pressure injection of the novocain.

The patient is permitted to bear weight immediately. The toe ordinarily remains sore for 2 to 3 days. At the end of this time the patient may be expected to become normally active. If appreciable soreness persists beyond 3 days, the plate should be carefully inspected. It may become slightly displaced and cause undue pressure on the sensitive nail fold adjoining the eponychium. Care in properly placing the plate and the tape at the time the operation is performed will avoid this complication.

The first plates to be used were cut from a grapefruit juice can. There was slight reaction between the plate and open wound as manifested by the formation of a dark brown deposit on the plate and the nail. This apparently interfered in no way with the healing of the wound. Plates of lightweight duraluminum were next used. These were quite satisfactory and caused almost no reaction. At the present time plates of stainless steel are employed and these are recommended. They are entirely inert in tissues. A stock of these, cut to 3 sizes, are kept on hand. Before preparing the toe for surgery, the plate nearest the size desired is selected and trimmed to the exact dimensions required, and then placed in an antiseptic solution preparatory for use. It is so cut that the free or distal end runs from the tip which is to project beyond soft tissue at the nail sulcus obliquely back or proximally at an angle of about 60 degrees (Fig 1, C). This allows a portion of the distal end of the nail to remain exposed. A small area of the nail opposite the side involved is likewise left uncovered (Fig 1, F). This serves for simplicity in securing the plate with tape and in keeping the area clean.

#### AFTER CARE

The outer gauze dressing should be changed on the third day. The toe is cleaned and a small piece of sterile gauze applied. The tape holding the plate in place is not disturbed. The patient is then instructed to keep the toe clean and to change the outer gauze dressing only when needed. If the tape holding the plate is loosened, fresh tape is placed over it without disturbing the plate. It is desirable to leave the plate in place until the nail has grown out to the distal end of its sulcus. However, after 3 weeks the plate may be removed and replaced with ease and without pain. The

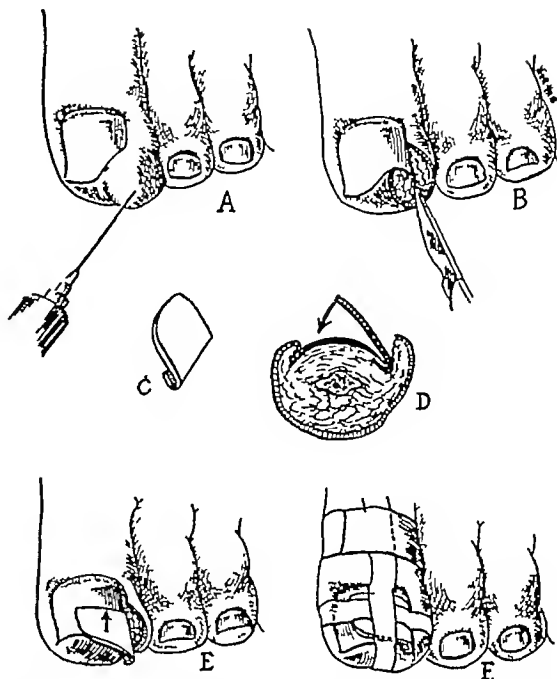


Fig 1 A, Novocain injected under pressure. B, Incision of swollen, overgrown soft tissue along line of nail sulcus exposing ingrown portion of nail. C, Nail plate made of light weight stainless steel. D, Cross sectional view of E. E, Nail plate being put in place. F, Operation completed with plate and tape properly placed. Note the relative size of plate and nail. The 60 degree angled corner of this plate projects beyond the soft tissue of the sulcus.

wound by this time has healed and is covered with healthy epithelium. Once the nail has grown out the desired length, the patient is instructed to cut the nail straight across and warned never to trim it back proximally in the sulcus, for this certainly invites the recurrence of the ailment.

If both sides of the same toe are involved, it is advisable to use two small plates. To obtain an accurate fit by use of one plate with both sides turned is too difficult to justify its use.

# THE PRODUCTION AND PREVENTION OF THROMBOSIS AND EMBOLISM

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**A**N experimental study on the subject of the production and prevention of experimental thrombosis and pulmonary embolism was published by one of us (Mason) in 1924 (1). In that report the author included the following data and conclusions: "Intravascular coagulation (thrombosis) was produced by the intravenous administration of the saline extract of dried lung tissue. All injections, in rabbits, were made in the marginal ear vein. It was observed that 1 to 3 minims of the salt extract was sufficient to kill a rabbit in 20 to 30 seconds. Emboli were produced by isolating the external jugular in dogs and occluding the vessel centrally. Tissue extract, generally about 1 cubic centimeter, was injected into the occluded vessel. After about 30 seconds the central occlusion was released and the firm clot (thrombus) was allowed to pass into the circulation."

It was also demonstrated that thrombosis and embolism, resulting from the injection of tissue extract, could be prevented by administering a definite amount of anticoagulant (heparin). By the use of shed blood to standardize the anticoagulant against the coagulant, it was observed that 0.0005 to 0.001 gram of anticoagulant would protect against 0.1 cubic centimeter of lung tissue extract added to the shed blood. "Figuring on this basis the anticoagulant was used for the protection against intravascular coagulation and we found that 0.003 gram of the anticoagulant was always sufficient to protect against 0.3 cubic centimeter of coagulant. Without such protection the rabbits died in 20 to 30 seconds, but, with the protection, the 0.3 cubic centimeter of tissue extract was injected without the least apparent harm to the rabbits." When the anticoagulant was tested on dogs it was found that the administration of 0.001 gram

per pound of body weight was sufficient to change coagulation time from 4 to 10 minutes and such delayed coagulation was maintained for approximately 2 hours. A record of blood pressure and respiration taken during the administration demonstrated no change even when the injection was increased to 0.003 gram per pound of body weight.

The possibility of using heparin to prevent clinical thrombus and embolism was repeatedly emphasized by the author. The following statement was included: "Considering that clinical thrombosis and embolism are, to a certain degree, comparable to experimental thrombosis and embolism, I have suggested that the preparation be put up in 1 cubic centimeter ampules containing 0.100 gram. However, it has been found more satisfactory to put it up in 2 cubic centimeter ampules dissolved in physiological salt solution and sterilized by saturating with boric acid and 0.5 per cent chlorotone." Convinced that heparin as a clinical agent could inhibit intravascular coagulation, the author extended his observations to include human subjects. His results and conclusions are to be found in "A Note on the Use of Heparin in Blood Transfusion" 1924 (2). "Before such clinical application could be made, it was necessary to (1) develop a sterile product, (2) determine the toxicity for the human, (3) determine the dose necessary to give the desired delay in coagulation and (4) the length of duration of its action." These problems were solved and heparin was used in 33 transfusions. Since 1924 volumes have been written on the use of heparin in the prevention of thrombosis and embolism, however the chief contribution has been the production of heparin with greater purity and potency.

## EXPERIMENTAL

The following study was undertaken with the desire to analyze and illustrate the mech-

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anism of the production and prevention of thrombosis and embolism

A simple artificial circulatory system was set up (Fig 1), consisting of a Mariot flask (A) as a reservoir, a glass tube equipped with a side arm (B) and a stopcock (C). The entire system was filled with freshly heparinized blood and the side arm packed with a wick through which controlled amounts of tissue extract were added. The blood was continuously circulated through the system for a period of nearly 2 hours, the rate of flow being regulated by the stopcock.

Analysis of the illustrated results demonstrates the following (1) the function of tissue extract in the production of thrombus formation and resulting embolus, (2) the antagonistic action of heparin and tissue extract, (3) the effect of the streaming action of the blood (hemodynamics) on the structure of intravascular clots.

*The function of tissue extract in the production of thrombus formation and resulting embolus* Thrombus formation is initiated at the base of the side arm where the circulating blood comes in contact with the tissue extract and growth of the thrombus is mainly in the direction of blood flow. Whether or not a clot forms at the point where the tissue extract is introduced depends largely upon the rate of blood flow and also upon the rate at which the tissue extract is introduced. If the rate of

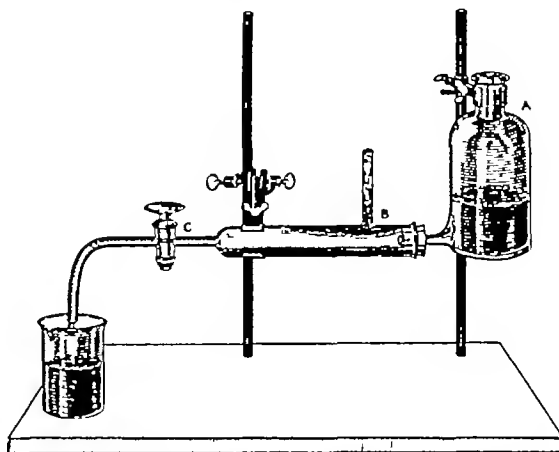


Fig 1 Apparatus for a simple artificial circulatory system

blood flow is slow, allowing the blood to stagnate, the introduction of a small amount of tissue extract will produce a clot, but if the blood volume flow is great the chances for clot formation, at the point of tissue extract administration, may be very slight even though a large amount of tissue extract be introduced.

Frequently during the course of this experiment there may occur a sudden marked slowing or stoppage of circulation due to a portion of the detached thrombus becoming lodged in the bore of the stopcock. The analogy to clinical embolism is thereby demonstrated.

*The antagonistic action of heparin and tissue extract* The exact mechanism of heparin ac-

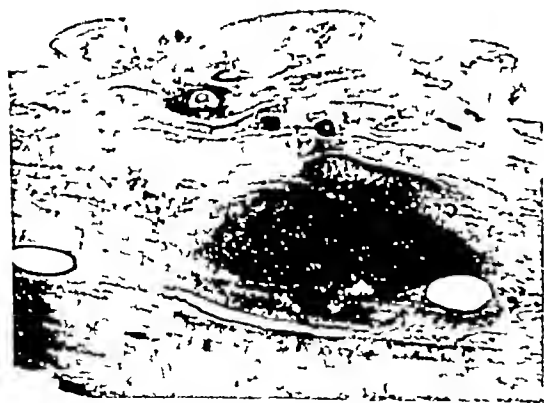


Fig 2 Upper surface of longitudinal section of thrombus originally in contact with glass tube, shows result of very rapid coagulation as evidenced by convolutions and eddies related to turbulent flow



Fig 3 Another section which was selected from a region of clot where stream line flow had been established demonstrates the fact that clot is laid down in definite parallel layers

tion, in the prevention of blood coagulation, has been the subject of much research and discussion. The anticoagulant action has been attributed to its being one or more of the following: (1) a powerful antithrombin, (2) an antiprothrombin, and (3) an antithromboplastin. Probably, under selected conditions, heparin may demonstrate each of the three actions, however, the clinical use of heparin, in the prevention and treatment of thrombosis, owes its value to its power to neutralize thromboplastin (tissue extract). In our artificial circulating system we have demonstrated that the anticoagulant action of heparin may be counteracted by the antagonistic action of tissue extract.

*Effect of the streaming action of the blood (hemodynamics) on the structure of intravascular clots.* Histological examination of an extravascular blood clot, resulting when shed blood is allowed to coagulate in paraffin tubes, reveals a uniform mass of red cells with about the usual number of leucocytes scattered diffusely. There are occasional small, light staining, homogenous areas which suggest collections of platelets and fibrin. In contrast to this, microscopic examination of the intravascular clot reveals an entirely different picture. The intravascular clot usually presents a laminated appearance, some layers being essentially platelets and fibrin alternated with layers of leucocytes and red blood cells enmeshed in fibrin.

The difference in the structure of intravascular and extravascular clots has prompted several observers to conclude that the factors active in intravascular coagulation are quite different from those in extravascular coagulation. We are of the opinion that the principles concerned are the same except for the single mechanical factor of the streaming movement of the blood. The blood passing through the blood vessels encounters resistance due to the friction of moving against the vessels' walls, therefore, the rate of blood flow is different at different points across the diameter of the stream. The external layer of fluid, in contact with the vessel wall, moves very slowly compared with the central portion of the

stream (axial stream). This unequal rate of cross section flow causes an unequal distribution of the formed elements of the blood so that the heaviest (red blood cells) are concentrated in the axial stream and the lighter elements (white blood cells and platelets) are concentrated along the vessel wall. This brings into prominence the preliminary agglutination of platelets and white cell distribution in intravascular coagulation.

Histological preparation of the clot and photomicrographs were made by Professor J. M. Thuringer of the Department of Histology. The clot within the artificial circulatory system was fixed *in situ* and carefully removed, sectioned, and slides prepared for microscopic examination. Figure 2 shows the structure of a longitudinal section of the thrombus taken from the region of the side arm of the apparatus. The upper surface of this section, originally in contact with the glass tube, demonstrates the result of very rapid coagulation as evidenced by the convolutions and eddies related to turbulent flow.

In another section (Fig. 3) selected from a region of the clot where stream line flow had been established, it will be observed that the clot is laid down in definite parallel layers.

#### CONCLUSIONS

1. Tissue extract is the most potent agent in producing thrombosis and resulting embolism.

2. Whether or not an intravascular clot forms at the point where tissue extract is introduced depends largely upon the rate of blood flow and also upon the rate at which the tissue extract is introduced.

3. The clinical value of heparin in the prevention of thrombosis and embolism is due to its capacity to neutralize thromboplastin (tissue extract).

4. The principles concerned in extravascular coagulation and intravascular coagulation are the same except for the single mechanical factor of the streaming movement of the blood.

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# EDITORIALS

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NOVEMBER, 1949

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### FRACTURES OF THE LONG BONES

THE management of fractures of the long bones is as old as surgery itself. Methods of splinting fractures were recorded in the earliest Egyptian writings and in the Bible, and Hippocrates devoted an entire chapter to "Fractures." In those ancient times the principles of immobilization and traction were applied, and were reasonably well understood, and occasionally various rather crude forms of internal fixation were used for the grossly displaced compound fractures of long bones. Only since the latter part of the 19th century, however, when Lister published his monumental work on asepsis and antiseptics, have surgeons been bold enough to treat closed fractures by operative means. During the past 30 or 35 years, fracture management has become a very specialized part of surgery. It is still a fact that the great majority of long bone fractures can be properly treated by manipulation and splinting, or by traction, and some surgeons are content so

long as they can restore length, and maintain reasonably good alignment of the bones. Since Roentgen's discovery of the x-ray, however, many surgeons have striven to restore perfectly the normal anatomy, and, if necessary, by open operation.

As the operative treatment of fractures has advanced materially in the 20th century, so, also, have methods of traction and plaster fixation. Skeletal traction, with the fine Kirschner wire, displaces very little bone, and is most effective when heavy pull is needed, or when the patient's skin will not tolerate adhesive for as long as is necessary to stabilize the fracture. Russell's traction employs the resultant of two forces, thus doubling the amount of pull of the weight applied, and is useful in realigning femoral shaft fractures. Many substitutes for plaster of Paris have been manufactured, but none is as satisfactory for general use by the average surgeon.

The modern operative approach to fracture treatment dates from the work of Lane, of Guy's Hospital in London, about 50 years ago, and from the enthusiasm of Sherman, of Pittsburgh, after World War I. Both of these surgeons advocated early operative reduction of long bone fractures. The metals they used frequently caused reaction of tissues and had to be removed, so that Sherman later abandoned his "vanadium steel," in favor of 18-8 S Mo stainless steel, which, with vitallium, is one of the standard materials used today.

The healing process of a fracture, so well illustrated by a motion picture recently produced by the American College of Surgeons' Committee on Fractures and Other Traumas, begins as soon as the bone is broken, and any delay in treatment postpones healing. There-

fore, the broken bone should be realigned as soon as possible. This is particularly true if open reduction is to be done. The hematoma about the fracture site serves a very definite function, and the less it is disturbed, the better. The earlier the fracture is manipulated, or placed in traction, the easier it is to reduce, and, once open reduction is deemed necessary, the only excuse for delay is an unfavorable condition of the local tissues or of the patient.

The reaction of tissues to metal is no longer a problem, now that 18-8 S Mo stainless steel and vitallium are available. In addition to internal fixation with plates and screws, other forms of metal fixation of long bones have been advocated during the last decade. Prior to World War II the Kuntscher rod became popular in Europe, and was extensively used during the war. It has a place in our armamentarium, but rapidly accumulating experience, particularly in America, seems to indicate that its use should be confined to the femur, and that it may be of very great assistance in stabilizing painful, pathological fractures. External skeletal fixation has lost some of its prewar favor, because of its indiscriminate use by inexperienced surgeons who failed to understand both the fundamental principles of application of the apparatus and of bone healing.

The management of compound fractures received great stimulus during the war, as a result of delayed closure of wounds and the extensive use of antibiotics. The tremendous importance of obtaining a closed wound by means of relaxing incisions, plastic skin flaps, or by skin graft, is being appreciated more and more, not only to prevent draining sinuses and osteomyelitis, but also to speed bone healing, by encouraging revascularization of the osseous fragments.

The vast majority of long bone fractures will heal, if given the opportunity and can, as in the past, be effectively treated by manipu-

lation and splinting, or traction, but without question certain fractures *must be* openly reduced, and secured, while others *can be better* treated by operation than by closed methods. Broadly speaking, the following fractures should be treated by operation: (1) joint fractures, in which there is gross misalignment of articular surfaces, (2) shaft fractures near a joint, where traction or manipulation will not realign the fragments satisfactorily and prevent ultimate deformity of the joint, particularly a weight-bearing joint, (3) fractures with gross interposition of soft tissues, (4) fractures with a large interposed third fragment, holding the main fragments apart, (5) fractures with shortening, which cannot be corrected by traction, (6) fractures of the femoral neck.

Finally, the decision to operate upon a fracture depends very much upon the surgeon himself. Does he have the proper tools? Is he operating in the proper surroundings? Does he have adequate assistance? Most important of all, is he qualified by training, experience, and ability to do the operation at hand? If these requisites cannot be fulfilled then the fracture had better be treated by closed methods.

EDWIN F. CAVE

## FRACTURES INVOLVING THE HAND, AND THE "POSITION OF FUNCTION"

THE loss of function that so often follows a crushing injury of the hand which is complicated by multiple fractures of carpals, metacarpals and phalanges is too well known to need comment as to its seriousness or importance. Whether because to many men the word "fracture" immediately suggests extension or whether because we have become "pin-and-gadget conscious" one at times cannot escape the impression that we are ignoring basic principles

of fracture treatment and surgical treatment, and thereby vitiating our results

The simple principles of fracture treatment—reduction, immobilization, and immobilization in such a position that there is a minimum of pull on the fractured fragments are as completely applicable to fractures involving the hand as to fractures in any other part of the body. Fortunately, too, the position in which there is a minimum of tension on the fractured fragments almost invariably coincides with the position of function, the position in which the hand is placed if it were to grasp a ball—fingers semiflexed, thumb semiflexed, abducted and facing the fingers, hand in dorsal flexion at the wrist and midway between pronation and supination.

If one simply lets his hand relax on the desk or on the arm of his chair it automatically falls into a position closely resembling the position of function because it is also the position of rest, and one which represents a balance between the muscle pulls exerted upon the bones and joint capsules that make up the framework of the hand. If by contrast one holds his fingers for a few moments in complete extension he quickly realizes that this is not the position of rest but one of tension, and if this position is maintained for a number of weeks with the aid of pins, wires and traction from an extension framework, and if at the same time there is extensive exudation into all the soft tissues not only is it difficult to maintain reduction of fractured fragments but the stiffness that quickly develops at the joints of the hand becomes a serious obstacle to the restoration of function.

The exudation of blood and serum that so quickly infiltrates all the soft tissues after a severe crushing injury suggests another principle of surgical treatment that has been long recognized but again is often ignored—the

principle of applying compression to limit exudation into injured tissues. How important this can be in all types of fracture was strikingly emphasized a few years ago by the late Dr A G Davis and Dr C W Fortune.<sup>1</sup>

If one can reduce fractured fragments, immobilize the hand in the position of function and then apply compression to the injured area one is approaching what could be considered the ideal treatment of fractures involving the hand. It was with these principles in mind that Mason and Allen, when confronted with many cases of severe compound injuries of the hand in the Italian Theater of the war, fashioned what they have termed the universal splint, a simple splint hammered out of sheet aluminum and fashioned so as to lie smoothly in the cupped palm of the hand and fingers held in the position of function and over the volar surface of the forearm. By laying the hand with fractured bones reduced upon the splint reduction could be maintained by packing gauze between slightly separated digits, and enveloping gauze covered hand and splint with a compression bandage. Not only was the hand immobilized in the position of function but the much desired compression was secured as well.

After studying the results obtained and reported by Mason and Allen,<sup>2</sup> in a considerable number of cases one cannot escape the conclusion that they have pointed the way to a greatly improved method of treating fractures of the hand and that pins, intramedullary wires and particularly the so-called banjo splint, except in unusual instances, have little place in the treatment of fractures involving the hand.

SUMNER L KOCH

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<sup>2</sup>Allen H S and Mason M L Q Bull Northwest Univ M School 1947 21 738

Mason M L and Allen H S Surg Clin N America Feb 1949 p 15





IRVIN ABELL  
1876-1949

# MEMOIRS

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DR IRVIN ABELL

THE sudden death of Irvin Abell brought to a close the career of one of the great men of American medicine. The profound grief which followed the announcement of his death and the eulogies of his life and work were evidence of the respect and affection in which he was held by his professional colleagues and by his innumerable friends and patients. Seldom has anyone in any walk of life been accorded the homage given him by the medical profession throughout the entire country, and particularly by the people of Kentucky, the State in which he was born and in which he gained national recognition as a superb surgeon, great administrator and a true humanitarian.

Irvin Abell was known to the profession as a sound clinical surgeon, splendid teacher, and a careful investigator. His logical approach to surgical problems, the clarity of his discussion, the skill with which he performed an operation, and, above all, the consideration he gave to patients and assistants made a visit to his clinic an unforgettable experience. In his desire to know the truth he was a general surgeon in the broadest sense of the term, and by his unusual talents in both the written and spoken word he contributed immeasurably to the part American surgeons played in the dramatic advances of the past fifty years. Because of his extraordinary ability to focus attention on the essentials of any subject, his published works were always instructive. Particularly notable, in the widening horizons of surgery in the early years of this century, were his papers on surgery of the thyroid, the colon, the stomach, duodenum, pancreas, abdominal emergencies and urologic and gynecologic conditions encountered by the general surgeon of his day. In his later years, he turned more often to discussions of the responsibilities of the medical profession to the public, in peace and in war, of medical education, graduate training in surgery, of medicine in industry, and of the influence of pioneers in the profession, particularly in his own state of Kentucky. Scholarly as his writings were, they acquired added luster as he presented them, for he was a most gifted and convincing speaker on every occasion.

As an administrator, Irvin Abell held a unique place in American medicine. In his own medical school at Louisville he organized the surgical teaching, first as Professor of Surgery and later as Clinical Professor, for more than forty years. These responsibilities, together with a busy surgical practice, gave him an insight into problems of teaching and practice which was constantly called upon in the high positions to which he was called in state and national societies and committees. In these activities, his unerring tact, his fairness, and wise counsel were of



# THE SURGEON'S LIBRARY

## REVIEWS OF NEW BOOKS

NEOPLASMS of the intrathoracic part of the esophagus and of the gastric cardia have been among the last to resist surgical attack. Real progress in the development of surgical techniques for the removal of malignant processes involving these organs has been made only in the last 10 years. In *Cancer of the Esophagus and Gastric Cardia*<sup>1</sup> Dr. George T. Pack has collected the experience and opinions, gained during this period of development, of a number of surgeons who have had an extensive experience with the surgical procedures involved. Among the authors included in this volume, Sweet and Garlock deserve particular credit because they have contributed so much to the development of this field of surgery. This book provides those interested in the surgical management of lesions of the esophagus and cardia a valuable opportunity to review the problems involved in the surgical treatment of these lesions and to compare the techniques and results of operation of a number of different surgeons who have had wide experience in this field.

All the authors of the various papers in this volume give well deserved credit to the progress in anesthesia that has made possible the operative procedures involved in the treatment of carcinoma of the esophagus and gastric cardia. The roentgenologic aspects of the diagnosis of these lesions are well presented. The difficulties in accurate roentgenologic diagnosis of some lesions of the gastric cardia are emphasized. The book includes a splendid chapter on the preoperative and postoperative care of patients who have malignant lesions of the esophagus and cardia. The importance of these measures cannot be overemphasized. It is unfortunate that this volume does not contain a more complete discussion of the endoscopic aspects of lesions of the esophagus and gastric cardia. Esophagoscopy and gastroscopy are indispensable in diagnosing lesions of this region.

It is apparent from a review of the various contributions to the volume that there is still considerable difference of opinion regarding many phases of the operative techniques used in treatment of cancer of the esophagus and gastric cardia. Some of the contributors prefer a preliminary abdominal incision for exploration of lesions of the gastric cardia, others feel that primary transthoracic transdiaphragmatic exploration is to be preferred. Some advocate combined abdominothoracic incisions, others condemn this approach, feeling that a lesion that requires such an incision for its removal probably is inoperable.

anyway. It seems generally agreed that the anastomosis should be accomplished with interrupted silk or cotton sutures throughout. However, there is difference of opinion as to whether the end of the stomach should be closed and the esophagus implanted on its anterior wall or the end of the stomach narrowed and end-to-end anastomosis of the stomach to the esophagus established. Most of the differences in opinion and technique probably are not of fundamental importance. With further experience many of the differences will be resolved.

The mortality rates reported seem reasonable when one considers the age group involved, the physical condition of most patients by the time a diagnosis of the lesion is arrived at, the magnitude of the operation necessary, and the fact that the experience reported covers the period of development of new procedures and techniques. The reported series are not large enough and the condition of the patients involved has not been followed long enough to permit accurate evaluation of prognosis, but the results seem at least to be as good as those which follow operations for carcinoma of the stomach in general.

One cannot read this volume without being impressed by the progress that has been made in this field of surgery during the last decade. Neoplasms of every portion of the esophagus and gastric cardia have become accessible to surgical procedures based on sound principles of surgery for malignant lesions. In this symposium Dr. Pack has brought together, from many sources, a wealth of experiences covering almost all phases of the problems involved in the surgical treatment of carcinoma of the esophagus and gastric cardia. It is a worth-while addition to medical literature.

O. T. CLAGETT

THE volume *The Normal and Pathological Physiology of Pregnancy*<sup>2</sup> is a collection of papers given at a conference of the Committee on Human Reproduction of the National Research Council, January 30 and 31, 1948. The various articles are well written and are of particular interest for obstetricians and those doing research in obstetrics. For the benefit of those who may wish to secure the volume, a brief summary of some of the articles is appended.

In addition to its functions as an organ subserving the catabolic and anabolic growth requirements of

<sup>1</sup>THE NORMAL AND PATHOLOGICAL PHYSIOLOGY OF PREGNANCY. Proceedings of the Conference of the Committee on Human Reproduction of the National Research Council on behalf of the National Committee on Maternal Health held in New York City, January, 1948. Reprinted from *Obstetrical and Gynecological Survey*, Vol. 3, No. 5, October 1948. Baltimore: The Williams & Wilkins Co., 1948.

<sup>1</sup>CANCER OF THE ESOPHAGUS AND GASTRIC CARDIA. Edited by George T. Pack, B. S., M. D. St. Louis: The C. V. Mosby Co., 1949.

the fetus, the placenta is an endocrine organ which appears to synthesize and secrete several hormones. During toxemia, there are definite objective evidences for dysfunction of the placenta, in regard to the elaboration of both enzymes and hormones, and its capacities for transmission. Such dysfunction appears to be associated with and probably caused by the diffuse trophoblast injury.

Dilation of the cervix is associated with a gradient of diminishing physiological activity from the fundus to the lower uterine segment. Deviation from this pattern is associated with prolongation of labor or prevention of dilation. The physiological basis of this gradient of activity is discussed with respect to the tissue tensions in fundus and lower uterine segment respectively, in the fundus the tension exceeds that in the cervix by about 3 x.

The precipitable iodine of the serum rises sharply at the onset of pregnancy from the normal concentration of 4 to 8  $\gamma$  per cent to concentrations between 6 and 10  $\gamma$  per cent, and remains at these levels until delivery, after which it rapidly returns to the normal range. No evidence has been found in a limited number of observations that serum precipitable iodine is abnormal in women with infertility or suffering from toxemias of pregnancy.

The study of the excretion of urinary metabolites of the ovarian, placental, and adrenal hormones has thrown considerable light on the interrelationship of the various endocrine glands in pregnancy.

EDWARD L. CORNELL

THE fourth edition of Doctor Partipilo's book<sup>1</sup> on surgical technique represents a complete revision of his previous fine textbook. In his preface the author states that "endeavor has been made to include in each chapter a review of surgical anatomy and a discussion of pertinent pathologic, physiologic, and clinical aspects of each subject. Complete chapters were devoted to consideration of the physiologic basis for the treatment of peptic ulcers, duodenal obstruction, intestinal obstruction, peritonitis, diseases of the gall bladder and extrahepatic bile ducts, diseases of the pancreas, thoracic diseases, diseases of the peripheral vascular system, and diseases of the colon and rectum."

The general principles of operative surgery are discussed in an interesting manner, and the technical steps of each operative procedure are described in detail and are illustrated by exceptionally fine line drawings by W. C. Shepard and Hooker Goodwin. There are 547 figures containing 997 illustrations accompanying the text. Each chapter ends with a brief bibliography and a list of questions for the student.

In a book of this scope and size, there is, it seems to me, too much space devoted to a procedure which has the limited application that gastrotomy has and a disproportionately large emphasis placed on duo-

denal obstruction. The book as a whole would have gained had those chapters been reduced for the more complete presentation of surgical principles in thoracic disease, but it is a book that can be recommended highly to the medical student, surgical resident, and general surgeon.

W. D. SEYBOLD

IN Dr. Quiring's *Collateral Circulation*,<sup>2</sup> there is presented an unusually convenient and concise account of the major arterial and venous channels, which offer possible bypaths for the circulation in cases of occlusion.

With excellent selective judgment, the author has taken examples from an abundant literature and has arranged them on a regional basis, he has portrayed, in 61 simple, diagrammatic figures, the circuitous routes by which blood passes through the newly enlarged, initially subsidiary, channels.

Following an introductory review of the embryonic, or primordial, capillary beds from which adult arteries and veins are selectively derived, Dr. Quiring discusses, in succession, the dynamics and associated features of collateral connections, chief vascular patterns, and the anastomoses which occur in the head, neck, trunk, heart, and extremities. Each complex region is exhaustively handled, to offer details of circulatory anatomy, for example, the orbit, the eyelids, the tonsils, the suprarenal glands and kidneys, the cardiac wall, the ear and temporal bone, the uterus and vagina, are treated from the standpoints of vascular requirement and plexiform source.

Dr. Quiring corrects the fallacious notion held by many modern writers, that all important anatomic and medicosurgical knowledge is a possession of recent acquisition; he pays tribute to the important contributions of Aristotle, Celsus, Galen, Vesalius, Paré, Harvey, and Hunter, their observations are placed appropriately with those of recent times.

The volume closes with a useful bibliography of almost 100 items. Altogether, this small book of 142 pages will be a most serviceable addition to the practitioner's library. It will also be an illuminating element among the textbooks assignable for students' use in the medical courses, being a dependable summary of many separate treatises, it presents fundamental information to the beginner at the time when correlation between current laboratory observation and prospective practice is most effectively established.

BARRY ANSON

THE book *Clinical Aspects and Treatment of Surgical Infections*,<sup>3</sup> a companion volume to his *Treatise on Surgical Infections*, deals in the broadest fashion with infections as seen by the surgeon. The management of surgical infections is not simply a

<sup>2</sup>COLLATERAL CIRCULATION (ANATOMICAL ASPECTS) By Daniel P. Quiring, Ph.D. Illustrated by Margaret Holman. Anatomy Division, Cleveland Clinic Foundation. Philadelphia: Lea & Febiger, 1949.

<sup>3</sup>CLINICAL ASPECTS AND TREATMENT OF SURGICAL INFECTIONS. By Frank Lamont Melency M.D., F.A.C.S. Foreword by Allen O. Whipple M.D. Philadelphia and London: W. B. Saunders Co., 1949.

<sup>1</sup>SURGICAL TECHNIQUE AND PRINCIPLES OF OPERATIVE SURGERY. By A. V. Partipilo M.D., F.A.C.S. Foreword by Alton Ochsner, M.D., F.A.C.S. 4th rev. ed. Philadelphia: Lea & Febiger, 1949.

matter of administering the proper chemotherapeutic or antibiotic drugs. Under many circumstances these drugs are of no value. In the majority of instances the drugs are simply adjuvants to other surgical measures, while in but few cases will drugs alone suffice. This broad concept of the surgical infection places the book at once among the classics in surgery. While the search for specific drugs and other specific agents does not cease and the rewards have been high, Dr. Meleney recognizes the fact that the surgeon cannot depend on drugs alone in his fight against infection. The surgeon is interested not only in the causative organism but also in those other factors which lead to the development of infections. He realizes that bacteria alone do not necessarily lead to infection. Bacteria are often simply fortuitous occupants of tissues or organs, and their growth and elaboration of toxins but a complication of some underlying pathologic process. The surgeon who would deal intelligently with these surgical entities or complications must be able to assess the significance of the various elements which enter into them.

Following an introductory chapter on the physiologic aspects of surgical infections by John S. Lockwood, Dr. Meleney covers the whole field of surgery by systems and regions. Each entity is first discussed from the standpoint of pathogenesis, upon which obviously logical therapy is based. Following adequate presentation of pathogenesis there follow bacteriologic observations and symptoms, signs, and treatment. Each part separately and the whole are presented with the thoroughness of a textbook of surgery, so that the student as well as the practicing surgeon is given a complete picture. Each section is followed by illustrative cases to bring out certain elements in signs, symptoms, or care, and each case is succinctly epitomized.

It would be difficult to select one chapter as more thoroughly presented than another. Meleney is perhaps best known for his pioneer contribution in bacterial synergistic gangrene, and although the chapter dealing with infections of the skin and subcutaneous tissues which contains the discussion of this entity is most excellent, all other chapters are equally thorough. One could scarcely find anywhere an equal to the chapter on appendicitis.

The chapter on peritonitis has been contributed by Harold D. Harvey, and a final chapter on war wounds has been prepared by Alfred B. Longacre and William R. Sandusky.

The book will be invaluable to both student and practitioner, and its comprehensive presentation and extensive bibliographic references will recommend it to the teacher.

MICHAEL L. MASON

THE book *Neurovegetativus*<sup>1</sup> is an accumulation of general information concerning the physiology and therapeutics of the neurovegetative system. It is a result of 20 years experience and study in various European universities.

<sup>1</sup>NEUROVEGETATIVO. By Estanislao Lluerna Uranga. Buenos Aires, Argentina. Lopez & Etchegoyen, 1948.

It is most comprehensive and is divided into 6 parts, the true perspective of the vegetative system, the extrinsic constants, diagnostic neurovegetative methods, the vegetative pathology, therapeutics and operative techniques. It is a practical book and appears to be designed to contain all the general subjects of medicine with a neurologist's and neurosurgeon's background.

The author presents his observations in temperamental vegetativism and neurovegetative effects in stomach ulcers, in appendicitis, in cancer, the emotional and psychovegetation response in trauma whether psychic or somatic, the neurovegetative attitude in relation to surgical prognosis. He narrates the results of his experimental studies concerning the physiopathology of peripheral vascular diseases, plethysmographic tracings, the vascular nutrition of the myocardium, the electric excitation of the vagi in the neck, stimulation provoked by ergotoxins and the physiopathology of the sinocarotid reflex.

The book has an exceptional comprehensive bibliography and is generously illustrated with excellent clear cuts. The last chapter on technique is most worth while from a practical viewpoint. It presents various surgical procedures illustrated in drawings so lucid that a beginner in neurosurgery may follow them with a high degree of confidence. This latter part of the volume is by far the outstanding feature and redeems whatever shortcomings and controversial issues which may be found in the preceding 5 chapters. The approach of the work is entirely different from anything found in the English literature and again for this reason the book is a valued addition to the neurosurgeon's library.

STEPHEN A. ZIEMAN

IN presenting his new text, *Obstetric Analgesia and Anesthesia*,<sup>2</sup> Dr. Snyder's objective is to consider the problem of obstetric pain relief from the fundamental physiologic point of view. He is primarily interested in the effect of pain relieving drugs on the fetus and on the mechanism of labor, and in determining these effects accurately and experimentally. Thus, the entire first section of this book (more than half the text) is devoted to a review of these basic aspects of the problem—fetal respiration, asphyxia and atelectasis, and a laboratory method for assaying the effects of various agents on the fetus and on the labor, etc. And in the consideration of the individual drugs available, which occupies the second and somewhat shorter section of the book, the presentation continually stresses the impact of each agent on the physiology of the fetus and on the course of labor equally with its pharmacologic action in effecting pain relief.

That this is a worthy objective is above dispute. A constant reconsideration of the fundamental physiology involved (in contrast to "Clinical Evaluations") is not only the better approach to medical

<sup>2</sup>OBSTETRIC ANALGESIA AND ANESTHESIA, THEIR EFFECTS UPON LABOR AND THE CHILD. By Franklin F. Snyder, M.D. Philadelphia and London: W. B. Saunders Co., 1949.

problems in general, it is imperative in the field of obstetric pain relief. Two patients of remarkably different environment—the mother and the baby—share each medication, and it is essential to know as accurately as possible the physiology of each of these patients and how it may be modified by the pharmacologic action of the administered drug.

The extent to which Dr. Snyder achieves this objective, however, varies. Certainly it is true that his compendium of information on intrauterine fetal respiratory efforts, on the establishment of initial respirations and on neonatal asphyxia and atelectasis is one of the most complete at present available in medical literature. His own work of the past 2 decades and the observations of others on these and related fields are here gathered together in readily accessible form.

However, it must also be pointed out that in expressing his views with vigor and cogency, the author's emphasis is sometimes partisan. Consider, for example, the total effect of the following 2 sentences: "How frequently the effects of asphyxia at birth are manifest in later life as mental retardation or brain lesions is difficult to prove. In 70 per cent of a group of 900 children in whom brain lesions were evident, Schreiber obtained a history of asphyxia at the time of birth." Each of these sentences is true, yet the impact of the paragraph on the reader is quite different than it would have been had the author, in his second sentence, quoted the work of McPhail and Hall (1941), for example, rather than selecting Schreiber's work. The true fact selected for presentation weights the final effect by its emphasis.

Also under the heading of emphasis it should be noted that morphine and scopolamine, alone or in combination, occupy 55 pages of text, while low spinal and continuous spinal anesthesia are covered in 5½ pages. Rectal ether, magnesium sulfate, and avertin and paraldehyde receive 24 pages and chloroform has a 12 page chapter, on the other hand, all caudal anesthesia, both continuous and intermittent, is covered in 14 pages. This distribution of text reflects to a great extent the author's interest and own experimental work more than it indicates the frequency of use of these forms of analgesia or anesthesia in practice.

Nevertheless, as a source book of fundamental information on fetal and neonatal respirations—normally and as influenced by drugs—this book has a definite place. The author has appended an excellent summary to each chapter which considerably enhances the book's value. ALLAN C. BARNES

**D**URING the recent World War II considerable momentum was given to the development of civilian blood banks as a measure for national defense. Prior to this time transfusion services had evolved by trial and error methods, the medical literature containing the experiences of many individuals along these lines. To facilitate expansion of blood transfusion facilities during those busy days the office of civilian defense authorized the publication of a

manual or handbook on organization and operation of such a hospital service. Because certain inadequacies were present in this working outline and due to the crystallization of further experiences in the field, the coauthors (E. L. D. and J. A. B.) collaborated with a third (R. C. H.) to produce the present comprehensive volume *Blood Transfusion*.<sup>1</sup> They have chosen to cover the entire field of blood transfusion rather than to limit themselves to either whole blood or any of its fractions, although obvious emphasis has been given to whole blood.

The text is written not only for the medical student and physician but also for the laboratory technician upon whose shoulders falls a considerable responsibility for successful blood bank operation. The scope and contents can best be appreciated by an outline of the 9 major sections which consists of (1) historical perspective, (2) clinical usage, (3) immunology of blood, (4) technical section, (5) transfusion of whole blood, (6) preparation and administration of plasma, (7) blood derivatives and plasma substitutes, (8) operation of hospital blood bank, (9) transfusion apparatus.

While the titles speak for themselves, the technical section should be given some special comment. It is well organized and sufficiently clear for handy reference. In many instances the procedures have been illustrated in such a way that the margins of the page constitute a series of flow diagrams. The authors have added the important factor of visual aid in obtaining clarity of sequence in the laboratory testing. This will be appreciated by the technician or house officer who is learning the procedure for the first time. Each section ends with a liberal though not cumbersome bibliography. It is appreciated that many hundreds of papers have filtered into the literature on various aspects of blood transfusion, some of which contain time tested information. These have been appended and add to the value of the chapters.

In criticism one feels that the volume contains some degree of repetition. This may be unavoidable due to the complete consideration of the various blood fractions according to a similar outline of inquiry. This, of course, makes each section sufficiently complete to obviate the need for further cross reference in using the text as a source book. Although the authors have stated their fear that any first edition will usually fail to include some unrecorded worth-while information, the book seems to be quite complete. In addition, the authors have reported their own extensive experience in a clear manner. The volume should be of definite practical value. WALTER W. CARROLL.

**T**HE work, *Diseases of the Nose and Throat, a Textbook for Students and Practitioners*<sup>2</sup> originally

<sup>1</sup>BLOOD TRANSFUSION. By Elmer L. DeGowin, M.D., Robert C. Hardin, M.D. and John B. Alsever, M.D. Philadelphia and London: W. B. Saunders Co., 1949.

<sup>2</sup>DISEASES OF THE NOSE AND THROAT, A TEXTBOOK FOR STUDENTS AND PRACTITIONERS. By Sir St. Clair Thomson, M.D., and V. E. Negus, M.S. 5th ed. New York: Appleton-Century-Crofts, Inc., 1949.

## REVIEWS OF NEW BOOKS

published by Britain's leading rhinolaryngologist in 1911, was at his request completely revised by Mr Negus in 1937 in order, as Sir St Clair stated, that it "should not fail in modernity."

Many of the old figures have been discarded, and the new plates, especially color pictures of laryngeal and esophageal conditions, are brilliantly accurate. The text is carefully subdivided and thoroughly indexed, and references to authors, especially American, follow each chapter.

Mr Negus has rewritten the chapters on malignancies of the nasopharynx and larynx, on treatment by sulfonamides and penicillin, radiotherapy and vitamins, on allergy, and on nasal physiology. Operative procedures are detailed in the appropriate sections, including peroral endoscopy. A section on inflammatory diseases of the lung has been added, and excellent discussion of the diagnosis and management of bronchogenic malignancy is given.

A formulary based on the British pharmacopoeia follows the text. This is a complete and thorough work of reference for the specialist in rhinology and laryngology, and a most valuable aid for beginners in this complicated and difficult field, it reflects great credit on the present editor, who is an internationally acknowledged authority. **RALPH A. FENTON**

THE volume *The Venereal Diseases, a Manual for Practitioners and Students*<sup>1</sup> is well written, informative, and is very easily read. Male and female gonorrhea with its complications are discussed in detail. Sulfonamide therapy is recommended as the treatment of choice in gonorrhea. In cases of failure of treatment, the administration of another sulfonamide is advised. Local irrigations, in addition, are recommended as an adjuvant in treatment. A chapter on penicillin has been added.

Nonspecific urethritis, prostaticitis, and seminal vesiculitis are carefully reviewed. The importance of male and female trichomoniasis is pointed out. Mild anterior urethral strictures causing urethral discharge or a "morning drop" are seemingly uncommon in Britain. The discussion of acute and chronic prostaticitis and abscess formation is adequate. The routine practice of irrigating the urethra before prostatic cultures are taken could be deleted. Reiter's syndrome is well presented but consideration of brilliant cures with intravenous arsenicals has been omitted.

The chapter on syphilis is excellent and complete. Excellent photographs, some in color, have been added. The outlines and suggestions on syphilis therapy are sane and practical. The combined penicillin arsenic-bismuth therapy is strongly recommended.

Chancroids, lymphogranuloma venereum, and granuloma inguinale are mentioned. The potential value of streptomycin in the treatment of some venereal diseases might well have been mentioned.

<sup>1</sup>THE VENEREAL DISEASES, A MANUAL FOR PRACTITIONERS AND STUDENTS. By James Marshall, M.D. B.S., M.P.C.S. L.R.C.P. 2d ed. London: Macmillan & Co. Ltd. 1948.

This volume is a useful reference book in the diagnostic and therapeutic field of venereal diseases. With all the recent social legislation, the author laments the fact that compulsory premarital examination laws have not been enacted in the British Isles. **LEANDER W. RIBA**

THE latest volume on diabetes, *Diabetes and its Treatment*,<sup>2</sup> designed to give the general practitioner a clinical approach to an understanding of the disease and its treatment, is a comprehensive, well written work. The general discussions, as might be expected from a writer who is one of the foremost clinicians especially interested in diabetes, are excellent. This is one of the best available books on the subject. A particular attempt is made to simplify the fundamental, yet often difficult, problem of diet by providing a special section or system of diets, which may be obtained separately by the patient. This section contains no less than 317 diets and daily menus adapted to men and women of varying build, providing 25, 27.5, and 30 calories per kilogram daily as may be needed to maintain their optimal weights. Included also are maintenance diets for children. By means of tables the physician can select the diet he believes appropriate for the individual patient who, given the number of the diet, is able to find it in a special book of diets furnished him. This method of prescribing diets is practical, efficient, and time-saving, and of particular value if the services of a dietitian are not available, it obviously requires that the doctor and his patients possess the author's list of diets and menus. **WALTER H. NADLER**

IN the words of the authors "the central purpose of this treatise is to present the pharmacodynamic and pharmacotherapeutic actions of drugs as they are used in the treatment and cure of disease. The principal emphasis of drug action has been the clinical application, as the text is intended mainly for medical students and the physicians who must use and evaluate drugs in the treatment of the sick." *Pharmacological Principles of Medical Practice*<sup>3</sup> is a medium sized treatise (963 pages) with 94 figures and 72 tables, and written to a considerable extent in the lecturer's style. Considerable attention is given to the historical evolution of pharmacology as a scientific discipline and the book contains portraits of individuals who have made outstanding contributions to pharmacology and therapeutics. The general content is essentially similar to that of other texts in this field although there is some variation from type in the organization of the material. The latter is brought up to date by inclusion of the many drugs of recent interest. The quality of the treatment of subject matter is somewhat uneven, being particularly good in the field of the general anesthetics and vascular agents, but less so in some anesthetic and its treatment. By Joseph H. Barach, M.D. F.A.C.P. New York: Oxford University Press, 1949.

<sup>3</sup>PHARMACOLOGIC PRINCIPLES OF MEDICAL PRACTICE. By John C. Krantz, Jr. and C. Jelleff Carr. Baltimore: The Williams & Wilkins Co., 1949.



of the other fields. On the whole it seems well suited to the audience to which it is directed.

CARL A. DRAGSTEDT

ALMOST a half century has passed since *Human Embryology and Morphology*<sup>1</sup> first took its place among the more pretentious textbooks on human development. Revised and somewhat enlarged, both in descriptions and illustrations, it now reappears as a sixth edition under the same authorship and finds itself competing with no book of equal age and some that comparatively are veritable infants.

Age, in this instance, does not imply obsolescence. This book has always had distinctive qualities that endear it to old friends and appeal to new readers who are broad in background. Rarely does one encounter a text in this or allied fields that makes serious reading so pleasant and profitable a task. Outside of a gifted style in description and exposition, the author has become notable for his insistence on interpreting the events of development in the light of evolution. The continuous correlations with conditions existing in lower vertebrates is a delight even when it verges on the speculative. It contrasts sharply with some modern embryologies that never offer a hint that man shares anything developmentally with other vertebrates, or even with other mammals, and with equal success conceal even those features that are peculiarly anthropoid.

All the praise that is due Sir Arthur does not imply that his book is beyond criticism. Early development is slighted in many regards in contrast to the plenary treatment of the morphogenesis of particular organs, systems, and parts. The illustrations continue to be simple pen drawings, printed on unglazed paper. A few are badly drawn and some others should be replaced with figures based on more typical stages or authentic material, but on the whole the illustrations are more effective than their unambitious style would lead one to expect. The order of treatment is partly regional, partly by organ systems, and not at all by germ layers. This has both advantages and disadvantages, the clarity attained is far better than in some British texts which have adhered strictly to a regional treatment.

Descending to specific details concerning this sixth edition, one finds that the number of chapters has increased from 30 to 32, the number of figures from 535 to 578 and the number of pages from 558 to 690. The valuable "Notes and References" at the end of each chapter have been expanded with citations to recent literature and continue to be enlivened with personal comment. The author states that hardly a page of the text has escaped some degree of amendment, and in his preface he documents some of these alterations. Despite such commendable improvements, this book in its current dress will impress old readers as not greatly changed, either in plan or in substance.

L. B. AREY

HUMAN EMBRYOLOGY AND MORPHOLOGY. By Sir Arthur Keith. (third ed.) Baltimore: The Williams & Wilkins Co. 1945.

THE atlas of 191 colored illustrations, *The Collection of Medical Illustrations*<sup>2</sup> portrays the anatomy and many of the common pathological conditions found in the lungs and heart, the gastrointestinal tract, the male reproductive organs, and the breast. Accompanying many of the illustrations are reproductions of pertinent roentgenograms, and on each page a discussion of the anatomy, of the pathological changes portrayed, of the course of the disease, and brief comments on symptomatology and diagnosis accompany the colored illustration. The textual material has been prepared by a number of distinguished medical men but the text does not indicate the specific contribution of each of the men.

This volume will be of particular value to medical students in helping them to review anatomical studies and to visualize pathological conditions which they are meeting for the first time. It should be of real assistance to teachers in presenting to students accurate and beautiful illustrations of conditions which the student has not yet had the opportunity to see in the laboratory or operating room. It can be of great help to the young surgeon in refreshing his anatomical knowledge and in enlarging his mental concepts of the pathological changes that occur in the viscera depicted.

SUMNER I. KOCH

THE book *Nursing Care of Neurosurgical Patients*<sup>3</sup> is a composite of lectures by the author, is based on years of personal experience in the care of neurosurgical patients. It presents the nursing situations particularly concerned with these patients.

Following a brief review of the essential anatomy, the author discusses clinical signs and symptoms indicative of intracranial pressure. The treatment—both preoperative preparation and postoperative care—and rehabilitation programs peculiar to the neurosurgical patient are clearly and simply presented. Special mention is made of traumatic head injuries, spinal cord tumors, neuralgias, and procedures applicable to neurosurgery, including among others sympathectomy, peripheral nerve surgery, and spinal puncture. The importance of the ability and co-operation of the neurosurgical team in the operating room is emphasized as the author describes a typical craniotomy.

Excellent diagrams throughout the book, including those of surgical setups and special operative instruments, help the reader to utilize the text to the greatest advantage. Pertinent detailed nursing procedures are given in the appendix. The value of the book lies not only in its presentation of basic nursing principles, but also as a reference in neurosurgical surgery. The information in this book should

THE CHINA COLLECTION OF MEDICAL ILLUSTRATIONS: A COMPILATION OF PATHOLOGICAL AND ANATOMICAL PICTURES. By Frank H. Netter, M.D. Summit, New Jersey: China Pharmaceutical Products, Inc. 1945.

NURSING CARE OF NEUROSURGICAL PATIENTS. By Polina M. Klemme, M.D., F.I.C.S., F.A.C.S. Springfield, Illinois: Charles C. Thomas, 1949.

## REVIEWS OF NEW BOOKS

be invaluable to the nurse caring for neurosurgical patients  
KATHERINE T. SMITH.

THE eighty-six page monograph *Posttraumatic Epilepsy*<sup>1</sup> is one of a series of treatises in the neurosurgery division of "American Lectures in Surgery." The author needs no introduction to neurologists in this country or abroad, and he has in this tidy and timely work presented in a simple, direct manner pertinent, up to date information concerning a subject of much importance to many doctors and patients alike. The book is shorn of all unnecessary discussion, and presentation of the subject material is in a modest but entirely adequate manner.

The pathogenesis of posttraumatic epilepsy is clearly and simply demonstrated, and such practical material as the location of the lesion, the extent of cortical involvement, and cerebrovascular instability are discussed in their importance to the symptomatology.

There is an excellent chapter on electroencephalographic manifestations of posttraumatic epilepsy, and surgical procedures are well covered. Apparently the surgical concepts have been written based upon the author's own wide experience. It is reassuring to find that Dr. Walker is conservative in his attitude toward cranioplasty and that undue enthusiasm does not get the better of his sound surgical judgment. There are many good illustrations.

The author has stressed the importance of the counseling of not only patients but relatives as well in the presence of this type of epilepsy, and he points out the necessity of overcoming in the patient's mind the false stigmas which are so unwisely attached in the mind of the laity to the general subject of epilepsy.

This is an excellent book. The author has accomplished in a few pages what previously has, in some instances, required large volumes.

JOHN MARTIN

AN excellent book written by the Drs. Boas<sup>2</sup> for study by medical students and general practitioners. The presentation of the clinical pictures of angina pectoris and myocardial infarction is well done. The description of the sequence of events which may happen to the patient with angina pectoris is particularly graphic. The importance of a good history correlated with physical examination and laboratory procedures is stressed.

The sections on embryology, anatomy, and electrocardiography are rather brief.

The authors have been rather dogmatic about some of the controversial points covered, such as the value of certain drugs in cardiac therapy and the relationship of trauma or strain to coronary thrombosis. Many authorities do not believe that trauma

<sup>1</sup>POSTTRAUMATIC EPILEPSY. By A. Earl Walker M.D. Springfield Illinois: Charles C. Thomas, 1949.  
<sup>2</sup>CORONARY ARTERY DISEASE. By Ernst P. Boas M.D. and Norman F. Boas M.D. Chicago: The Year Book Publishers Inc., 1949.

or sudden stress are a cause of coronary thrombosis as the authors suggest  
CHAUNCEY MAHER.

THE book *Operative Surgery*<sup>3</sup> is a one volume work containing detailed descriptions of the majority of the standard operations of general surgery. The author has attempted to include only material of practical value, and no effort has been made to cover indications for surgery, preoperative diagnosis, or anesthesia. Discussions of surgical pathology, apart from descriptions of the gross appearance of abnormal conditions as seen at the operating table, have been omitted purposely. The bulk of the volume is devoted to abdominal surgery, but there are also chapters on surgery of the skin, mouth, salivary glands, neck, chest and mediastinum, genitourinary system, blood vessels, bones and joints, and the extremities. In addition, chapters on preoperative preparation and postoperative care and a general chapter on instruments, positioning of patients, sutures and knot tying, and other miscellaneous topics, have been included. In general, the technical aspects of the operations included are covered in considerable and adequate detail. The binding, typography, and paper are pleasing and the book has been kept to the reasonable size, including the index, of 698 pages. All the illustrations are new and an adequate number have been included.

The book was written particularly for the younger man in surgery and for house officers. As the author points out in the preface, while there can be no substitute for training and experience, there are principles that can be passed along by the mature surgeon. The method of presentation is somewhat unusual and not displeasing. In each section the more important surgical lesions of the organ or anatomic area being discussed are described briefly. The associated conditions that might be encountered are listed and the bulk of each section is then devoted to detailed descriptions of the operations used to treat the condition in question. In each section there is a short discussion of the preoperative preparation pertaining to the particular organ or operation, and a description of pertinent postoperative care is added.

All references to current periodic literature and virtually all other references have been purposely omitted, as have critical evaluations of the various operations, in most cases. These omissions, along with the author's failure to comment on the hazards and pitfalls of the operations in question, as well as a seemingly studied effort to exclude controversial discussion, leave one with the impression that the technical side of general surgery is without problems or complications and that the field is almost entirely static. In the hands of the less mature surgeon, particularly one with limited training whose knowledge of surgical literature may be limited, the omissions may be serious. However, the author usually indicates his procedure of choice when several operations

<sup>3</sup>OPERATIVE SURGERY. By Frederick C. Hill, B.A., M.S. (Surg.), M.D. Foreword by Charles W. Mayo, B.A., M.S. (Surg.), M.D. New York: Oxford University Press, 1949.

are listed, so that the reader is not entirely without critical guidance. Obviously, also, in the effort to cover the field in a single volume, the author was forced largely to exclude all ancillary material.

The value of such books as *Operative Surgery* cannot be questioned. The gap in surgical writing between the usual textbook of surgery, designed essentially for students, and surgical monographs and the periodic literature prepared by and for mature

surgical specialists, has been great. The usual text book devotes little space to technical considerations, while the assumption is generally made in surgical monographs that most technical aspects are familiar to the reader. Hill's volume fits well into this gap, and, when it is used in conjunction with standard texts and surgical journals, should prove of real value in supplying part of the essential background of a surgeon.

B MARDEN BLACK.

## BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

**THE DIAGNOSIS OF PANCREATIC DISEASE** By Louis Bauman, M D. Foreword by Allen O Whipple. Philadelphia, London, Montreal J B Lippincott Co, 1949.

**EARLY CARCINOMA OF THE UTERINE CERVIX, PATHOGENESIS AND DETECTION** By Hansjakob Wespi, M D. Translation by Marie Schiller, Ph D. Foreword and Survey by Walter Schiller, M D. Rev augmented ed. New York. Grune & Stratton, Inc, 1949.

**CONTRIBUCIÓN AL ESTUDIO Y DIVULGACIÓN DE LA PELVI-METRÍA RADIOLÓGICA CON ESPECIAL REFERENCIA DEL MÉTODO DE SNOW Y LEWIS** By Alejo Fuenmayor Garcia. Buenos Aires. Editorial "P R O C M O", 1949.

**FÜNFZIG JAHRE PATHOLOGIE IN DEUTSCHLAND** By Walther Fischer and Georg B Gruber. Stuttgart. Georg Thieme, 1949.

**DIE WIEDERHERSTELLUNGS CHIRURGIE** By Prof Dr Med Karl-Ewald Herlyn. Stuttgart. Georg Thieme, 1949.

**A DESCRIPTIVE ATLAS OF RADIOGRAPHS, AN AID TO MODERN CLINICAL METHODS** By A P Bertwistle, M B, Ch B, F R C S Ed. 7th rev enl ed. St. Louis. The C V Mosby Co, 1949.

**ATLAS OF OBSTETRIC TECHNIC** By Paul Titus, M D. Illustrations by E M Shackelford. 2d ed. St. Louis. The C V Mosby Co, 1949.

**TOM CULLEN OF BALTIMORE** By Judith Robinson. London, Toronto, New York. Geoffrey Cumberlege, Oxford. University Press, 1949.

**OPERATIONS OF GENERAL SURGERY** By Thomas G Orr, M D. 2d ed. Philadelphia, London. W B Saunders Co, 1949.

**FUNDAMENTALS OF OTOLARYNGOLOGY** By Lawrence R Boies, M D, and associates. Philadelphia, London. W B Saunders Co, 1949.

**THE PHYSICIAN'S BUSINESS, PRACTICAL AND ECONOMIC ASPECTS OF MEDICINE** By George D Wolf, M D. Foreword by Harold Rypins. 3d ed. Philadelphia, London, Montreal. J B Lippincott Co, 1949.

**HEMORRHAGIC DISORDERS, A GUIDE TO DIAGNOSIS AND TREATMENT** By Paul M Aggeler, M D, and S P Lucia, M D. Chicago. The University of Chicago Press, 1949.

**BIOMICROSCOPY OF THE EYE, SLIT LAMP MICROSCOPY OF THE LIVING EYE** By M L Berliner, M D. Vol 2. New York. Paul B Hoeber, Inc, 1949.

**PHYSIOLOGY IN DISEASES OF THE HEART AND LUNGS** By M D Altschule. Cambridge, Mass. Harvard University Press, 1949.

**THE ORIGIN OF MEDICAL TERMS** By Henry Alan Skinner, M B, F R C S (C). Baltimore. The Williams & Wilkins Co, 1949.

**A PRACTICE OF ORTHOPAEDIC SURGERY** By T P Mc-

Murray, C B E, M B, M Ch, F R C S (Edin). 3d ed. Baltimore. The Williams & Wilkins Co, 1949.

**ILLUSTRATIONS OF SURGICAL TREATMENT, INSTRUMENTS AND APPLIANCES** By Eric L Farquharson, M D, F R C S (Ed), F R C S (Eng). Foreword by the late Sir John Fraser. 3d ed. Baltimore. The Williams and sign Wilkins Co, 1949.

**GERMAN-ENGLISH MEDICAL DICTIONARY** Compiled by F S Schoenewald, M D. Philadelphia, Toronto. The Blakiston Co, 1949.

**A COMPANION IN SURGICAL STUDIES** By Ian Aird, Ch M, F R C S. Baltimore. Williams & Wilkins Co, 1949.

**VÁRICES DEL MIEMBRO INFERIOR** By Alberto E Laurence. Buenos Aires. "El Atenco", 1949.

**BLOOD AND PLASMA TRANSFUSIONS** By Max M Struma, M D, Sc D (Med), and John J McGraw, Jr, M D. Philadelphia. F A Davis Co, 1949.

**LIFE AMONG THE DOCTORS** By Paul De Kruf and Rhea De Kruf. New York. Harcourt, Brace & Co, 1949.

**GYNAECOLOGICAL HISTOLOGY** By Josephine Barnes, M A, D M (Oxford), M R C P (London), F R C S (England), M R C O G. New York. Grune & Stratton, 1949.

**OBSTETRICS AND GYNAECOLOGY** By Beatrice M Willmott Dobbie, M A, M B, F R C S, D M R E. New York. Paul B Hoeber, Inc., 1949.

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**INJURIES OF THE BRAIN AND SPINAL CORD AND THEIR COVERINGS, NEURO PSYCHIATRIC, SURGICAL, AND MEDICOLEGAL ASPECTS** Edited by Samuel Brock. 3d ed. Baltimore. The Williams & Wilkins Co, 1949.

**FRACTURES** By Paul B Magnuson, M D, F A C S, and James K Stack, A B, M D, F A C S. 5th ed. Philadelphia, London, Montreal. J B Lippincott Co, 1949.

**HUMAN PATHOLOGY** By Howard T Karsner, M D, LL D. 7th ed. Philadelphia, London, Montreal. J B Lippincott Co, 1949.

**ARTERIAL HYPERTENSION** By Irvine H. Page, M D, and Arthur Curtis Corcoran, M D. 2d ed. Chicago. The Year Book Publishers, Inc, 1949.

**MONGOLISM AND CRETINISM** By Clemens E Benda, M D. New York. Grune & Stratton, 1949.

**UROLOGICAL ASPECTS OF SPINAL CORD INJURIES** By George C Prather, M D. Springfield, Ill. Charles C. Thomas, 1949.

**CHILD OF DESTINY, THE LIFE STORY OF THE FIRST WOMAN DOCTOR** By Ishbel Ross. New York. Harper & Brothers, 1949.

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**SURGERY**  
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## COLLECTIVE REVIEW

### INTERNAL STRANGULATING OBSTRUCTION OF THE BOWEL

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**F**EW more positive indications for surgical intervention exist than intestinal obstruction in which there is a coexistent embarrassment of the blood supply to the obstructed bowel segment. Such obstructions are generally termed as strangulating obstructions to differentiate them from intestinal obstruction of the simple type in which the bowel is obstructed but without any coexistent major impairment of the intestinal blood supply.

Strangulating bowel obstruction is further classified into two types (1) external, in which the cause of the obstruction and the concurrent impairment of the blood supply are apparent by demonstrable external signs, e g, an irreducible mass through an abdominal orifice, and (2) internal, in which the signs of obstruction and circulatory embarrassment is completely concealed within the abdominal parietes. In strangulating obstructions of the external type, little diagnostic difficulty is usually presented, but when the obstruction is of the nature of an internal strangulating lesion, the problem of diagnosis preoperative may be considerable and errors frequent. The subsequent observations are based upon this latter type of strangulating obstruction.

Errors in the diagnosis of strangulating internal obstruction arise from several sources

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- 1 The cause of the obstruction is concealed
- 2 There is no single pathognomonic sign by which the presence of a strangulating internal obstruction can be absolutely identified
- 3 There is a large number of acute surgical lesions of the abdomen with which the condition may be confused

The diagnosis of the condition of internal strangulating obstruction rests, therefore, upon the recognition and evaluation of all of the features presented. It is the belief of the writers that strangulating internal obstruction can, in the great majority of instances, be diagnosed preoperatively if the available diagnostic criteria incident to the lesion are carefully searched for and interpreted. The following features concerned in the diagnosis are presented by the writers in the hope that they may prove of some value to others in the preoperative recognition of the condition.

#### GENERAL CONSIDERATIONS IN PREOPERATIVE DIAGNOSIS

Intestinal obstruction in general has been elsewhere defined as a condition in which there exists, from whatever cause, a cessation, either partial or complete, of the normal forward motion of the intestinal content for a period long enough to produce local and general pathological changes.

- (8) Internal strangulating obstruction, as the term is to be employed here, denotes a condition of obstruction arising from causes not apparent from external examination of the abdomen, in which

there is a coexistent impairment of the mesenteric blood supply to the obstructed bowel segment

The local and general pathological alterations occurring in strangulating internal obstruction arise mainly from two features

1 A cessation of the normal forward motion of the bowel content, from whatever cause, (distention effect)

2 An interference with the mesenteric blood supply to the obstructed bowel segment (circulatory effect)

*Distention effects* The importance of the distention factor in intestinal obstruction of any type is well recognized and has been appropriately stressed in the experimental and clinical literature dealing with the subject, and little reiteration need be made here beyond recalling the essential changes by which distention effects are produced (11, 17, 18, 21, 42)

Whenever the normal forward motion of the bowel content is impaired, from whatever cause, distention of the bowel results from the accumulation of gas and fluid in the obstructed bowel segment. This accumulation produces an increasing intraluminal pressure within the obstructed bowel segment and in the normal bowel above, which serves as a stimulus for the outpouring of the fluid and chloride content of the blood into the bowel. A decrease in the circulating blood volume with consequent dehydration and hemoconcentration thereby occurs which progresses with the distention. If the distention is unrelieved and the depleted fluid and chloride lost from the effective circulation are not replaced, death as a result of the distention factor alone may occur. The urea and fibrinogen levels of the blood are also elevated as a result of the distention.

Besides causing the dehydration and hemoconcentration effect, distention is a prime factor in the production of pain associated with obstruction (2). The bowel is generally insensitive to the ordinary pain-producing stimuli such as cutting, burning, pinching, but under excessive degrees of increased intraluminal pressure produced by distention, pain is invariably present. The pain incident to distention is of a rather characteristic type. It is generally cramplike in nature, undergoing exacerbations periodically with peristalsis. Its intensity is roughly proportional to the amount of distention. It is only diffusely localized in the abdomen, the sensation being felt in the upper area of the abdomen when the proximal segments of the bowel are involved, and in the lower abdominal areas when the obstructive lesion is in the more distal portions of the intestine. When the distention stimulus is decreased or re-

moved by decompression, the pain diminishes or disappears accordingly.

Obstruction distention is also responsible for certain effects (reflex), the exact nature of which are still obscure. Changes in the blood pressure and respiration have been noted experimentally when the various parts of the bowel have been subjected to high degrees of distention (8, 36). The reflex character of these changes has been demonstrated by their abolition by removal or inactivation of the afferent nervous pathways (visceral afferents) which are stimulated by excessive degrees of intraluminal pressure. Perhaps the most significant features of these reflex effects concerned with the distention factor is vomiting which occurs early in certain obstructive cases. It is probable that such vomiting is in part reflex in origin, resulting from stimulation of the splanchnic visceral afferents from the bowel by the increased intraluminal pressure incident to the distention.

While the most significant changes in the circulation to the bowel are produced by lesions involving the vascular radicals of the mesentery, the pressure of distention, if present in a considerable degree, will result in marked alterations in the intraluminal circulation in the distended bowel segment, as evidenced grossly by stasis, venous engorgement, and edema (24, 39).

A schematic summary of the effects of distention just discussed is given below (9).

Specific causal agent producing obstruction—

Stasis of intestinal content—

Distention of intestinal lumen—

Dechlorination—dehydration—elevation of urea and fibrinogen blood levels—hollow viscus pain

Vomiting—change in respiration—blood pressure—intramural circulation of the bowel  
—stasis—edema

The dehydration, pain, and reflex and circulatory changes are found in all cases of intestinal obstruction whether or not the obstruction is simple or strangulating. However, when the latter condition, that of strangulating obstruction, obtains, there are, in addition, further important effects concerned with the circulation in the obstructed bowel segment.

*Circulatory effects* While simple obstruction will produce circulatory changes in the bowel wall by an increase of the intraluminal pressure because of distention from accumulating fluid and gas, these changes are far less extensive and significant than those which occur when the blood supply of the bowel is impaired from lesions involving the vascular radicals of the mesentery. It

should be noted in this connection that much of the experimental investigation previously carried out to determine the effects of impaired mesenteric circulation on the bowel loses its significance when applied to human subjects for the reason that the mesenteric vascular patterns in the human being are considerably different from those found in the usual experimental animals employed, e g , dogs, cats, and rabbits (29, 31).

Certain generalizations can, however, be made regarding mesenteric vascular lesions occurring in obstruction based upon experimental and clinical evidence (5, 10, 12, 13). Regardless of the nature of the specific causal agent producing the impaired blood supply, the extent and character of the circulatory changes in the bowel wall are generally dependent upon the following factors:

- 1 The locality of the lesion producing the circulatory interference with respect to the mesenteric vascular pattern
- 2 The rapidity and completeness with which the vessels are occluded

- 1 When the lesion is at or close to the origin of the principal mesenteric vessels, the area of the bowel which will be affected by impaired circulation will be greater. Conversely, the further from the origin of the main vascular radicals these lesions occur, the less will be the involvement. A single lesion, e g , embolus, thrombus, occluding the main mesenteric trunk will produce extensive impairment involving the entire small bowel and part of the large one, while a single similar lesion occurring in one of the lesser radicals close to the bowel wall may produce no detectable change whatever. This is apparent from an examination of the mesenteric vascular pattern in which the anastomotic channels increase progressively as they pass from their origin distally toward the bowel. If, however, a sufficient number of the smaller radicals are consecutively involved, even when the site of obstruction is close to the bowel, the circulation in the bowel may be severely impaired (5, 10, 12, 13).

- 2 As with other body parts, a lesion which suddenly and completely interrupts the blood supply produces more immediate and severe effects upon the bowel than one in which the occlusion occurs more gradually. In the latter instance the decreased blood supply through the occluded vascular channels may be to a variable extent compensated for by the development of a collateral circulation through channels not affected by the lesion so that the changes incident to circulatory deficiency take place more gradually and are less liable to jeopardize bowel viability. Whenever the blood supply to the bowel is reduced below that

necessary for the maintenance of its normal physiological activity, a condition of anoxia of the tissue supervenes. Initially, the smooth muscle of the bowel wall under the stimulus of the anoxic state increases the force and frequency of its contractions and, therefore, peristalsis is temporarily augmented. If the impairment to the blood supply persists, the bowel ultimately loses its power of contractile response, becomes spastic, then flaccid, and, finally, completely atonic. If the circulatory embarrassment continues, the final result is necrosis of the bowel wall with discharge of its bacteria-laden content into the peritoneal cavity. Nor is it essential for the bowel to become necrotic before pathogenic organisms pass through its walls, for it has been demonstrated that organisms capable of producing peritoneal inflammation changes can gain access to the peritoneal cavity through bowel wall which is not actually necrotic, but of which the viability has been markedly impaired (19, 26). As has been previously stated, the rapidity with which these changes occur is, in general, proportional to the rapidity and completeness of the production of circulatory impairment. If it is recalled that distention of itself will produce circulatory impairment within the bowel wall, the fact is apparent that when an abnormal degree of distention is present together with a lesion which occludes the circulation in the mesenteric vessels, the impairment is greater than if there were no distention. In other words, the presence of distention in strangulating obstruction increases the circulatory impairment initially produced on occlusion of the mesenteric vessels. Moreover, when the circulation to the bowel is impaired sufficiently by a lesion involving the mesenteric vessels, distention is bound to occur for the reason that circulatory embarrassment alone will produce obstruction.

A summary of the progressive effects of an embarrassed circulation may be represented as follows:

Circulatory embarrassment—*anoxia of the bowel musculature—hypermobility—spasm—flaccidity—dilatation—loss of viability—perforation*

*Toxic factor* Much has appeared in experimental and clinical literature concerning the presence of absorbable toxic products formed in simple or strangulating obstructions (4, 37). Before the demonstration that distention incident to obstruction can of itself produce fatal disturbances largely through alterations in the fluid balance (6, 7, 9, 15, 16, 17, 27, 32, 34), it was assumed by many that the lethal effects observed in obstruction were in a great measure accounted for by the formation of toxic products in the static bowel



the splanchnic afferent nerve fibers of the mesentery, and any palpation which does not change either of these has little effect upon the pain. There are, however, as previously noted, outstanding exceptions. These occur in closed loop obstructions in which a definite mass can be palpated, or in instances in which perforation of the bowel has actually occurred. In these instances the mass palpated may be extremely sensitive to pressure, or, when perforation has occurred, generalized tenderness is present throughout.

4 Unless perforation has occurred in the obstructed area with a resulting peritonitis, true muscular spasm is rarely present. The abdomen, dependent upon the amount of distention or fluid contained at the time of examination, has rather a doughy consistency upon palpation, and this condition obtains until such time as true muscular spasm incident to perforation and peritonitis appears. It should be remarked, however, that in most instances there is usually a considerable degree of voluntary muscular splinting which may be confused with true reflex rigidity. However, by persistent effort the difference can be distinguished.

5 The presence of a mass is an inconstant feature. This depends upon the specific nature of the obstruction and its location. It is also dependent to a considerable extent upon the thickness and character of the abdominal wall. If the mass is superficial in a thin-walled individual such as a child, or an elderly person lacking muscular tone, continued attempts may reveal an ill-defined tender tumor. Also careful observation may reveal an inequality in the contour of the abdomen. Obviously this is significant only when present, and failure to demonstrate it is of little consequence in effecting diagnosis. It should be remembered that not infrequently the location of the mass may render it incapable of abdominal palpation, but it may be reached by rectal examination. The obvious necessity of including rectal, and, in females, vaginal examinations, is therefore emphasized.

*Character of the peritoneal fluid* In practically all instances of strangulating obstruction, whatever the specific causal agent, the extravasation of blood into the peritoneal cavity occurs sooner or later. The mechanism by which such extravasation occurs is obvious from the foregoing statements and little additional comment concerning it need be made. There are, however, certain features which are of practical interest.

As has been pointed out, intra-abdominal lesions producing strangulating internal obstructions characteristically involve the mesenteric

vessels. These lesions (volvulus, adhesive bands, intussusception) seldom, if ever, completely occlude both the venous and arterial channels at onset. Usually the thinner walled veins are compressed first with a resultant rise in the venous pressure, but the arterial pressure is little affected. Then as the process progresses with edema, the arterial flow is gradually reduced or completely shut off. However, in the main, aside from actual rupture of the thinner walled capillary and venous channels, the extravasation of the blood is produced early by the elevated capillary pressure maintained against an impeded venous return. The result is a passage of the fluid and cellular elements of the blood into the lumen of the obstructed bowel and into the free peritoneal cavity. The extent to which this occurs depends upon the number of the mesenteric vascular channels involved and the degree of compression the obstructing lesion produces. This is the usual sequence of events in by far the great majority of strangulating obstructions. The only instances of such obstruction not characterized by at least some suffusion of blood into the peritoneal cavity are those in which the condition of bowel obstruction and the circulatory embarrassment arise from a complete or partial occlusion of arterial radicals without any impediment to the accompanying venous channels (primary mesenteric arterial thrombosis, arterial embolism, or dissecting aneurysm). The latter are, however, of far less frequency than the usual lesions which produce strangulating internal obstructions (adhesive bands, internal herniations, volvulus). The point made by the immediately foregoing statements is that in most instances of strangulating internal obstruction, bloody peritoneal fluid is invariably present within 4 to 6 hours following onset if the lesion producing the obstruction and vascular occlusion is mechanical, but the absence of bloody peritoneal fluid by no means abolishes the possibility of a strangulating obstruction on a purely vascular basis (mesenteric arterial thrombosis).

The value of the presence of bloody peritoneal fluid as a pathognomonic sign of strangulating internal obstruction is further lessened when it is recalled that other acute abdominal conditions commonly, if not invariably, produce it (torsion of pedunculated ovarian cysts, ectopic pregnancy, hemorrhagic pancreatitis).

In spite of this multiplicity of conditions also characterized by the presence of bloody peritoneal fluid, it may be confidently stated that in instances of obstruction the presence of bloody peritoneal fluid determined preoperatively by paracentesis provides one of the most indicative



signs in the differentiation of simple from strangulating obstructing lesions

It is rarely that the quantity of blood loss in a strangulated obstruction is of sufficient degree to produce signs of acute blood volume deficiency, as evidenced by the fact that in most, if not all, instances of strangulating obstruction, the blood studies invariably show concentration with elevation of the hemoglobin and cellular elements, in contrast to the hemodilution shown in blood loss. It should be noted, however, that sufficient blood may on occasion be extravasated into the peritoneal cavity to produce signs of peritoneal irritation with the result that signs of fluid appear, as exemplified by tenderness and reflex spasm.

*X-Rays* While x-ray studies of the abdomen are an essential part in the establishment of the presence of small bowel obstruction, they are of particular consequence in the differentiation between the simple and strangulating types (23, 25, 30)

The nature of the agents causing most instances of internal strangulating obstructions is such that obstruction of a "closed loop" type is produced. That is to say, the lumen of the bowel is mechanically occluded at two points by a single constricting lesion with a compression of the mesentery and its vascular radicals at the site of the constriction and an open lumen of the bowel between the constricted areas. Upon x-ray this usually appears as an isolated loop showing gaseous distention of small bowel pattern. The presence of such an isolated loop of distended small bowel in the presence of other diagnostic features may be considered almost pathognomonic.

It should be pointed out, however, that it is possible and of frequent occurrence that a closed loop obstruction of the strangulating type can exist but the closed and distended loops cannot be exactly identified in the film. Visualization depends largely upon the time factor or the period during the course of the obstruction at which the films are taken. An isolated loop is more prone to be distinguished early in the course of the obstruction, before distention of the bowel above the actual obstruction site becomes visibly dilated and distended with the increasing increment of fluid and air. When the latter condition occurs, as it inevitably does later in the progress of the obstruction, it becomes impossible to differentiate the isolated loop from the general distention pattern. It is not intended to imply that in all cases in which an isolated loop of distended small bowel is demonstrated by means of the x-rays that the condition is inevitably one of strangulating obstruction, for there are undoubtedly rare in-

stances of isolated loop obstruction which are of the simple type with only occlusion of the lumen and no embarrassment of the intestinal circulation, but these are distinctly few. Nor can it be assumed that because no isolated loop is demonstrable that no strangulating obstruction is present. However, the presence of a single loop, if found together with the diagnostic features, may generally be regarded as the strongest evidence of strangulating obstruction.

It not infrequently occurs that together with a visible isolated loop, the presence of fluid may also be noted in the abdomen. This is apparent by the familiar hazing of the outlines of the distended bowel and viscera, and when present is strong corroborating evidence, since the transudation of fluid into the peritoneal cavity inevitably occurs during the course of strangulating obstruction.

*Miscellaneous features* There are, in addition, certain features of a minor nature, a consideration of which may influence judgment in the individual case. These are diverse in nature and difficult of categorical placement, and therefore are included under a miscellaneous heading.

Certain specific types of internal strangulating obstructions are associated with the extremes of age as, for example, intussusception and Meckel's diverticulum in children, and volvulus of the large bowel (sigmoid) and mesenteric thrombosis in individuals of advanced age.

The possible existence of a precedent or co-existent pathological state, which although not directly related to the obstructive conditions may either markedly influence the progress of the latter or be influenced by it, must certainly be taken into account. This remains a consideration particularly in the older age groups in which such disabilities as diabetes, cardiac lesions, anemia, and renal and extrarenal azotemia are common. The importance of recognition of such associated incapacities as factors complicating diagnosis and treatment is so obvious as to require little comment.

It should also be borne in mind that on occasion simple obstruction may, by the unrelieved progress of the local disturbances located in the obstructed bowel segment (engorgement, edema, and the intraluminal collection of fluid), be converted into obstruction of the internal strangulating type. If this possibility is not recalled, it may be erroneously assumed from the history of gradual onset, delayed initial vomiting, and other initial features, that the obstruction is still of the simple type, which indeed it was at the onset. Thus the intercurrent strangulation factor may be missed with fatal result. It is wise, therefore,

to regard any increase in the severity of signs and symptoms of internal obstruction with considerable suspicion

A history of previous laparotomy and the presence of abdominal scars, although perhaps of minor import, may be mentioned. While the formation of postoperative adhesions is recognized as a prime causal factor in the production of internal obstruction of either the simple or strangulating type, it has been frequently observed that in the absence of such adhesions and, therefore, in the absence of any scars or previous operative history, obstruction of sudden onset and severe progression of symptoms are apt to be of a strangulating nature. This is explained on the basis of the fact that aside from adhesions which are the most frequent cause of natural obstruction of either type (simple or strangulating), the next most frequent specific causal lesions (volvulus, intussusception, internal hernia, thrombosis) produce internal obstructions of the strangulating type.

It is within the experience of everyone who has had to deal frequently with instances of obstruction that what was diagnosed as the internal strangulating obstruction preoperatively is found to be due to external hernia and therefore an obstruction (definition) of the external strangulating type. This is prone to occur in extremely obese individuals with great thickness of the abdominal parietes in whom abdominal examinations in general, and examinations of the hernial orifices in particular, are apt to be difficult. Actually such an error, aside perhaps from the technical consideration of the placement of the exploratory incision, is not a grave one provided the strangulating character of the obstruction is recognized. It does, however, serve to re-emphasize the often reiterated point that extremely careful examination of all external abdominal areas through which hernias are prone to occur is necessary.

#### THERAPEUTIC CONSIDERATIONS

There is no question of the urgent indication for immediate surgery once the diagnosis of strangulating obstruction has been positively made. It may also be added that when, in spite of careful consideration of the diagnostic criteria, doubt still exists as to whether the obstruction is of the simple or strangulating type, surgical intervention as soon as possible remains mandatory. While there is no question concerning the indication for surgery in positive and even doubtful instances of strangulating obstruction, there remain three other practical considerations

TABLE 1—SUMMARY OF THE DIFFERENTIAL DIAGNOSTIC FEATURES DISTINGUISHING STRANGULATING FROM SIMPLE ACUTE SMALL BOWEL OBSTRUCTIONS

	Strangulating Obstructions	Simple Obstructions
Pain	Onset sudden and fulminating Type severe cramplike present continuously with peristaltic exacerbations	Onset gradual less sudden Type less severe cramplike but tends to disappear in periods of peristaltic inactivity
Vomiting	Onset tends to occur at onset of pain Type sustained continuous, severe little relation to peristaltic action.	Onset gradual usually at a considerable interval after onset of pain Type periodic tends to be simultaneous with peristaltic action.
Shocklike manifestations	Onset appear early almost at onset. Type persistent with progressive severity	Onset appear much later Type less severe
Response to conservative therapy (decompression and hydration)	Poor response—symptoms and signs tend to persist and progress in spite of all measures	Good response—symptoms and signs tend to improve with conservative measures
Peritoneal fluid	Invariably bloody—frequently demonstrable with x rays	Clean—rarely present in excess
Presence of isolated loop	Frequently present and demonstrable with x rays	Rarely present.
Abdominal scars	Frequently present.	Frequently present.
Abdominal mass	More often present and detectable by abdominal or rectal palpation	Rarely present or detectable.
Abdominal tenderness	More frequently present and marked	Less frequently present and less marked.
Abdominal spasm	More frequently present and marked	Usually absent when present, less marked
Blood studies	Show dehydration and hemoconcentration—present in spite of therapy	Show dehydration and hemoconcentration—tend to ameliorate with therapy

- 1 The time at which operation is to be carried out
  - 2 The preoperative preparation
  - 3 The specific type of surgical procedure
- Concerning the first, it has already been stated that the indication for surgery is immediate. The principal concern, therefore, in this regard is whether or not the general condition of the patient is such that the necessary procedure can be without stood. It should be recalled in this connection that in instances of strangulating obstruction, despite adequate treatment of the patient's systemic circulatory disturbances (dehydration and shock), his general condition does not materially improve and there is a marked tendency toward fatal circulatory collapse. Any attitude of delay in operation to await an expected response to conservative measures of treatment is extremely dangerous. It is also to be remembered that,

although the response to the usual measures employed in combating the systemic disturbances is poor as long as the condition of obstruction persists, when the obstruction has been relieved by the indicated operative procedure, the decrease in systemic manifestations is dramatic. On this account the general precept of immediate operation while the usual measures for correction of the patient's circulatory depletion are in progress is advanced.

Concerning the preoperative preparation of the patient, in addition to the administration of fluid and blood, the most important single measure is that of instituting decompression. It is to the advantage of the surgeon as well as to the patient if the patient can be successfully intubated prior to undergoing operation, and every effort should be made to do this provided it does not entail any considerable delay. By successful intubation is meant the passage of the long tube, of whatever type selected (Johnston, Miller-Abbott), past the pylorus and well into the duodenum so that decompression may be begun during, and carried on after, operation. Accomplishment of this particular procedure not only facilitates any technical procedure during operation by lessening the distention of the distended segments of the bowel, but also obviates the necessity of intubating critically ill patients subsequent to operation for the control of inevitable ileus (1, 20, 21, 28, 30).

Regarding the latter statement, some mention is essential of the repeated criticism that intubation with the long tube is a dangerous procedure in strangulating obstruction. This criticism is apparently based upon unfortunate fatalities resulting in strangulating obstruction when long tube decompression was relied upon as the sole and principal form of treatment. So far as the writers are aware, no observer of recognized experience has ever recommended long tube decompression as a substitute for surgical intervention in strangulating obstruction. The statement has been made, and with ample justification from clinical experience, that long tube decompression together with restoration of the fluid balance are indicated in all instances of intestinal obstruction (9, 22, 23, 30, 42). In simple, nonstrangulatory obstructions of the mechanical type in which intubation and decompression have been successfully carried out, subsequent surgery may be an elective procedure because the lethal effects of distention are thereby controlled and there is no danger of peritonitis from perforation. In simple obstructions of the ileus or paralytic type, intubation decompression is practically the sole reliable form of therapy (23, 41). When dealing with

strangulating obstructions, however, there is no substitute for the immediate operative relief of the obstruction and the embarrassed blood supply to the obstructed part, and long tube decompression is advocated only as an adjunct therapeutic agent to facilitate the operative procedure and minimize the usual postoperative ileus. It is apparent, therefore, that criticism of the use of long tube decompression in obstructive cases arises mainly from the reliance upon it as the sole form of therapy in instances of obstruction of the strangulating type in which surgery is urgently indicated. This error is patently one of diagnosis, a failure to appreciate the strangulating nature of the obstruction, and in no way constitutes a reasonable indictment of long tube decompression, which is a most valuable form of therapy. It would seem almost as rational to criticize the use of knives because of unfortunate instances in which vital structures were unintentionally cut because of error or oversight on the part of the operator.

It is not within the scope of this article to outline the details of the various types of surgical procedures which may be indicated, for these are largely determined by the particular conditions encountered in the individual case. There are, however, certain general observations which may be ventured.

In all instances of obstruction a decision must be made as to the viability of the obstructed bowel segment. This probably constitutes the most important single decision during the operative procedure, because the critical matter of resection of the bowel in question depends upon it. The state of bowel viability, in spite of the recent ingenious procedures devised for its determination, remains in the last analysis a matter of individual judgment on the part of the surgeon. Frequently, the state of viability is so doubtful as to tax the acumen of the most experienced. It has been the observation of the writers that the common error is in the resection of viable bowel rather than the failure to remove necrotic bowel segments. While the former mistake is certainly preferable to the latter, it is believed that the margin of error can be considerably reduced by a longer period of observation of the questionable bowel than is ordinarily advocated (20 minutes). An additional interval of observation, provided the patient's condition permits, may prove unquestionable viability, and therefore preclude resection of a segment which for the initial 20 minutes appeared permanently damaged.

An additional point of emphasis bears reiteration since grave mistakes too frequently occur. This concerns the performance of complete ex-

ploration of the small bowel rather than confining attention to what appears to be the obviously obstructed area. Not infrequently the bowel may be obstructed at more than one point and a second obstructive area may be easily missed unless its entire extent is explored. Moreover, while the obstruction may occur only at a single point, other segments may be affected by conditions correctable at the time of operation and which if unrelieved may be capable of producing subsequent obstructive episodes.

It is scarcely necessary to emphasize that the standard antibiotics, penicillin, streptomycin, and sulfone derivatives should be employed as therapeutic adjuncts in combating possible septic complications in individual cases (3, 35).

#### CONCLUSIONS

Internal strangulating obstructions of the small bowel constitute a group of acute surgical emergencies frequently misdiagnosed preoperatively.

Errors in diagnosis arise because of the concealed origin of the obstruction, the variety of acute abdominal lesions with which the obstruction may be confused, and the absence of any single pathognomonic sign by which the condition may be positively identified.

Correct diagnosis is largely a matter of evaluation of the signs and symptoms enumerated.

The lethal as well as the pathological changes giving rise to the presenting signs and symptoms arise from distention and circulatory effects.

Prompt surgical intervention in positive and doubtful cases is urgently indicated.

The specific surgical procedure is determined by the nature of the obstructive lesion and the individual experience and judgment of the surgeon.

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# ABSTRACTS OF CURRENT LITERATURE

## SURGERY OF THE HEAD AND NECK

### HEAD

**Internal Wire Immobilization of Jaw Fractures**  
J B BROWN, M P FRYER, and F McDOWELL.  
*Plast Reconstr Surg*, 1949, 4 30

Various methods of treating complicated and compound fractures of the jaw appear in the literature, including open bite splints, overhead plaster-cap, traction devices, complicated dental appliances, and external fixation

No single method of immobilization is applicable to all patients, and whatever will give the best fixation is the ideal method. A very simple and direct method is that of internal wire fixation, which may be used alone, or may be combined with dental arch supports, interdental wiring, direct bone wiring, and dental fixation

When enough teeth are present in the proper position to allow wiring the jaws in proper occlusion, this is the method of choice. No. 24 or No. 26 stainless steel wire is used between the teeth and, for further stability, an arch of No. 24 wire is looped around the posterior teeth and twisted together in front with anchors of No. 28 wire to the individual teeth. Loop, eyelet, and button wiring, elastic loop fixation, and acrylic splinting are variations of technique which may be efficacious

When, for some reason, interdental wiring would not be sufficient, as in patients with lack of available teeth, patients with fractures of the symphysis, or with angle fractures with posterior fragments displaced into the upper buccal fornix and compounding into the mouth with infection and sloughing, the fractured lower jaw may be immobilized by a Kirschner wire, .05 to .08 inch, driven across the fracture site

In an edentulous mouth, internal wires can be used in conjunction with circumferential wires around the patient's dentures

The technique of introduction of the internal wire is to drive the wire across the fracture site below the nerve canal with a power drill while another person holds the fragments in reduction

Asepsis should be as good as possible, the skin and periosteum nicked, the wire cut to minimal length to prevent "whipping," and a power drill used with a speed fast enough for penetration, but not fast enough to produce necrosis

A fixation dressing of mechanics' waste is a further support to the jaw and helps prevent hematomas and soft tissue swelling, decreases the chance of infection, and increases the patient's comfort

Complications have been slight, usually confined to slight drainage around the pins

LOUIS T BYARS, M D

### EYE

**Experimental Studies on the Pathogenesis and Treatment of Ocular Tuberculosis.** ALAN C WOODS *Brit J Ophth*, 1949, 33 197

The author reports his experimental studies over a 12 year period on the pathogenesis and treatment of ocular tuberculosis. The objective of the investigation was to determine the following

- 1 Whether Rich's law holds true in localized ocular tuberculosis. This was determined by the effect of the number and virulence of the infecting organisms on the resulting ocular lesion, the influence of local tissue sensitivity, the influence of systemic immunity, and the relation of cutaneous and ocular sensitivity

- 2 Whether enhancement of local resistance or immunity is possible

- 3 The effect of desensitization on the local ocular lesion

- 4 The possibilities of sulfone and antibiotic treatment in ocular tuberculosis

It was previously supposed that the phenomena of hypersensitivity and immunity were interdependent and that allergy was responsible for immunity. However, Rich demonstrated in 1929 the independence of hypersensitivity and immunity, and that a previously tuberculous animal could be completely desensitized to the extent that not only the soluble bacterial products but even living bacilli injected into the skin would cause no local inflammatory reaction. Moreover the resistance to dissemination of the bacilli or immunity to reinfection was totally undisturbed. Rich's law may be expressed in the following manner

$$\text{Lesion} \propto \frac{\text{Number and virulence of bacilli} \times \text{allergy}}{\text{Resistance}}$$

It has been known for a long time that experimental ocular tuberculosis took quite a different course in the normal animal from that in an animal previously infected with tuberculosis (the immune allergic animal)

A virulent human strain of tubercle bacilli was used in the experiments. It was injected into the anterior chamber of the eye of a normal or immune-allergic rabbit in proper dose, as well as systemically to develop a self-limiting disease from which recovery occurred with an immune allergic status

It was found that Rich's law for the pathogenesis of tuberculous lesions holds true in localized ocular tuberculosis. The factors which govern the course and character of the lesion are the number and virulence of the infecting organisms, the degree of tissue hypersensitivity present, and the amount of

# SURGERY OF THE HEAD AND NECK

the resistance developed by the host. These studies also explain the relative cutaneous allergy often present in animals and man with inflammatory tuberculous lesions of the eye.

As a result of this concept of the pathogenesis, many therapeutic approaches are provided, such as

- 1 Enhancement of immunity. No specific measures along this line have been developed so far.
- 2 Removal of the fatal tissue hypersensitivity. This can be accomplished by the use of tuberculin as a desensitizing agent. Tuberculin has a distinctly beneficial effect on the clinical course of the lesion.
- 3 Direct attack on the tubercle bacilli. This may be accomplished best with a combination of streptomycin and promizole.

Promizole is a nontoxic sulfone. It can be administered to human beings in doses as high as from 12 to 15 gm daily with comparative safety. Penicillin alone had no effect whatsoever on the clinical lesions, but streptomycin combined with promizole appeared to eradicate the bacilli from the infected tissues in a large per cent of the treated cases and curtail their growth and virulence in the remaining cases.

JOSHUA ZUCKERMAN, M D

## Diathermy Cauterization of the Ciliary Body for Glaucoma

SAMUEL J MEYER Arch Ophth, Chic, 1949, 41: 417

Cyclodiathermy puncture is indicated in cases of (1) glaucoma with a flat anterior chamber in which previous trephination or iridectomy has been unsuccessful, (2) aphakia with secondary glaucoma, (3) secondary glaucoma due to iris prolapse, (4) hemorrhagic glaucoma, and (5) primary glaucoma in which the chamber angle is obliterated. Other operations are of questionable merit.

The author operated on 142 patients and the results obtained in 136 are reported. There was complete relief of pain in 94 patients (74%), and reduction of intraocular pressure below 35 mm of mercury in 42 patients (33%).

The operation is usually performed inferiorly, and retrobulbar and subconjunctival procaine anesthesia is used. The conjunctiva in the region of the insertion of the inferior rectus is opened and the incision is extended in an arc nasally and temporally to the insertions of the medial and lateral rectus muscles. The sclera is dissected clean to within 1 or 2 mm of the limbus. Diathermy needle punctures (45 milliamperes for  $\frac{1}{2}$  to 1 second) are then placed about 0.5 mm apart in a zone 2 to 4 mm wide just anterior to the insertion of the inferior rectus and extending in an arc to within 2 mm of the insertion of the horizontal rectus muscle. The conjunctiva is closed with continuous black silk and atropine ointment is instilled.

To prevent corneal complications, the diathermy needle must never be placed within 2.5 mm from the limbus. The needle must be not longer than 0.5 mm and 0.18 mm in diameter, and should have a shoulder stop to prevent too deep penetration.

FRANK W NEWELL, M D

## Successful Diathermy Treatment of Recurring Retinal Hemorrhage and Retinitis Proliferans Report of a Case

F H VERHOEFF

Arch Ophth, Chic., 1948, 40: 239

In most cases of retinal hemorrhage the patient gives a cutaneous reaction to tuberculin, and in the cases in which the retina has been examined microscopically, nodular foci of epithelial cells have been observed along the veins. These facts constitute strong evidence that the condition termed "periphrisis adolescentum" is an entity, that it is caused by tuberculosis, and that to it most cases of what is called Eales's disease belong. It is uncertain whether the periphrisis is directly hematogenous or results from dissemination of the infection by way of the vitreous.

Various treatments were used, including injections of tuberculin which have been of doubtful value. So far, the case presented has been the only instance of recurring hemorrhages in which diathermy treatment was employed. The entire hemorrhagic region was subjected to diathermy. Numerous additional hemorrhages produced by this treatment seemed alarming at the time, but all the blood had disappeared at the end of about 3 weeks, and up to the time of this report (15 months after the second episode) there has been no recurrence of hemorrhage in the eye.

Diathermy may possibly be of benefit, not only in selected cases of tuberculous periphrisis but in cases of retinal vascular obstruction from any cause. It may establish communication between retinal and choroidal vessels and thus restore retinal circulation. The appearances in some of the treated areas indicated that such a communication had been made. It would seem, therefore, that attempts to establish, by this or other means, such collateral circulation should be made in all cases of impending blindness from obstruction of the retinal vessels. These cases would include those of partial obstruction of the central vein or artery, cases of pronounced sclerosis of the retinal vessels, and early impairment of central vision, and early cases of circinate retinitis. In cases of complete obstruction of the central vein, the treatment might at least prevent the development of hemorrhagic glaucoma. It might even offer some hope in cases of diabetic retinopathy. The possible establishment of a collateral circulation also offers hope in cases of retinitis proliferans arising from the disk or vicinity. Here, of course, the affected vessels are not safely be obliterated by diathermy, but the establishment of a collateral circulation near the site might relieve the venous congestion and thus prevent the proliferation of new vessels.

MICHEL LOUTFALLAH,

## The Diagnosis of Retinoblastoma

BEDELL Arch Ophth, Chic, 1948, 40: 311

Three types of the common yellow pupillary complexes are included in the author's definition but not detachment of the retina (which

times be confusing), nor the rare cysticercus of the vitreous. The subject of retinoblastoma is presented with 6 case histories, and a description of the ocular signs which led to enucleation in 5 cases, and to the unmistakable diagnosis of angiomas in 1 case.

The first case was of interest because of the early inflammatory reaction which led the parents to delay in bringing the child for diagnosis. With a tumor of such rapid growth, it is doubtful whether anything could have prevented the fatal outcome 1 year after the first sign of the retinoblastoma. In the second case there was a slower rate of growth and the absence of recurrence. The child was first seen when she was 26 months old because something was wrong with the left eye. Nine months before, the parents had noticed that the left pupil had a peculiar yellow color, and lately they had noted that the eye rolled about as though it could not see. The diagnosis was retinoblastoma. In this case the tumor was large and was growing rapidly in and on the retina. After 4 years, there has been no metastases or recurrence, so that the outcome seems favorable.

The third case was of unusual interest because of the appearance of the vessels which resembled angiomas, the fundus picture which suggested a growth, the pathologic type of the tumor, and the development of multiple metastases. There were many fine dustlike cells in the vitreous. The disk was slightly oval, but even under the powerful light of the camera it could not be sharply outlined. The veins of the upper half of the fundus were larger than normal, and the superior temporal branch was beaded, the veins in the lower portion were not remarkable. A short time later, the child complained of pain. There was an area of hypopyonlike sediment measuring 1 mm in the anterior chamber. The eye was enucleated, and the diagnosis was leukosarcoma of the choroid.

The fourth case was that of a 4 month old girl born in the sixth month of pregnancy. The iris was dark, with a deep yellow-gray reflex visible through the pupil which measured 3 mm, the anterior chamber was very shallow. On section, the diagnosis of retrolental fibroplasia was verified.

In the fifth case, the diagnosis of angiomas seemed unmistakable, and the changes characteristic of this condition, of a bizarre type, were well shown except for the angioma itself, which was outside the photographic field, in the extreme field visible with the ophthalmoscope.

The sixth case was that of an 8 month old baby who, according to the parents, did not see as well as the other children. With the child under ether anesthesia, the reflex was found to be produced by a smooth-surfaced, large yellow layer without definite boundaries but limited mainly to the temporal half of the retina. Enucleation was done because the eyeball was obviously extensively involved and sightless, and all previous treatment had been unavailing. The diagnosis was glaucoma secondary to uveitis and retinitis, classifiable as Coats' disease.

MICHEL LOUFFALLAH, M D

## EAR

### Prefabricated Autogenous Ear Cartilages H ELLIOTT BLAKE *Brit J Plast Surg*, 1949, 1 220

The chief difficulty in the provision of support for a reconstructed pinna is to find an inlay which is sufficiently rigid and yet thin enough to pass as a reasonable likeness of normal ear cartilage. Prior to June, 1947, the author buried sheets of costal cartilage beneath the postauricular skin, later excavating and skin grafting at a deeper level, thus providing a skin-cartilage-skin sandwich as the supporting element of the reconstructed pinna. This was flat with no concha, was limited in size by the amount of hairless postauricular skin available, and short in its upper third as compared with a normal ear.

The additional skin is provided first, usually by a tubed pedicle from the upper arm. Later a laminated sheet of cartilage is added, which is shaped to a reasonable likeness of the pinna by burial in the subcutaneous tissue of the abdomen between thin sheets of tantalum.

Peer and Aufricht previously have used buried autogenous cartilage in shaped molds, but they placed reliance for rigidity on the massive solidity of their molds. With use of the following method, the author aims to produce an extremely thin sheet of cartilage, as much like normal ear cartilage as possible, which needs no further shaping, the rigidity depending solely on its multiple curves, and its resilience on its thinness.

The cartilage is taken from the superficial two thirds of the eighth and ninth costal cartilage, and the superficial reflected perichondrial flaps are then resutured. At the abdominal end of the paramedian incision, a subcutaneous pocket is left for the mold. The cartilage is cut into coarse flakes, spread and squeezed tightly between the plates of the tantalum shaping cup, and buried beneath the abdominal skin.

The shaping cup is made of 0.015 cm tantalum sheet molded to the shape of a modified ear, perforated by multiple holes to allow the passage of blood, lymph, and fibrous tissue. Ledges keep the two sections separated 1 to 2 mm apart, thus determining the thickness of the cartilage mold. Curves, ridges, and depressions have been intensified in the anterior plate in later models to give more rigidity where needed.

The mold is removed from its pocket after from 3 to 7 months, and is resilient and correctly shaped.

Histologically the cartilage flakes appear as normal living cartilage, firmly bound together by fibrous tissue in which capillaries can be seen. There is firm, fibrous union between flakes after a period of 5 months, but no fusion of cartilage flakes.

The cartilage plate is trimmed, and a few holes are punched into it to allow fibrous tissue to grow through and anchor it in place. It is then fitted into the bag of ear skin and a pressure dressing is applied.

Of the 7 completed cases, 2 showed flaccidity due to insufficient rigidity of cartilage, 1 showed crumpling due to insufficient skin covering, the other 4 were sufficiently encouraging to justify continuing the



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method, and attempting to prefabricate nasal cartilages even thinner and more complex in shape  
 LOUIS T BYARS, M D

**The Microtic Ear** EDGAR M HOLMES *Arch Otolaryngol*, 1949, 49 243

The author briefly outlines the embryology of all portions of the ear according to best authorities and shows how the inner ear develops separately from the middle and external ear and how the pinna is the last part of the ear to develop. He thus justifies the known fact that congenital anomalies may affect any portion of the ear separately. He classifies congenital anomalies of the external and middle ear as follows:

- 1 The ear which is small over all
- 2 Lack of development of the upper part of the auricle and helix.
- 3 Adherence of the usually free portion of the upper part of the auricle to the side of the head
- 4 Agenesis of the entire auricle except for the concha and lobule
- 5 Agenesis of the entire auricle. Only a mass of skin covered cartilage is found in this case although the lobule may be well formed

It is usually only in this last case that the meatus may be partially or totally obliterated by fibrous or bony tissue. When the canal is nearly or entirely obliterated the structures of the middle ear are often deformed with absence or deformity of the malleus, membrane and ossicles. This particular condition is also frequently associated with an asymmetry of the face and a partial agenesis of the ramus of the mandible on the corresponding side. Although the bone condition may be normal in these cases, an attempt to re-establish hearing by the formation of an external auditory meatus usually fails partially because of the presence of agenesis in the middle ear structures. The author has hopes that this may be rectified to some extent by the performance of fenestrations on these patients. Bone conduction hearing aids may also be used.

Surgical procedures for the correction of the deformities Nos. 2, 3, 4, and 5 are described. The author counsels against the performance of any of the cosmetic operations on women when the microtic ear can be covered with hair, and also against the performance of any type of reconstruction of an external auditory canal in an individual who has good hearing in one ear because of the possibility of injuring an abnormally located facial nerve. The use of the newer, better prosthesis may be the answer to the more severe deformities. It can never be entirely satisfactory, however, because of the ever-changing color of the normal skin.

WILLIAM K WRIGHT, M D

**Hydrodynamics and Hearing. The Operative Relief of Otosclerotic and Nonotosclerotic Deafness and Its Relationship to a Hydrodynamic Hypothesis of Hearing** OTTO POPPER *Arch Otolaryngol*, 1949, 49 335

The author believes that because of the development of the fenestration operation, the theories of

hearing should be reorganized. He believes that otologic teaching should be revised, and it is his belief that the hydrodynamic hypothesis offers a satisfying explanation for many of the phenomena in hearing.

He divides his leading questions into several parts, as follows:

1 What is meant by hydrodynamics? It is a fact that the inner ear consists of fluid columns which communicate freely with each other and thus form a perfect hydrodynamics system, rigidly enclosed, but with mobile sealed ends, these ends being the stapes and the round window.

2 How does fenestration restore hearing, and is such restored hearing normal? In otosclerosis the stapes is gradually immobilized and ceases to function as an escape valve, and the perilymph is impeded to pressure, and the perilymph is impeded. The organ of Corti thus receives a weaker stimulus, and deafness is established. Clinical otosclerosis is not a deafness, but a breakdown of the hydrodynamic system, with a stapedia fixation converting the latter into a tube rigidly sealed at one end, and deafness is thus the predominate symptom of this breakdown. The fenestration operation restores hearing by forming a new escape valve, removes the mechanical barrier, restores the hydrodynamic system, and re-establishes mobility of the perilymph.

3 The stapes, the perilymph, and the round window membrane. What is their protective role? The stapedius muscle contracts on loud stimuli and directly protects the organ of Corti from injury, and the whole organism from the perils of surprise attack. The contraction of this muscle controls excessive excursions of the perilymph and partially immobilizes the perilymph in cases of extreme stimuli, also by its contraction, it aids the ear in picking out certain portions of the sound spectrum.

4 Why are the organs of balance and of hearing so intimately related to one another? These are related because the entire labyrinth is formed for the interception of minute differences of pressure—continuous, as in the vestibular apparatus, or periodic, as in the cochlea.

The author discusses the function of the ossicles. The stapes (1) accommodates excursions of the perilymph in hearing, (2) creates differences in pressure between the two windows (a) for the protection of the organ of Corti against injury, and (b) for the protection of the whole organism. The function of the malleus is (1) to close and center the capitulum of the stapes so that movement caused by contraction of its muscle will be restricted to a prescribed orbit or plane, (2) to oppose the tone of the stapedius muscle and prevent the permanent deafness that would result if the footplate were pulled out of the oval window with resultant dampening of the perilymph, and (3) to support the articular surface of the head of the malleus. The function of the tensor of the tympanic membrane by action of the tensor tympani muscle.



The author then discusses the surgical classification of cases conforming with the hydrodynamic hypothesis. When the opening at the oval window end of the system is the cause of deafness, as in otosclerosis, with the fixed stapes sealing the oval window, the condition is called stapedia deafness. Obstruction to sound reaching the round window is termed hypotympanic deafness. To both of these groups must be added irreversible deafness with irreversible changes in the cochlear organ. The author supports the view that the round window is part of the sound pathway.

Hypotympanic deafness, which is responsible for a large group of cases of air conduction impairment, is caused mainly by chronic otorrhea and suppuration, the impairment being caused by granulations, polyps, and scar tissue around the region of the round window. The author operated on a number of patients with chronic suppuration and deafness, and each had a densely sclerotic mastoid process, the infection was confined to the attic. Considerable tissue, scars, etc., were found overlying the hypotympanum and thus sealing off the round window. In 27 cases the transtympanic technique was employed to clear the attic and hypotympanum. Eighty per cent of the patients exhibited a dry ear within 3 weeks, and the same percentage of patients had immediate postoperative improvement that amounted to almost normal hearing. Only 4 of these patients, however, maintained their hearing improvement, in the other cases new scar tissue may have formed. It is believed that we are on the verge of entering an era wherein operations directed toward this type of hearing loss may be carried out.

The author presents a number of diagrams to support his hypothesis. WILLIAM A. AERON, M.D.

#### Histopathologic Investigations on the Localization, Number, Activity, and Extent of Otosclerotic Foci. BENGT NYLÉN. *Uppsala läk fören förh*, 1949, 1: 1

Nylén has made an extensive investigation of 74 cases of otosclerosis and 3 other cases with pathological bone changes from the collection of temporal bones of F. R. Nager.

Preliminary to his investigation the author made a survey of the large series of histologically established cases of otosclerosis in the literature by writers acknowledged as authorities on this subject. From the survey, the following facts were pointed out.

In clinically established otosclerosis, nearly 100 per cent of the foci are located in the oval window region and are accompanied by ankylosis. In investigations of the frequency of otosclerosis in unselected material, this figure decreases considerably, and stapes ankylosis is less frequently encountered. Statistical calculations of the relation of age and sex to the incidence, and of the morbidity rate have not been possible because the series has been too small and the material lacked homogeneity. Because otosclerotic foci in other regions than those of the windows and stapes have apparently not been sought,

relatively little appears to be known about the localization of the lesions in the labyrinthine capsule outside of those regions. Thus, the author wished, by his investigation, to add to the present knowledge of the localization, number, activity, and extent of otosclerotic foci.

After uniform histological treatment and study of all his material the author presented his facts in case reports and in a complete tabulated form. In summary, the principal findings of the histological investigation were as follows:

1 Of 74 patients examined, with 121 temporal bones showing otosclerotic foci, 34 were females and 40 were males.

2 The localization of the otosclerotic processes was as follows:

In the window regions in 90 per cent of the cases, approximately 50 per cent of the cases with a localization at the oval window were associated with stapes ankylosis. The round window was involved in approximately 40 per cent of the entire material, the cochlear capsule in 35 per cent, the internal auditory canal region in 30 per cent, and the semicircular canal capsule in 15 per cent. Typical otosclerotic foci entirely outside of the labyrinthine bony capsule were rare, being found in only 2 instances.

3 A focus limited to only one of the regions mentioned in the previous paragraph was found in 55 per cent of the whole material. The process was confined to the stapedia region in 40 per cent and to the round window in 8 per cent of all cases. The 40 per cent involvement of the stapedia region is divided into 18 per cent with and 22 per cent without ankylosis of the stapes.

4 There was a higher proportional incidence of stapes ankylosis among the females, when the number of cases with foci at the oval window accompanied by stapes ankylosis was compared with the number of cases without the latter finding.

5 The pathological areas are usually symmetrically located in both temporal bones of a patient, except, obviously, in unilateral otosclerosis.

6 No difference in localization of foci appeared when the patients were divided into two age groups, that is, over or under 50 years of age.

7 A single focus occurred in approximately 65 per cent of the total number of bones, in the others there were two or more foci, those with more than three being rare.

8 On classifying the foci according to their degree of activity, active foci were found in 20 per cent of the cases, mixed in 50 per cent, and quiescent foci in the remainder. When several foci were present in the same bone or in the same individual they were usually of the same degree of activity. Mixed and quiescent areas were more common in the patients over 50 years of age.

9 The extent of the process varied from 0.4 mm to more than 20 mm, with no correlation between the extent, localization, and activity.

10 Diffuse otosclerosis usually involved the entire cochlear capsule, but the vestibule and even parts

# SURGERY OF THE HEAD AND NECK

of the semicircular canal capsule were involved in approximately 10 per cent of the cases. Stapes ankylosis was considerably more common on comparing the material as a whole and the activity was extremely mixed.

11 The findings in the present investigation as well as in other recent investigations indicate that unilateral otosclerosis occurs in from 15 to 30 per cent of the cases collected for histological specimens.

12 Histologically, the foci in the oval window region were typical in extent. The round window was often occluded by the process. The lumina of the cochlea, the vestibule, and the semicircular canals were often compressed, particularly in cases of diffuse otosclerosis, whereas foci in the internal auditory canal do not appear to compress the lumen to any extent.

EUGENE L. DERLACKI, M.D.

**Acoustic Function Before and After Operations for Otosclerosis**  
HARALD EWERTSEN *Arch Otolar*,  
Chic., 1949, 49: 393

This is the first of a series of 4 articles dealing essentially with the postoperative results following Popper's operation for otosclerosis and with acoustic function. The author made observations on the first 85 patients operated on in the ear department of the Sundby Hospital, Copenhagen, beginning November 8, 1946.

Of these 85 patients, 59 per cent complained preoperatively of paracusis, 1 patient, of 38 questioned, complained of diplacusis, and 89 per cent, of 70 questioned, complained of tinnitus. Hearing acuity was assessed on the basis of whisper and voice tests, audiometry, tuning forks, the monochord test, and the patient's own statement. Of the group capable of hearing voice at a distance of 10 cm or less, only 18 per cent obtained definite improvement, and this group must be regarded as unfit for fenestration. Of 30 patients operated on more than 6 months ago, 63 per cent showed "definitely improved" hearing. If the least fit group, i.e., those with hearing for speech less than 10 cm, are not included, 75 per cent of the patients obtained definite hearing improvement. This is shown in Table I.

TABLE I—RESULTS OF SPEECH TESTS OF 30 PATIENTS 6 TO 13 MONTHS AFTER FENESTRATION

Preoperative hearing distance	Patients	Ad aures to 10 M	Postoperative hearing distance					Safe improvement
			0-20 M	0-50 M	1-2 M	4 M*	8 M	
Ad aures to 10 M	10	5	1		1	1	1	4 of 10
0-20 M	9		1	1	1			7 of 9
0-30-1 M	5							3 of 5
1 m 3 M	3							2 of 3
4-60 M	1							1 of 1
8-90 M	2							2 of 2
Total	30							19 of 30 = 63%

\*Bold face figures indicate safe improvement.

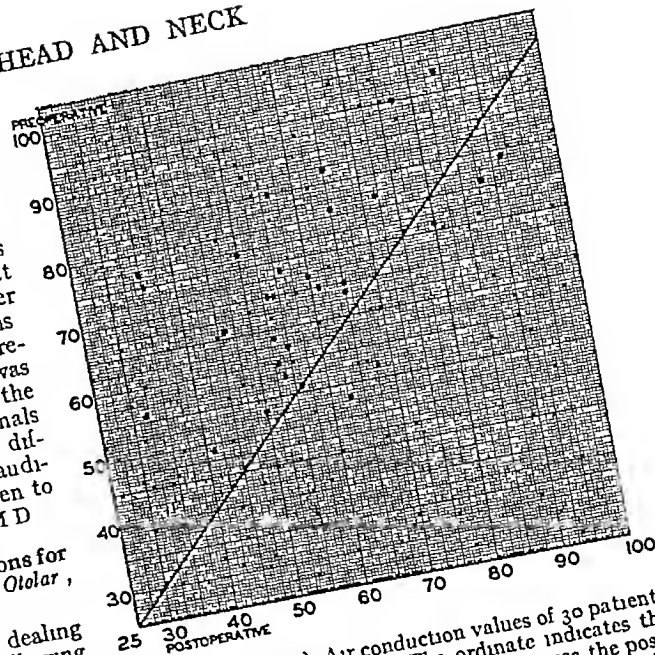


Fig 1 (Ewertsen) Air conduction values of 30 patients according to Fowler's test. The ordinate indicates the preoperative value in decibels, and the abscissa the postoperative value measured from 6 to 13 months after the operation. Eighteen of the 30 patients, i.e., 60 per cent, have obtained improved hearing.

The fistula, the author believes, closed in 13 per cent of 30 patients within 6 to 12 months postoperatively.

The air conduction values according to Fowler's test are given in Figure 1.

JOHN J. BALLENGER, M.D.

**Popper's Operation for Otosclerosis**  
*Arch Otolar*, Chic., 1949, 49: 380

Lund presents his experiences with 90 patients operated on for otosclerosis by his modification of Popper's original procedure. Popper's transtympanic operation differs from Lempert's transmastoid route

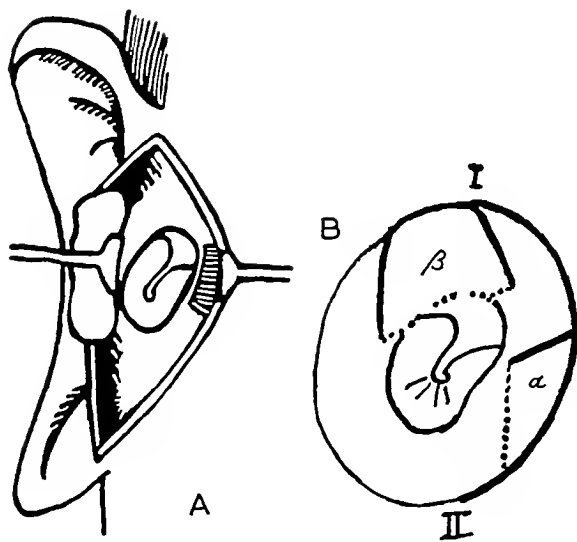


Fig 1 (Lund) A shows the "square on" presentation of the posterior wall of the external meatus and the drum B shows the incision made through the skin that lines the anterior wall of the bony meatus *a* and that made through the skin that lines the upper posterior part of the bony meatus *B*. The broken lines give the extent of the detachment of the margin of the tympanic membrane. The curved line I-II marks the incision of the anterior wall of the external meatus between the cartilaginous and the bony part.

principally by offering the surgeon a "square-on" approach to the site of election for the fenestra, namely, the "roof of the vestibule above the facial canal," according to the author.

Various modifications of Popper's original method are used by the author. The head of the patient is not placed in the side position but turned halfway upward. The author's incision is a curved one just anterior to the tragus rather than a straight one. After the anterior cartilaginous meatal wall is uncovered, a jaw lever is used to keep the mouth open (and thus provide more room), and the entire anterior bony wall (the tympanic plate) is removed.

Popper sacrifices the cutaneous lining of the tympanic plate, but the author elevates and preserves the skin and from it forms a skin flap, as shown in Figure 1, to be used in covering the vestibular fenestra. Entry to the attic is then gained by drilling with a 2 mm burr, as shown in Figure 2, and then removing the bony wall with chisel and punch. The incus is then easily removed through this opening but the head of the malleus is not disturbed.

The fenestra, after Lund's modification, is made in the vestibule just above the facial canal. After removal of the periosteal layer of the cupola an elongated hole is made in the most prominent part of the cupola. During this process, the field is under continuous irrigation with Ringer's solution.

After the fenestration, the tympanomeatal flap is placed over the fenestra and kept in place by tam-

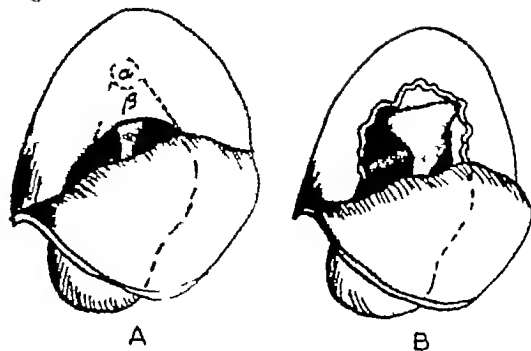


Fig 2 (Lund) A shows the pars flaccida of the tympanic membrane plus the meatal flap reflected forward over the tympanic membrane. The crus longum incus is seen in the depth. A hole is drilled in the lateral attic wall over the vestibular space *a*. The "bridge" *B* is chiseled off. B shows the hole of the lateral attic wall widened, the incus presenting. A relief of the facial canal is seen in the depth.

ing loosely with gauze. The operation is performed under general anesthesia. The patients are given sulfanilamide preoperatively and postoperatively and penicillin postoperatively.

The author believes that Popper's transtympanic approach has an important advantage over the transmastoid approach in that the "square on" view makes the operative technique easier. Thus, the operative trauma is less. The author's modification of Popper's method involves mainly the suggestion of an inverted U-shaped meatal flap, the width corresponding to the attic wall. He gives a summary of his operative mishaps. JOHN J. BALLENGER, M.D.

#### **Transtympanic Approach and Fenestration: The Current Technique** OTTO POPPER *Arch Otolaryngol*, Chic, 1949, 49: 350

The author discusses his transtympanic approach in operations on the middle ear. It is ideal for the performance of atticotomy if the mastoid process is sclerotic and the infection is confined to the atticotomy region as an alternative procedure to the radical mastoidectomy. It is also a dual procedure, as it can be used in the fenestration operation; it is a transtympanic approach followed by the Lempert fenestration.

The author discusses in detail the advantages of his procedure over that of the Lempert technique. It is a difficult operation to learn, he admits, and should be practiced on cadavers even if the student is an expert with the Lempert procedure. The position of the patient at operation, and the illumination and magnification of the operative field are also discussed.

The author discusses a series of 200 cases and the difficulties in evaluating the results to date because of the time element and the newness of the procedure. He admits that his record is not as impressive as some other previously published studies, but he

## SURGERY OF THE HEAD AND NECK

hopes that with more experience, and with other surgeons using the transtympanic approach, the records of achievement will be equalled.

In conclusion, the author gives a somewhat detailed description of the operative technique for the transtympanic approach. The article contains diagrams and drawings showing the different stages of the operation.

WILLIAM A. AHROON, M.D.

### NOSE AND SINUSES

**Benign Cysts of the Superior Maxilla with Special Reference to Cysts of the Maxillary Sinus Clinicopathologic Study of 30 Cases** LELAND R. HOUSE *Arch Otolaryngol*, Chic., 1948, 48, 301

The author discusses cysts of the superior maxilla and reviews 48 selected cases from the White Memorial Hospital, Los Angeles, California. These cysts occur more frequently than is generally believed. In 27 cases of this series of 48 selected cases radical surgical procedures were performed on the maxillary sinus for some type of cyst, in 24 of these the cyst was found in the maxillary sinus, and in 3 it was found in the bony palate adjacent to the sinus.

There are various classifications of these cysts, but the following are those of the author:

- 1 Cysts of nonodontal origin
  - a Retention cysts (secreting cysts)
  - b Nonsecreting cysts of the nasal mucosa
  - c Mucocoele
  - d Traumatic bone cysts
- 2 Cysts of dental origin
  - a Follicular (dentigerous) cysts
  - b Radicular (root) cysts
- 3 Cysts of nonodontal origin developing from defects in embryonic life
  - a Median anterior maxillary cysts
  - b Facial cleft cysts

The author discusses the pathology, etiology, findings at examination, and the diagnosis of these various types of cysts in some detail. He also gives short case presentations of each type of cyst. These types are also illustrated by photographs and photomicrographs.

WILLIAM A. AHROON, M.D.

### MOUTH

**Cleft Lip and Palate Some Technical Procedures Used in Its Treatment, with Especial Reference to Closure of Complete Cleft of the Anterior Half of the Palate** FRED Z. HAVENS *Arch Otolaryngol*, Chic., 1948, 48, 9

Procedures for the repair of harelip have been thoroughly described and discussed by numerous authors. For the single harelip the Mirault operation is a most excellent procedure and is applicable in a large percentage of cases. It may be necessary, however, to make modifications in order to cope with special problems. Occasionally the Rose operation is preferable, especially in cases of incomplete harelip.

In the management of the accompanying nasal deformity, emphasis is to be laid on the necessity of

building a good floor for the nostril, of freeing the tissues widely so that the nose comes into proper relationship to the face as a whole and, finally, of making the necessary dissections in order to mobilize the alar cartilages so that they can be brought into as nearly normal position as possible.

For bilateral complete harelip, the Thompson operation combined with the procedure advanced by Veau for closure of the alveolar and anterior palatal clefts has given excellent results.

For the repair of those clefts which involve only the soft palate or the soft palate and the posterior half to two-thirds of the hard palate, the author has employed the Wardill type of operation with gratifying results.

He is of the opinion that it is important to free the soft tissue from the medial surface of the internal pterygoid plate above and behind the hamular process after this has been disconnected. The procedure which he follows is described in the complete article.

Repair of the incomplete cleft of the palate usually is deferred until the patient is between 14 and 16 months of age.

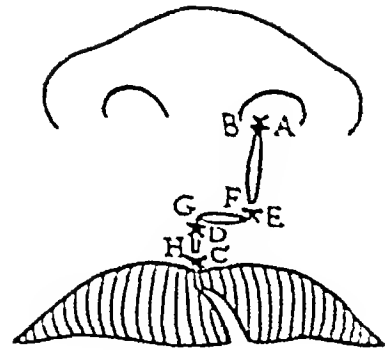
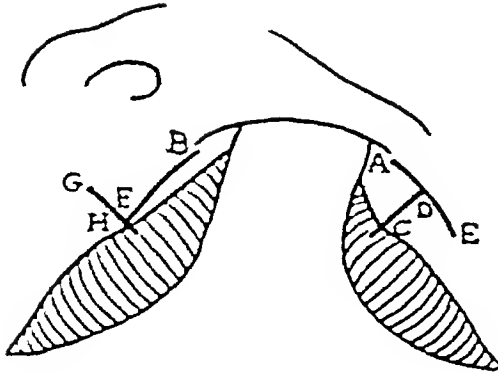
For the complete cleft of the palate, either single or bilateral, the author prefers the Veau type of operation if the cleft involves the anterior part of the palate and the alveolar process.

In cases of single palatal cleft and associated single harelip, the Veau type of closure of the anterior half of the palate and of the alveolar process is combined in a single stage with a Mirault type of repair of the harelip.

In cases of bilateral complete cleft palate and bilateral harelip, the bilateral Veau operation and the bilateral repair of the harelip sometimes can be done as a single operation, or the anterior part of the palate and the lip can be repaired on one side only at one time, and the same operation done on the other side after an interval of from 10 days to 2 weeks. Often, the decision whether to use the single stage or the two stage method is not made until the defect of one side has been repaired. If the operation has proceeded smoothly thus far and if the child is taking the anesthetic well and is in good condition, one can proceed with the repair of the defect on the other side, otherwise, it is better to defer the remainder of the repair until later.

In cases of bilateral cleft of the palate and lip, the Thompson method of repair of the lip is preferred. When the premaxilla projects badly, it usually can be forced back by digital pressure so that the lip can be closed, and only rarely is it necessary to section the vomer. If section of the vomer is necessary, simply dividing it so that the anterior segment can slide back alongside the posterior segment is preferable to removing a portion of it.

The author is fully aware that criticism has been made of the Thompson type of operation for double harelip. However, it is not to be expected that this severe deformity can be corrected satisfactorily by a single operation in infancy. Further plastic operations are needed almost invariably.



This tumor, often diagnosed as a malignant neoplasm, presents itself as an immovable, hard, and smooth or lobulated tumor of one of the salivary glands, most often the submaxillary. Its growth is slow and painless, with fixation to the surrounding tissues, such as the buccal mucosa, by solid adhesions. No abnormality of the salivary duct orifice is noted.

The diagnosis is made by histologic examination, after total excision, and the principal features of the histologic picture are abundant fibrous connective tissue separating the acini and enclosing various-sized sections of glandular parenchyma, infiltration of polymorphonuclear leucocytes and plasma cells, destruction of glandular parenchyma, and thickening of the lumina of the ducts.

After reviewing the opinions of other writers the author concludes that the etiology, although as yet unclear, is not related to the common pyogenic organisms, since the inflammatory process is not characterized by tissue softening, necrosis, and purulence.

The treatment of choice is excision of the tumor, and no recurrence has ever been reported.

EUGENE L. DERLACKI, M.D.

### PHARYNX

#### A Clinical and Pathologic Study of Tonsil Tags

J. OLIVER GOOCH and HAROLD I. LILLIE *Ann Otol Rhinol*, 1948, 57, 957

The authors' study of cases of tonsil tags at the Mayo Clinic and in the literature on this subject reveals that the physiology of the tonsil is poorly understood. This study also indicates that the presence of tonsil tags is difficult to demonstrate in many instances, and reliance should be placed on qualified otolaryngologists for this examination.

The common associated signs and symptoms of 171 patients who underwent operation for the removal of tonsil tags at the clinic, in order of frequency, were (1) sore throat, (2) pain in the joints, (3) cervical adenitis, (4) lassitude, (5) loss of weight, and (6) fever. The common associated conditions diagnosed in patients undergoing operation for removal of tonsil tags, in order of frequency, were (1) arthritis, (2) fibrositis, (3) chronic heart disease, (4) chronic disease of the middle ear, (5) chronic renal disease, (6) affections of the eyes, and (7) asthma.

The cause of tonsil tags is incomplete removal of the tonsils. Complete removal can be accomplished only when the thickened capsule is removed by sharp dissection.

The average tonsil tag can be described compositely as a bit of tonsil tissue of varying size covered by stratified squamous epithelium which also lines the crypts. The crypts contain increased amounts of keratin, cellular debris, and leucocytes. Stasis, as a result of induration, is present in the crypts, a condition which provides suitable soil for infection. Ulceration of the epithelium lining the crypt is frequent. The lymphoid elements continue to be arranged in

characteristic pattern and germinal centers remain when a sufficient amount of the lymphoid tissue is present. When the lymphoid tissue is of such a scant amount that only nests of it without germinal centers are seen, the stroma of the gland shows considerable increase in fibrous connective tissue, particularly in the subepithelial area and in the trabeculae in which the blood vessels course. The capsule is thickened and may contain isolated bits of lymphoid tissue or cystic areas of varying size. The entire gland is indurated and inelastic when compared to a normal whole tonsil. Tonsil tags were found to be more dangerous from a standpoint of infection than are whole tonsils. Diathermy tags studied presented the same pathologic qualities as those of operative tags but in greater degree.

### NECK

Nontoxic Nodular Goiters. GEORGE CRILE, JR., and W. S. DEMPSEY *J. Am. Med. Ass.*, 1949, 139, 1247

The present study was undertaken with a view to determining whether the routine removal of soft, nontoxic nodular enlargements of the thyroid is warranted, as is that of firm nontoxic adenomas. Between 1937 and 1946, 30 malignant tumors were encountered in a series of 768 thyroidectomies, an incidence of 3.9 per cent. Of 274 nontoxic nodular goiters removed surgically, 10.9 per cent proved to be malignant, as did 24.5 per cent of 98 cases of nontoxic solitary tumors. The incidence of malignancy in 537 nodular goiters, with or without hyperthyroidism, was found to be 5.6 per cent. The correct diagnosis was made or suspected prior to operation in over 90 per cent of the patients presenting malignancy.

It was pointed out that the figures obtained in this study could be interpreted as indicating that (a) over 3 per cent of nontoxic nodules of the thyroid are undiagnosed malignant tumors, or (b) there is only 1 chance in 6,675 that removal of a nontoxic solitary nodule in the thyroid will give protection against death from carcinoma of the thyroid. Emphasis was also placed on the pitfalls inherent in statistical determinations of the incidence of carcinoma of the thyroid in nodular goiter. It was believed that the high incidence of carcinoma reported by surgeons was due principally to the selectivity of cases for surgery, the obviously benign nodules being screened out by the patient or internist.

The authors came to the conclusion that it was best to base indications for removal of nodular goiters on clinical judgment rather than on statistical surveys. The pertinent concern, it was reasoned, was not motivated by the question of subsequent malignant transformation of an adenoma as much as by the possibility that carcinoma existed at the time of examination.

The authors urged that solitary thyroid adenomas be viewed with suspicion, irrespective of the age of the patient, particularly in cases in which the tumor is enlarging, discrete and firm, and of a different

consistency from the rest of the gland. The removal of large adenomas for cosmetic reasons was also recommended. However, it was felt that soft involutary nodules which were multiple, inconspicuous, and asymptomatic, and which were not enlarging in size could be disregarded.

DAVID H. LYNN, M.D.

**Carcinoma of the Thyroid Gland** WILLIAM E. HOWES and MERRILL N. FOOTE *Radiology*, 1949, 52: 541

The authors have studied 40 proved cases of carcinoma of the thyroid in patients admitted to the Brooklyn Cancer Institute. Of these, 33 were females and 7 were males. The average age of the patients was 55 years. The lesions were classified microscopically as anaplastic carcinomas, papillary adenocarcinomas, adenocarcinomas (including Hürthle-cell adenocarcinomas), squamous cell carcinomas, and unclassified carcinomas.

Adenocarcinomas, presumably arising in adenomas, were found in the largest group in this series. Although such tumors were prone to metastasize early via the blood stream, often before the parent neoplasm was recognizable, more than 50 per cent of the patients survived 5 years or longer. The outcome was less satisfactory in the 4 remaining groups,

only 6 other patients in the entire series surviving. The high percentage of survivals among the patients with adenocarcinoma is attributed to radiosensitivity of the lesion, the slow growth of the parent tumor and its metastases, and the unusual tolerance of patients to this neoplasm.

Medullary or anaplastic carcinomas were found to grow rapidly and metastasize early, seldom to bone. They were inclined to be radiosensitive but not radiocurative. Metastases of papillary carcinoma frequently overshadowed and masked the primary tumor and took place early via the cervical lymphatic chains. However, metastasis was seldom widespread. Squamous-cell carcinoma and sarcoma of the thyroid are extremely rare, only 1 case of the former type being encountered.

In general, the prognosis continues to remain poor if the presence of carcinoma of the thyroid is sufficiently evident prior to operation to warrant this diagnosis. The most successful results are achieved when the neoplasm is localized within an adenoma. Surgical treatment combined with irradiation appears to have improved the life expectancy in the more advanced cases. At least 2 patients appear to have obtained symptomatic improvement from the use of radioactive iodine (I-131).

DAVID H. LYNN, M.D.

# SURGERY OF THE NERVOUS SYSTEM

## BRAIN AND ITS COVERINGS, CRANIAL NERVES

**Abscess of the Brain** JOHN MARTIN and LOYAL DAVIS  
*Q Bull Northwest Univ M School*, 1949, 23 64

Since the advent of chemotherapy and antibiotics the course of infection in various parts of the body has been strikingly altered. Acute cerebritis and brain abscess are no exceptions, and thus the surgical problems and clinical pictures have been considerably changed. This article points out the problems now involved in the management of cases with localized infection of the brain. The material consists of 105 patients with a diagnosis of brain abscess, in 89 of whom the diagnosis was verified, in 16 it was not, but most of the latter were patients treated intensively by chemotherapy and antibiotics. The authors had experience with a large number of brain abscesses due to open wounds incurred in military service.

The pathology of brain abscess is adequately discussed with reference to the usual sources of origin. The result of infection in the brain is reviewed, with illustrations, from the swelling of the white matter through areas of liquefaction to the encapsulated abscess. Abscess of the brain is still difficult to localize for some of the methods usually employed in expanding lesions are not acceptable and others are not reliable. Encephalography and even ventriculography may be dangerous and electroencephalography is not specific for abscess as opposed to swelling and softening. Neurological examination is, of course, the most reliable guide but this may fail. Further, since the use of intensive chemotherapy, encephalograms have been normal in patients strongly suspected of having an abscess which eventually must have cleared up under intensive modern treatment.

The surgical problem has changed with recent methods. Fewer patients are seen with brain abscess and far less of these come to operation. Under intensive treatment with penicillin and sulfadiazine, fewer abscesses go on to capsule formation and so fewer abscesses are tapped or are totally removed. Some years ago abscesses were allowed to form capsules and were either tapped as often as necessary or they were completely extirpated. Tapping may still be necessary and subtemporal decompression may be required to counteract the swelling of the brain, but the aftermath has many drawbacks. Many patients have residual neurological defects such as some contralateral weakness, aphasia, or Jacksonian seizures. The mortality rate is now much lower and many abscesses may be cured as far as their infectious component is concerned but apparently, in the brain, as elsewhere in the body, this cannot be done without scar formation and destruction of substance. ADRIEN VER BRUGGEN, M D

## SPINAL CORD AND ITS COVERINGS

**The Cause of Spinal Paralyzes with Special Attention to Factors Responsible for Compression** (Zur Aetiologie der spinalen Laehmungen mit besonderer Beruecksichtigung der Kompressionsnoxen)  
ROBERT H. VON MURALT *Helvet chir acta*, 1949, 16 3

A review of 104 patients with extramedullary and 17 with intramedullary compression of the spinal cord who were operated on during a 10 year period led the author to the following conclusions:

A subdivision of intravertebral processes into intramedullary and extramedullary types is of practical importance from the therapeutic point of view.

All factors responsible for compression of the spinal cord may be divided into mechanical, infectious, anoxic, idiopathic, and congenital.

Metastases, meningitic processes, injuries, kyphoscoliosis, and Paget's disease may serve as examples of mechanical factors. Suppurative or tuberculous meningomyelitis, mycoses, and acute anterior poliomyelitis are representatives of infectious processes. Blood or air emboli may cause anoxemia. Examples of an idiopathic degeneration are spastic spinal paralysis or amyotrophic lateral sclerosis. Congenital malformations are represented by syringomyelia or hydromyelia.

One-third of all the intramedullary tumors were malignant.

Among the benign tumors there were 34 neurinomas, 25 meningiomas, and 9 other types.

The author calls attention to the fact that compression of the spinal cord at any level is able to produce a flaccid paralysis.

Compression of the spinal cord may be mistaken for arachnoiditis, Elsberg's disease, thickened ligamentum flavum, kyphosis, and spinal varicosities.

Hereditary factors have not been sufficiently elucidated but seem to be of minor importance.

The rôle of trauma must be denied in the majority of cases.

Untoward effects of spinal puncture can usually be avoided by strict observance of all technical rules and the employment of a fine needle.

Mycelography is harmless if a small dose of a water soluble contrast medium is used.

JOSEPH K. NARAT, M D

## PERIPHERAL NERVES

**Vasomotor Changes in Peripheral Nerve Injuries**  
C. A. R. SCHULENBURG *Surgery*, 1949, 25 191

An interesting study is presented of the changes in skin temperature produced by degenerating or regenerating peripheral nerves in various periods after injury and repair. The skin temperatures were measured by a "sensitive instrument employing a light-



consistency from the rest of the gland. The removal of large adenomas for cosmetic reasons was also recommended. However, it was felt that soft involutary nodules which were multiple, inconspicuous, and asymptomatic, and which were not enlarging in size could be disregarded.

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A subdivision of intravertebral processes into intramedullary and extramedullary types is of practical importance from the therapeutic point of view.

All factors responsible for compression of the spinal cord may be divided into mechanical, infectious, anoxic, idiopathic, and congenital.

Metastases, meningitic processes, injuries, kyphoscoliosis, and Paget's disease may serve as examples of mechanical factors. Suppurative or tuberculous meningomyelitis, mycoses, and acute anterior poliomyelitis are representatives of infectious processes. Blood or air emboli may cause anoxemia. Examples of an idiopathic degeneration are spastic spinal paralysis or amyotrophic lateral sclerosis. Congenital malformations are represented by syringomyelia or hydromyelia.

One-third of all the intramedullary tumors were malignant.

Among the benign tumors there were 34 neurinomas, 25 meningiomas, and 9 other types.

The author calls attention to the fact that compression of the spinal cord at any level is able to produce a flaccid paralysis.

Compression of the spinal cord may be mistaken for arachnoiditis, Elsberg's disease, thickened ligamentum flavum, kyphosis, and spinal varicosities.

Hereditary factors have not been sufficiently elucidated but seem to be of minor importance.

The rôle of trauma must be denied in the majority of cases.

Untoward effects of spinal puncture can usually be avoided by strict observance of all technical rules and the employment of a fine needle.

Myelography is harmless if a small dose of a water soluble contrast medium is used.

JOSEPH K. NARAT, M D

## PERIPHERAL NERVES

**Vasomotor Changes in Peripheral Nerve Injuries**  
C A R. SCHULENBURG *Surgery*, 1949, 25 191

An interesting study is presented of the changes in skin temperature produced by degenerating or regenerating peripheral nerves in various periods after injury and repair. The skin temperatures were measured by a "sensitive instrument employing a light-

beam galvanometer." After section of a peripheral nerve the denervated skin passes through a temporary warm phase of initial vasodilatation lasting approximately 3 weeks, and a more permanent cold phase in which the temperature corresponds mostly to that of the environment. The author considers that the warm phase is caused by interruption of the vasoconstrictor sympathetic fibers within the peripheral nerve.

Various factors are responsible for the change from the warm phase to the cold phase, such as the lowering of the local metabolism of inactive or inert tissue. Division of postganglionic sympathetic fibers in the peripheral nerve sensitizes the denervated vessels to circulating adrenalin. This drug was found to produce significant falls of temperature in totally denervated areas, slight but definite falls in partially innervated areas, and only a slight insignificant fall in normal areas. The axonal vasodilatation of Lewis (histamine flare) occurring in response to minor trauma disappears after nerve degeneration is complete, but is present during the degenerating and regenerating process. The reduction of the total blood flow to the entire limb as a response to cold environment was thought to be not as important as the local environmental temperature itself. The prolonged effect of short exposure of the denervated skin to cold temperature was thought to be due to local effect on the blood vessel walls. A thickening of the intima and the media, with interruption of the internal elastic lamina, was found in digital vessels in cases which came to amputation.

Plethysmographic studies showed interesting changes after reflex warming of the involved extremity, which were characteristic of nerve regeneration.

GEORGE PERRET, M.D.

#### Open Wounds of the Brachial Plexus DONAL M. BROOKS *J Bone Surg*, 1949, 31-B 17

In 42 of 820 peripheral nerve injuries due to penetrating wounds, the brachial plexus was involved. In order to compare the results, the author adopted the following method of grouping the injuries.

Group 1 consisted of lesions of the roots and trunk of the fifth and sixth cervical nerves, Group 2 consisted of lesions of the posterior cord, and Group 3 was made up of lesions of the eighth cervical nerve, the first thoracic, and the medial cord.

The object of the study was to answer pertinent questions regarding the findings, results, and the advisability of exploration of the brachial plexus in injuries due to open wounds. All patients were treated by electrical stimulation of the paralyzed muscles, and observations are recorded for at least 2 years following injury.

The brachial plexus was explored in 22 patients. In only four instances, however, was interruption of continuity of the nerves found, in contrast to the frequency of division of nerves in more distal injuries under war conditions. It was not considered justifiable to resect a lesion in continuity, and there was no evidence that neurolysis influenced recovery

in any instance encountered in the 22 explorations, although the scarring was severe. The findings at exploration are classified, and correlation between the operative findings and the prognosis is not considered precise. Results of repair in 3 cases of nerve severance were discouraging.

The recovery of patients in Group 1 was good, in Group 2, fair, and in Group 3, poor. Five patients presented Horner's syndrome, and in 11 patients the brachial plexus paralysis was associated with injury to a main vessel. Analysis of the results is clarified by the inclusion of case histories in well planned tables. The author concludes that the routine exploration of open wounds of the brachial plexus is not justified.

JOHN L. BELL, M.D.

#### Modern History of Peripheral Nerve Surgery BARNES WOODHALL. *J Am M Ass*, 1949, 139 564.

The recent war caused a tremendous amount of peripheral nerve surgery to be done and provided a stimulus for research on the regeneration of nerves in the human being. Some 15,000 peripheral nerve operations were performed and a Peripheral Nerve Registry of World War II was established. By the end of hostilities about 7,000 nerve sutures were registered and follow-up clinics have been established for veterans. These should eventually add to the experience in this field and lead to some application in civilian practice.

Suture material was carefully considered and, finally, tantalum wire 0.003 inch in diameter was found useful not only because it was inert in the tissues, but also because the suture line could be reviewed roentgenologically. Fine silk was easier to handle in some cases of small nerve repair. Plasma glue was useful as an auxiliary when there was no tension on the suture line. Nerve grafting, and especially cable grafting, was said to be of help when there were nerve defects that could not otherwise be bridged.

Causalgia, whatever its etiology, was almost universally relieved by chemical or surgical interruption of the appropriate sympathetic nerve fibers. This distressing complication occurs in about 3 per cent of nerve injuries.

The proper time for suture has been debated but it appears that the definitive time is from 3 to 6 weeks after the initial trauma. Normal wound healing occurred in 98 per cent of the cases and failure of the suture line in only 5 per cent as compared to 22.4 per cent following immediate nerve suture. Operation is performed best under relatively normal conditions both as far as the patient and the surgeon are concerned.

ADRIEN VER BRUGGHEN, M.D.

#### MISCELLANEOUS

#### Evaluation of Treatment of Hypertension WINCHELL MCKENDREE CRAIG *J Am M Ass*, 1949, 139 1239

Essential hypertension, similar to all disease entities of which the causes are obscure, has a tendency

to progress as time and age advance. It requires careful and frequent observation, and treatment should be instituted before more severe stages of the disease develop. Abnormal elevation of the blood pressure may persist for years in a minimal degree without producing symptoms or disability, and more severe elevation of the blood pressure may respond to medical management and remain under control without being disabling or showing evidence of progression. The problem confronting the medical profession today is the control of progressive hypertension, and the prevention of irreparable damage to the various structures of the body.

Not much is known about the mechanism of elevation of the blood pressure in essential hypertension. Three factors are responsible for maintaining normal blood pressure, and derangement of any one of these may cause a change in the blood pressure. The cardiac output, the volume or viscosity of the blood, and the resistance to the flow of the blood through the peripheral arterial system determine the blood pressure. Cardiac output or viscosity of the blood is not altered in essential hypertension, but the caliber of the peripheral vessels is decreased. The decrease in diameter of the peripheral vessels is attributable to (1) a condition inherent in the arterioles and (2) an abnormal reaction of the arterioles to vasomotor stimuli.

There is a large hereditary factor in essential hypertension. Little therapeutic interest has been centered on early or potential hypertension in spite of definite evidence that heredity plays a part in the etiology, that hyper-reactive children have been found, and that a recent report from one of our leading medical schools revealed that 20 per cent of the students were found to have arteriosclerosis.

Treatment may be classified as expectant, physiologic, and palliative. Expectant treatment con-

sists of (1) determining whether the patient is a hyper-reactor and has early hypertension, (2) instruction as to the harmful effects of nicotine and emotional stress, and (3) education in the proper methods of living.

The physiologic treatment comprises both medical and surgical measures and is indicated in the early stages of the disease before irreversible changes have taken place in the vascular and organic tissues of the body. This type of therapy is instituted to arrest the progress of the disease. The medical treatment consists of diets and drug therapy. The surgical treatment consists of operations upon the sympathetic nervous system to relieve vasomotor spasm of the vessels of the splanchnic region, abdomen, and lower extremities.

Palliative treatment consists primarily of surgical measures. Its objective is to relieve the incapacitating symptoms of the later stage of the disease without arresting the progress of the condition or lowering the blood pressure.

The author's observation is that less radical operations might be followed by more permanent results if instituted earlier in the course of the disease. If the less radical operations are not entirely successful or if the results prove temporary, the more radical procedures can then be done.

Instead of an attempt to evaluate surgical results by classification of the condition of the patients post-operatively, it would seem that a more rational basis would be the assigning of the hypertension of a patient to the correct individual group preoperatively. This, together with the prognoses associated with the several groups of hypertension, would form a background for evaluation.

The author has presented a report of 4 cases in the complete paper and has enlarged on each of the three types of treatment for hypertension.

# SURGERY OF THE THORAX

## CHEST WALL AND BREAST

**The Operative Treatment of Pectus Excavatum**  
MARK M. RAVITCH *Ann Surg*, 1949, 129 429

Pectus excavatum is a deformity of the thorax which is marked by a sharp posterior curve of the body of the sternum—deepest in the inferior portion. The lower cartilages bend inward and the sternum moves posteriorly on inspiration. The deformity is usually progressive from birth. Physiologic disturbances of the thoracic viscera may occur. The mechanism of the deformity is uncertain. It may be due to a short central tendon. At operation a tough fascial band, tensely stretched between linea alba and sternum, is usually found. On section of this band the sternum may be elevated.

Operation is undertaken to correct the existing deformity and to prevent its progression. Indications for operation are (1) cosmetic, (2) orthopedic, and (3) physiologic. In the procedure described, the xiphisternal articulation and substernal ligament are divided and all the deformed costal cartilages are dissected. A transverse cuneiform osteotomy is performed at the sternomanubrial junction and the position is maintained by braided silk sutures. No traction is used. The defect from excision of the cartilages is allowed to remain.

The author points out that early operation is important as a prophylaxis against progression of symptoms and signs. He has treated 8 children ranging in age from 22 months to 10 years. In 7 children there were no complications and the results were excellent. One child died of a fulminating wound infection.

ROBERT E. FLORER, M.D.

**Mammoplasty for Pendulous Breasts** G. AUFRICHT  
*Plast Reconstr Surg*, 1949, 4 13

Any reconstructive operation on a woman's breast is a major problem in technique and esthetics. Certain precautions must be observed: (1) fixation landmarks should be considered in relation to the thorax, (2) allowance should be made for the elasticity of the skin and the effect of breast weight on it, (3) measurements of both breasts should be made under similar conditions, to produce symmetry.

From the surgical point of view, all breast tissues are well vascularized and there is sufficient blood supply from any direction to nourish the corresponding breast tissue. It should be treated as in the preparation of a skin flap, providing a sufficient nourishing pedicle to the remaining gland, and leaving a broad central axis of tissue intact to protect the areola and nipple.

The esthetic aims are normal size, form, position, symmetry, and inconspicuous scarring. An attempt should be made to form a gently pendant, mature breast rather than a virginal one, as it is more normal in appearance, longer lasting, and the scars are less

conspicuous. A tight skin brassiere must be made to maintain this effect.

There are two approaches to mammaplastic operations: (1) improvised (without presurgical mensuration), and (2) presurgically planned—(a) visual empiric or (b) geometric.

The visual empiric planning is as follows. The new nipple site is selected visually with the patient standing erect with arms relaxed, and then marked. The width of the breast is measured about 1 or 1½ inches above the planned nipple site, and the width bisected. The central point is connected with the actual nipple, and the point at which this bisects the planned nipple level will be the site of the new nipple. The breast is then pushed forcibly to one side and the point in the submammary fold below the nipple site is connected with a straight line to the new nipple site. The breast is then pressed in the opposite direction and the same points connected. The skin between these lines is the vertical sector to be removed. A transverse segment must be removed at the lower aspect of the breast to correct the redundancy. This is done by measuring the distance between the new nipple site to the submammary fold on the vertical lines and excising the medial and lateral triangles below these points, taking care not to extend the apex of the inner triangle beyond the lateral sternal line to insure inconspicuous scarring.

The normal breast can be considered as a geometric body, a hemisphere, or a cone. As such it has geometric components, namely, circumference, diameter, radius and axis, and can be used to reconstruct a pendulous breast.

The normal or reconstructed breast should be placed between the lateral sternal and preaxillary lines and between the submammary fold and the lower border of the third rib.

The diameter of the breast should be equal in the vertical and transverse planes between the boundaries indicated above. If not, the sums are added together and divided by 2, to get the mean diameter. Similarly the procedure is carried out on the opposite breast. If there is a great difference between the mean diameters of the two breasts, the two are added together and divided by 2, the resultant sum being acceptable for the diameter of each breast. The thickness of the breast is measured from the chest wall to the summit of the breast. A quadrangle is then drawn on a piece of paper, the long side equal to the diameter and the short side equal to the thickness of the breast. The quadrangle is divided into three equal parts and a diagonal is drawn through the first two-thirds and another in the opposite direction through the last third. These diagonals represent the silhouette of the breast. The long diagonal is projected on the mammillary line from the lower border of the third rib and the lower end indicates the new nipple site.

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With the aid of the diameter, the circumference of the required skin flap can be established by the use of the mathematical formula  $\pi$ , which denotes the ratio of the circumference of a circle to its diameter (3.1416).

The requisite flap is fashioned from that available by measuring the width of the hypertrophic breast, multiplying by 3, and measuring this circumference on a circular flexible metal tape, placing the zero mark at the upper limit of the new breast (third rib), the mid-marker at the opposite pole on the mammary line, the skin included in the circle being the amount available. Now half distance points of the circumference of the planned breast are marked on the large circle from the zero point, and these are connected with the new nipple site, forming an inverted V. The shorter diagonal of the quadrangle of the paper pattern is then measured on this V from the nipple site. The redundant skin to be excised is that between the inverted V and down to the submammary fold. To measure the amount of breast tissue proper, the diameter of the planned breast is used, subtracting 2 cm for the thickness of the skin covering, figuring the new circumference, and measuring this amount on the periphery of the hypertrophied breast, removing the surgeon, but whatever location is desired by the surgeon, but excising not closer than 2.5 to 3 cm to the center of the circle to preserve the areola. This discrepancy in geometric planning may be compensated by removing an additional 1.5 cm from the periphery and making the circumference of the planned skin brassiere 1.5 cm longer.

The areola is similarly reduced in circumference in proportion.

When the reconstructed breast is affixed in its proper position, the areola is anchored in position, and, as a control measure before excision, the skin is approximated with towel clips along the planned lines and any necessary adjustment of the skin brassiere can be made before the excess skin is excised.

Fine silk sutures are used for closure of the skin margins, with drains at medial and lateral aspects of each breast, and a dressing of fluffed gauze and a snug binder is applied.

LOUIS T. BYARS, M.D.

### Some Enigmas Associated with the Genesis of Mammary Cancer in Mice

JOHN J. BITTNER  
*Cancer Res*, 1948, 8: 625

The interpretation of data on the genesis of mammary cancer in mice in which the disease results from the interaction of several causative factors is becoming more difficult as shown by a review of the results of various experiments.

Because of the isolation of sublines within inbred strains of mice, and the possible influence of environmental factors, as well as of environmental factors, upon the final results, controls should be maintained for each experimental series. The physiological response of animals of various stocks following castration has been found to be

dependent upon the genetic constitution of the animals. In several strains an association has been found between adrenal hyperplasia and estrogenic stimulation of the secondary sex organs, as well as with the inherited hormonal influence. The possibility of other inherited hormonal factors is considered and discussed.

As the basis for further research, it is suggested that the role of the mammary tumor milk agent in the genesis of mammary cancer in mice may be to alter the hormone metabolism with the production of more "carcinogenic" hormones.

JOHN J. MALONEY, M.D.

### TRACHEA, LUNGS, AND PLEURA

Tracheobronchial Tuberculosis in General and Its Connection with Pulmonary Surgery P. M. STEINER. *J. internal chir. thor.*, 1949, 1: 7

The author gives a description of the various forms of tuberculous alteration of the bronchi, classing them according to the 3 stages of the evolution of tuberculosis.

Tertiary tuberculosis is divided into two kinds of alterations: those secondary to common phthisis, aggravating evolution and prognosis, and the seemingly primary alterations situated in the large bronchi and resulting in severe scarring stenosis. The latter seem to be a good indication for pneumonectomy when the disease is not too advanced and the patients are well selected.

JOHN J. MALONEY, M.D.

### An Analysis of Variations of the Segmental Bronchi of the Right Lower Lobe of 50 Injected Lungs

FRANKLIN R. SMITH and EDWARD A. BOYDEN, Jr.  
*Thorac. Surg.*, 1949, 18: 75

Notwithstanding the general acceptance in this country of the Jackson-Huber terminology of the bronchopulmonary segments, and in the British Empire of the somewhat differently named but corresponding zones, there seems not to have been made, as yet, a statistical study of the variations of the lower lobe segments. Brock discussed these from the standpoint of the varying amount of territory a given segment can cover and published excellent figures of some of these injected specimens. However, there still remains the task of analyzing variations in the light of an empirically established prevailing pattern, that is, of determining how cal surface area of a segment and then noting how often, and by what other bronchi, this is supplied in whole or in part. Such an analysis would seem to be a necessary preliminary to accurate localization of lesions of the lung and to surgical resection of its segments.

The present study is restricted to the segments of the right lower lobe.

The terminology employed in designating the bronchopulmonary segments is that proposed by Jackson and Huber (1943). The numerical designation of branches is that devised by Boyden (1945).

The distribution and arrangement of the segmental bronchi of the right lower lobe have been studied in 50 fresh lungs by the following methods (1) the successive injection of the principal bronchi by differently colored gelatin masses, (2) the accurate sketching of each injected lobe, to record the surface distribution of the bronchi on interlobar, costal, and diaphragmatic surfaces, and (3) the dissection of each lobe, to verify the distribution of bronchi and to ascertain their mode of branching.

From these data it has been possible to establish the prevailing pattern empirically, and to analyze the principal variations in the light of that knowledge.

As viewed from the interlobar surface the right lower lobe may be divided into superior and basal zones, the line of separation usually falling at the interfissural crest. Posteriorly, an interpolated, "subsuperior" zone can be demonstrated between superior and basal segments in 100 per cent of specimens (*vide infra*).

Since the superior segment is resectable, it is important to know its extent. Prevailing, it "caps" the basal segments horizontally, but in 38 per cent of specimens it is obliquely fitted to the basal segments. Usually (in 78 per cent), it occupies the upper half of the lobe, but it may occupy two-thirds of the lobe (8 per cent) or only one-third (14 per cent). On the paravertebral surface it may extend two-thirds (or more) of the way to the diaphragm (30 per cent of specimens).

The superior segmental bronchus ( $B^6$ ) has three constant ram—*a* medial ( $B^6a$ ), *a* superior ( $B^6b$ ), and *a* lateral ramus ( $B^6c$ )—but it rarely trifurcates (6 per cent), the prevailing pattern (86 per cent) being *a* bifurcation into  $B^6a+b$  and  $B^6c$ . On the interlobar surface the superior segment is usually fused to *a* greater or lesser degree with the right upper lobe, and in 5 of 11 consecutive specimens examined for this purpose *a* branch of  $B^6b$  was observed to supply the adjacent portion of the right upper lobe. This may explain how consolidation of the lower lobe, in lobar pneumonia, may extend into the adjoining area of the upper lobe.

The subsuperior zone is *a* constant posterior zone interpolated between superior and basal segments. In this series of dissections it has been identified in 100 per cent of specimens, as contrasted with Brock's identification of only 48 per cent in *a* series of bronchograms. It is supplied by one or more posterior bronchi of inconstant origin. These arise from levels 1.5 to 5 cm below the orifice of the superior bronchus ( $B^6$ ). For this reason, the bronchi supplying this zone have been indicated by the noncommittal designation, " $B^*$ " (Boyden, 1945).

In general the principal levels of origin correspond to Aeby's dorsal bronchi,  $d_2$  and  $d_3$  (the first dorsal being the superior bronchus,  $B^2$ ). That posterior bronchus which arises from Level 2 (that is, from the common stem of  $B^8$ ,  $B^9$  and  $B^{10}$  or  $B^{9+10}$ ) is designated the "subsuperior proper,"  $B^*$ . That posterior bronchus which arises from Level 3 (that is, from the

trunk of  $B^{10}$ ) is designated the "accessory subsuperior,"  $BX^*(10)$ .

In about one-half of the specimens (48 per cent), the subsuperior bronchi arise from both levels, and range in number from two to four. In the remaining one-half (52 per cent), there is only one subsuperior bronchus—more commonly  $BX^*$  (38 per cent), as against 14 per cent with *a* subsuperior proper.

Primarily the subsuperior zone lies in the posterior sector of the lobe, but it may spread laterally or medially. It is *a* common site of lung abscess.

The basal bronchi are four in number and tend to radiate from above downward into the anteromedial, anterolateral, posterolateral, and posteromedial sectors of the lobe, respectively.

The medial-basal segmental bronchus ( $B^7$ ) is the highest in origin. It extends to the zone that lies on either side of the pulmonary ligament (78 per cent of specimens), and is placed athwart the other basal zones—that is, it occupies *a* plane virtually at right angles to the others. This segment corresponds to the cardiac lobe of mammals. Therefore, it is not surprising to find *a* incisure of varying depth separating it from the anterior-basal segment in 36 per cent of specimens. In two-thirds of this number the incisure is possibly deep enough to have been visible in *a* roentgenogram.

The bronchus to this "cardiac" region commonly divides into *a* anterior ( $B^7a$ ) and *a* medial ramus ( $B^7b$ ). The line between the two usually falls in the sulcus of the inferior vena cava.

In 14 per cent of specimens the medial basal bronchus is absent as such, the zone being supplied by one or two accessory rami from the adjacent bronchi— $B^8$ ,  $B^*$ , or  $B^{10}$ .

Contrary to Brock, the zone prevailing occupies two-thirds or more of the anterior margin of the lobe, and contrary to Jackson and Huber it usually extends onto the paravertebral surface.

Because of the high accessible origin of its bronchus, the frequent presence of incisures, and the superficial position of this segment, it is deemed suitable for resection.

The anterior basal segmental bronchus ( $B^8$ ) is remarkably constant. It arises from the anterolateral aspect of the basal trunk, *a* little below  $B^7$ . It soon divides into *a* lateral ( $B^8a$ ) and *a* basal ramus ( $B^8b$ ). The former supplies the area on either side of the interlobar margin below the level of the interfissural crest. The latter supplies the lower part of this sector including the corresponding diaphragmatic area. Usually (50 per cent),  $B^8b$  occupies only the lateral one-third of the lower interlobar surface as measured along the inferior margin of the lobe, but in 16 per cent of specimens it extends as far medially as the sulcus of the inferior vena cava. In another 8 per cent it takes over the territory of  $B^8b$ . Occasionally the lateral ramus ( $B^8a$ ) invades the superior segment.

Because of the high origin of  $B^8$ , its fairly constant distribution, and the fact that its medial border is frequently marked by *a* incisure (36 per cent), it is also deemed suitable for resection.

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The lateral basal segmental bronchus ( $B^9$ ) arises deep within the lobe and is not considered to be readily resectable. It is absent in 8 per cent of specimens. Typically it divides almost immediately after its origin into a lateral ( $B^9a$ ) and a basal bronchus ( $B^9b$ ). The former ramus, when present (86 per cent), supplies the posterior lateral zone adjacent to the subsuperior. When absent, its territory is supplied by  $B^*$  or  $B^9a$ . The basal ramus ( $B^9b$ ) supplies the lower posterior lateral sector and the corresponding diaphragmatic area. When absent (8 per cent), its territory is taken over by  $B^{10}$ .

The posterior basal segmental bronchus ( $B^{10}$ ) appears to be a continuation of the lower lobe bronchus—particularly the ramus  $B^{10b}$  which extends into the inferior, posteromedial corner of the lobe. Typically,  $B^{10}$  breaks up into three major branches. The highest is that which has been already described as the accessory subsuperior,  $BX^*$  (10). It occurs in 86 per cent of specimens and is reflected upward or backward to supply the subsuperior segment. The two remaining major branches (the mediobasal,  $B^{10b}$ , and the laterobasal ramus  $B^{10a}$ ) pass respectively to the paravertebral and posterior surfaces, and to the corresponding diaphragmatic sectors.

Because of the inaccessibility of its origin, this bronchus, like  $B^9$ , is not readily resectable.

## An Analysis of Variations of the Segmental Bronchi of the Left Lower Lobe of 50 Dissected, and 10 Injected Lungs. ROGER M. BERG, EDWARD A. BOYDEN, and FRANKLIN R. SMITH. *J Thorac Surg*, 1949, 18: 216

A survey of the literature regarding the bronchopulmonary segments leaves one with the impression that the left lower lobe of the lung is a somewhat condensed or even defective version of the right lower lobe, that if one understands the pattern of the right side it is necessary to remember only one or two modifications—such as the union of medial and anterior basal bronchi—to comprehend the left.

Such at first was the experience of the authors. Soon, however, it began to appear that the left lobe, although capable of being compared with the right, is distinctive throughout. For instance, the ramus of the left superior segment have a different system of branching, the left subsuperior zone is prevalently posterolateral and not posterior, the left anterior basal and not the left medial basal is the "defective" bronchus, the lateral branch of the left lateral basal contributes to the subsuperior zone, and the left posterior basal, in a third of the specimens, was characterized by a prominent paravertebral ramus.

Hitherto, only Brock (1942 to 1944) seems to have made any detailed study of the variations of the lower lobe segments and he has largely confined himself to describing the varying extent of the segmental bronchi. The authors' purpose has been to establish the prevailing pattern in a large number of specimens and from this firm and hitherto unestablished base to analyze the significant and puzzling variations which are so frequently encountered.

In general, the terminology of Jackson and Huber (1943) has been employed, supplemented by the system of enumeration of bronchi developed by Boyden (1945). Also, throughout the article, the segmental pattern of the left lower lobe has been compared with that of the right, as was done by Smith and Boyden (1949).

An analysis of the bronchial tree of 60 left lower lobes is presented. The prevailing pattern and its variations are described and compared with those of the right lower lobe.

The superior segmental bronchus ( $B^8$ ) has the same apparent mode of branching as on the right side, namely, a bifurcation, but it differs in formula—" $B^8a$  and  $B^8b+c$ " instead of " $B^8a+b$  and  $B^8c$ ". The lower and independent origin of  $B^8a$  in the left lung seems to permit a greater paravertebral extent in that it reaches the lower third of the paravertebral surface in 57 per cent of the specimens. As a consequence, the superior segment caps the basal segments obliquely, whereas on the right side its orientation is prevalently horizontal. This presents an anatomic hazard to the resection of this segment. A large posterior branch of this ramus,  $B^8a_2$ , invades the posterior sector of the subsuperior zone in 45 per cent of the specimens.

The subsuperior zone is present in 100 per cent of the specimens. It is a wedge-shaped district that is interpolated between the superior and basal segments on the costal surface of the lobe. It derives its name from an independent dorsal ramus (the  $d_2$  of Aeby) which arises from the stem bronchus below the superior segmental bronchus. This "subsuperior proper" ( $B^*$ ) occurs less frequently on the left (29 per cent) than on the right side (62 per cent). In the left lung it extends primarily to the postolateral sector of the costal surface but it may spread laterally or posteriorly. (On the right side it extends primarily to the posterior sector.) When it is absent on the left, its place is taken by high posterior or posterolateral branches of the corresponding basal bronchi— $BX^*$  (10) and  $BX^*$  (6). These "accessory subsuperiors" may also supplement  $B^*$  when it is present. (On the right side the zone is supplied primarily by  $B^*$  and  $BX^*$  [10].) On both sides, according to Neil and others, the subsuperior zone is an important "site of localized pathologic change."

The basal bronchi have generally been considered to be three in number—the anteromedial basal ( $B^7+8$ ), the lateral basal ( $B^9$ ), and the posterior basal ( $B^{10}$ )—and to arise as a trifurcation of the lower lobe bronchus. As a result of the detailed analysis of 60 specimens it is believed that both ideas should be revised. First, the prevailing mode of branching (87 per cent) is a bifurcation, the common formula (67 per cent) being  $B^7+8$  and  $B^{10}$ . Second, it would seem necessary to give  $B^7$  and  $B^8$  an independent status. Whether they should be called subsegmental or segmental bronchi is of lesser consequence.

The medial basal bronchus ( $B^7$ ) arises with  $B^8$  from a short common stem in 87 per cent of specimens. Consequently, in contrast to its homologue





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life after an attack of atypical pneumonia. Conservative treatment is palliative but never curative in the established case. Recent advances in thoracic surgery have resulted in the development of a technique of partial or total pulmonary resection which makes possible eradication of the disease in many cases. An analysis of 96 cases in which 105 pulmonary resections were performed from January, 1933, to May, 1948, indicates that this treatment is not hazardous and gives satisfactory results in a high proportion of selected cases.

The essential diagnostic method is bronchography, by means of fluoroscopy and roentgenopaque substance (lipiodol) into the bronchial tree. It is essential that the entire bronchial tree be satisfactorily filled. The full extent of the pathologic process must be outlined and all normal lung sharply delineated. Only with this information can one proceed confidently with radical surgical procedures.

The type of treatment employed is based on the severity of the symptoms, the degree and extent of ectasia, and the age and physical condition of the patient. Minimal symptoms, however, do not warrant a radical attack. In the presence of significant symptoms surgical therapy must be considered. Pulmonary resection is the only form of surgical therapy which has proved satisfactory. The more localized the disease, the more amenable it is to resection. The more diffuse the pulmonary involvement, the more difficult the surgical problem, but careful segmental and lobar resections can eradicate even bilateral disease involving several lobes. In bilateral bronchiectasis, if the major involvement is on one side, the degree of relief obtained following resection of this portion of the pulmonary bed may be sufficient to obviate the necessity of resection on the second side. If extensive bilateral resections are contemplated, it is imperative that the residual lung be free of bronchiectasis.

Pulmonary resection is admittedly a formidable surgical procedure but the improvement in results over the years has been striking. Increasing experience in the evaluation and management of the patient, technical surgical refinements, effective antibiotics, and the increasing use of whole blood have contributed materially to the improvement in results.

The virtual disappearance of postoperative pneumonia, the chief cause of death, was coincident with the introduction of effective antibacterial agents and the institution of routine hilar dissection. The reduction in the incidence of empyema and fistula has been remarkable, although not as abrupt. Further technical refinements and the more effective use of antibiotics have contributed to this improvement. It has become increasingly apparent, however, that in the cases of partial pulmonary resection prompt re-expansion of the remaining pulmonary tissue to fill the hemithorax is of the utmost importance in the prevention of these complications. In order to accomplish this the bronchial tree must be constantly cleared of secretions. At operation two intercostal

tubes are placed, one anterior to the apex and the other posterior and low in the paravertebral gutter. These tubes are connected to a negative suction apparatus and remain for a few days until the lobe is well expanded and the pleural drainage minimal. Complete re-expansion usually occurs within from 24 to 72 hours. Postoperative pain has been reduced by the injection, at the time of operation, of all the intercostal nerves with a long-acting local anesthetic agent. This facilitates the encouragement of voluntary coughing which is the most important postoperative maneuver. The patient must be closely observed, examined, and assisted in coughing at frequent intervals the first few days. Nothing can replace this constant attention. Whenever spontaneous bronchial clearing is inadequate, intratracheal catheter suction should be used. The liberal use of whole blood preoperatively to correct anemia and to restore diminished blood volume in the debilitated, as well as prompt operative and postoperative shock, placement of all blood lost has prevented hastened convalescence, and, the authors believe, aided materially in aborting infection.

The progressive improvement in results with the reduction in morbidity and the practical elimination of fatalities as a result of the procedure make pulmonary resection an attractive therapeutic method. In this series there has been no hospital fatality in the last 92 operations. Subsequent death from pulmonary disease has occurred in 3.1 per cent of the cases. The incidence of irremedial unsatisfactory results has been 4.2 per cent. With present experience and facilities most of these unsatisfactory results should be completely prevented in the future. It therefore seems fair to state that pulmonary resection is indicated in any established case of bronchiectasis provided the disease is neither too mild nor too extensive, the patient is not elderly, and medical conditions are not contraindications.

JOHN E. KIRKPATRICK, M.D.

### Primary Bronchiogenic Carcinoma: Correlation of the Recent Literature with 131 Proved Cases

JOHN J. O'KEEFE. *Arch. Int. M.*, 1948, 82: 345

O'Keefe analyzed 131 cases of proved primary bronchiogenic carcinoma and correlated the data as found in the recent literature.

It was seen that the incidence of this disease is absolutely, as well as relatively, increasing. Characteristically, it is predominantly a disease of white men between the ages of 45 and 60, it has a definite predilection for the right lung, and the average length of life of patients not amenable to surgical treatment is from 12 to 18 months.

Notable among the efforts to secure earlier diagnosis is the development of the technique of cytologic study of bronchoscopically removed secretions, this practice promises to increase the recognition of early cancer of the lung by an appreciable margin.

The management of patients with this neoplasm entails the evaluation of several factors: the location and degree of extension of the primary growth, the



# SURGERY OF THE THORAX

An analysis of the delays incurred between the onset of symptoms and therapy are as follows

	1932-1942	1947-1948
	133 patients	
Patient's delay in seeing doctor	3 months	3 8 months
Interval between first symptom and establishment of diagnosis	12 75 months	10 months
First x ray examination ordered	3 months after seeing doctor	1 6 months after seeing doctor
Diagnosis established	5 75 months later	4 6 months later

The interval between the onset of symptoms and the diagnosis must be shortened, it can be altogether eliminated. The neoplasm can be discovered before it is large enough to produce symptoms since early carcinomas usually produce x-ray changes discoverable by the experienced observer even if the tumor itself will not cast a shadow, for approximately 80 per cent of the lesions are situated in a lobar or segmental bronchus. Roentgenologic screening of the population is necessary. Older age groups should be included and the screening should be repeated annually.

Surgical exploration is advised in all suspected or proved cases with but 2 exceptions

- 1 When there is absolute or strong presumptive evidence that the growth is out of bounds
- 2 When the patient's general condition is too precarious for a reasonable chance of success

In the same period (1932-1948) 27 bronchial adenomas were discovered. Among this group of patients there was no operative mortality, but 1 patient has died of metastasis. Of 26 patients subjected to follow-up study, 25 have lived from 5 to 15 years.

FRANK B. QUEEN, M.D.

## Segmental Pulmonary Resection DOUGLAS ROBB

*Austral N Zealand J Surg*, 1949, 18: 217

This article deals with the practical aspect of division of lung tissue into units smaller than the five major lobes.

The lingula is frequently involved along, or in conjunction, with other sections in prognosis. The author points out that an avascular plane of cleavage can be dissected easily after ligation of the vessels to the area involved.

Another segment frequently attacked surgically is the apical, or first dorsal, segment of the lower lobe. This portion of the lobe is dissected in a similar manner. The same is true of the middle lobe of the right lung.

The author has also followed this procedure in the performance of lobectomies in cases with partial absence of fissures. The author has used this method of securing the bronchus and vessels and peeling the segments off through an avascular plane in 6 cases of segmental resection and in 1 case of lobectomy with poor or absent fissures.

He points out that it is necessary to have good preliminary bronchograms in at least two projections

so that, as nearly as possible, the plane of action may be mapped out before operation. His post-operative bronchograms in 3 cases have shown excellent immediate results except for some unavoidable distortion. There was no bronchiectasis, and the remaining segments seem to have good aeration.

ROBERT E. FLORES, M.D.

## The Occurrence of Infection after Pulmonary Resection CARROLL C. MILLER and RICHARD H. SWEET

*N Engl J Med*, 1949, 240: 589

Four hundred and twenty-seven cases of lung resection at the Massachusetts General Hospital, Boston, between 1942 and 1947 have been reviewed with the specific intent of correlating the trend of post-operative morbidity and mortality rates with the use of chemotherapeutic and antibiotic medications. During this 6-year period, sulfonamides, penicillin, and streptomycin were used singly and in combination with one another. In addition to these agents, the following advances in surgical technique contributed strongly to the improvement in postoperative results: the diminishing use of tourniquet lung resection and adoption of individual ligation methods in dealing with hilar structures, the careful suture of the bronchus with a single row of interrupted fine silk sutures, and complete capping of the closed stump with a pleural flap.

The cases have been divided into four major categories: bronchiectasis, lung abscess, tuberculosis, and carcinoma. The incidence of empyema, the duration of hospitalization, and the operative mortality due to septic and nonseptic causes have been considered for each disease for each year. A significant decline in each of these factors was noted during the period from 1942 to 1947, it was accompanied by the increasing use of particular types of drug agents. Often it was observed that patients showed little or no preoperative response, as shown by their temperature charts, to chemotherapeutic agents, but their postoperative course appeared much smoother than would have been expected without such medication.

The preoperative use of aerosol is advised in patients with bronchiectasis. The injection of penicillin and streptomycin into the pleural cavity in cases of frank empyema is advocated. The inefficacy of sulfonamides and the value of penicillin and streptomycin are evident from the results.

The present routine for these chemotherapeutic agents consists of the intramuscular injection of 300,000 units of penicillin (100,000 units every 8 hours) and of 1 gm of streptomycin (0.25 gm every 6 hours) daily for 2 days before operation. When fever or other signs of infection are present, as indicated by profuse sputum or roentgenological examination, penicillin is administered from 7 to 10 days preoperatively. Aerosol penicillin, 50,000 units in 1 cc of normal saline, with or without streptomycin is given four times a day when expectoration is abundant. At operation before the chest is closed, 100,000 units of penicillin and 10 gm of streptomycin dis-

solved in 30 cc of normal saline are instilled into the pleural cavity. The value of this cannot be evaluated at present, but its use appears justified. The intramuscular injection of both drugs (100,000 units of penicillin and 0.25 gm of streptomycin every 6 hours) is continued postoperatively for 5 or 6 days, or until the patient's temperature chart has been normal for 3 days. At present streptomycin and penicillin are administered in all cases of lung resection.

Early postoperative bronchoscopic aspiration should be used when there is failure of lung expansion as a result of bronchial obstruction and prompt thoracentesis should be done in the presence of appreciable effusion. It is believed that penicillin and streptomycin minimize the tendency for the development of pneumonitis in postoperative atelectatic areas.

C. FREDERICK KITTLE, M.D.

### HEART AND PERICARDIUM

**Aspiration of Blood from the Pericardium in the Treatment of Acute Cardiac Tamponade after Injury. Further Experience, with a Report of Cases.** MARK M. RAVITCH and ALFRED BLALOCK. *Arch Surg*, 1949, 58: 463.

Five years ago the authors reported their experience with the aspiration of blood from the pericardial cavity in the treatment of acute cardiac tamponade due to hemopericardium. At the time of this report, the results led to the conclusion that aspiration of the pericardial contents is the treatment of choice for hemopericardium and that open operation should be resorted to only if bleeding continues or is resumed. Blau, Anderson and Starbuck, and others have reported successful results with non-operative treatment. Since this previous report, there has been an improvement in the mortality rate associated with the operative treatment of wounds of the heart.

Since this report, there have been admitted to the Johns Hopkins Hospital, Baltimore, Maryland, a total of 8 patients with cardiac tamponade due to wounds of the heart. Seven of these patients were treated by pericardial aspiration and the usual supportive measures. All survived without complications. The eighth patient, shot through the heart, failed to respond to aspiration of 7 c.c. of the pericardial blood and was thought not to have a tamponade. Exploration revealed a through-and-through wound of the heart, with penetration of the right pulmonary hilus. The patient died of ventricular fibrillation. A patient with a stab wound of the neck bleeding into the left thoracic cavity was subjected to immediate thoracotomy. A wound of the left auricle was successfully sutured. The cases are recorded in detail later in this article, and the available data in 4 instances are presented in graphic charts. No other patients with heart wounds were admitted to the hospital during this period. The cases of patients who died in the accident room and therefore were not admitted to the hospital are discussed separately.

The authors continue to be impressed by the simplicity, and regularly successful outcome, of pericardial aspiration. Aspiration is performed in the left fourth or fifth interspace parasternally with a 16 or 18 gauge needle. The quantity of blood in the 7 cases reported varied widely, from 12 to 305 c.c. (the latter amount being obtained in two aspirations, 4 minutes apart). In all these cases there was an unequivocal cardiac tamponade. In some of them, as in Case 4 in which the venous pressure did not reach a normal level for several days, it can safely be assumed that aspiration removed only a portion of the blood from the pericardial cavity. A salient feature of the treatment is the striking rapidity of clinical improvement after removal of blood from the pericardium.

The usual clinical picture is that generally described. The standard signs of tamponade are low arterial pressure, elevated venous pressure, distant or absent heart sounds, decreased or absent cardiac pulsations as seen with the fluoroscope, and the usual concomitant signs of shock. In addition, there is the frequent occurrence of a relatively slow heart beat, when any is detectable, and the common occurrence of wild excitement in patients not completely prostrated. The electrocardiogram, even when taken in the first few minutes of treatment, has shown no specific change, except in Case 11, in which the diagnosis of an injury of the coronary artery was made during life and demonstrated at autopsy. In several of the patients some degree of hemothorax subsequently developed, which conceivably would indicate a leakage of pericardial fluid into the chest, and prevent the delayed development of tamponade. It is particularly interesting that of the 8 cases, including Case 11, in which tamponade was successfully treated by aspiration alone, 3 were of bullet wounds, 3 of knife wounds, and only 2 were of ice pick wounds. Therefore, the type of the weapon used to inflict the wound need not affect the treatment.

The possibility of cardiac tamponade is kept in mind in any case of thoracic wound, particularly if it is precordial, and all such patients are closely watched. In Case 1, signs of tamponade developed under observation during a period of almost 2 hours. Fluoroscopic examination and pericardial aspiration are the most helpful diagnostic measures. Arterial pressure and venous pressure should respond steadily after aspiration, and these, with the heart sounds and fluoroscopic findings, form the basis for evaluation of improvement. If improvement ceases or is not maintained at a satisfactory level, aspiration is repeated, as in Case 8, in which 305 c.c. of blood were aspirated in two attempts, 165 c.c. and 140 c.c., respectively. If a second aspiration should fail to give relief, the plan is to take the patient to the operating room for cardiorrhaphy. The operating room is always alerted as soon as a patient with a wound of the heart is received in the accident department. It is the authors' practice to take patients suspected of pericardial tamponade directly to the fluoroscopic room in the accident department and to perform all examina-

## SURGERY OF THE THORAX

tions and treatment of the patient on the fluoroscopic table, with frequent observation of the heart. A needle is at once placed in a peripheral vein, and the administration of plasma is started prior to the giving of whole blood. At times, dextrose injection in isotonic sodium chloride solution (U.S.P.) is injected preliminary to the administration of plasma. The administration of whole blood is continued until the patient's condition and blood pressure are stabilized at a satisfactory level. It would appear that in most cases of wounds of the heart which are not immediately fatal, bleeding is controlled and arrested by the tamponade and does not recur when the tamponade, which is now the life-threatening condition, is relieved by aspiration. Thus far we have seen no recurrence of symptoms of tamponade once the initial symptoms have been relieved.

Seven consecutive patients with pericardial tamponade due to hemopericardium were successfully treated by aspiration alone, 1 patient was successfully treated by immediate cardiorrhaphy, and 1 patient without tamponade died as a result of a perforating bullet wound of the heart and pulmonary chest from a laceration of the left side of the heart. One patient bleeding into the left side of the chest from a laceration of the auricle. One patient successfully treated by suture of a bullet wound re-sponded well to aspiration, only to die abruptly 2 hours after he was first seen. Autopsy showed laceration of the anterior descending branch of the left coronary artery, fresh infarction of the left ventricle, and evidence of cardiac failure with pulmonary edema. Three additional patients died of heart wounds within 5 minutes of being admitted to the accident room. A fourth lived 55 minutes and might have been saved, but was thought not to have a penetrating wound.

Pericardial aspiration is the most important initial treatment for cardiac tamponade due to wounds of the heart. Facilities for open operation should be held in readiness, but it appears that with most wounds which cause cardiac tamponade and are not immediately fatal aspiration alone will suffice. The administration of blood and plasma is an important adjuvant.

JOHN E. KIRKPATRICK, M.D.

### ESOPHAGUS AND MEDIASTINUM

Some Rare Anomalies of the Esophagus. A. S. HANDOUSA BEY. *J. Lar. Otol.*, Lond., 1949, 63: 217.

The author discusses some rare anomalies of the esophagus and speculates on their cause. Four cases are reported, the first 2 being those of diverticulosis of the upper end of the esophagus, and of the thoracic portion. The diverticulum of the upper area was found opposite the second and third thoracic vertebrae, and on radiologic examination there appeared to be pouches, forming a pear-shaped shadow. The upper and larger one communicated directly with the pharynx by a wide opening, whereas the smaller one was connected with the left side of the main diverticulum.

The patient was a 20 year old girl whose diverticulosis was symptomless until she swallowed a medallion which obstructed her food passage. On removing the medallion complete relief was obtained, and for this reason surgery was considered inadvisable.

The second case was that of a fully developed true diverticulum of the middle third of the esophagus in a woman 40 years of age. This was considered a traction diverticulum, the cause of which is an acquired pressure from the inside forcing the mucosa through a vascular foramen, although a congenital origin cannot be excluded in this patient.

The third case was that of congenital stenosis caused both by a stricture and a membranous diaphragm present in one position.

The fourth case was one of a hypertrophied, enormously elongated esophagus with two large coils in a 24 year old male patient. The coils moved about and appeared to have a mesentery. The anomaly is comparable to the condition known as dolichocolon and to megacolon of the large intestine.

Congenital malformation is considered an important function in the formation of these abnormalities.

From a study of these 4 cases, it may be concluded that diverticula of the esophagus are not so rare as supposed. Many are not discovered because they are symptomless, others are found incidental to systematic radiologic study, and because of this fact it is believed that surgery is not necessary in every case and that the patient may live contented with his congenital anomaly without any serious compromise to his health.

STEPHEN A. ZIEMAN, M.D.

Statistical Contribution to the Subject of Surgery of the Mediastinum. (Contributo casistico alla chirurgia del mediastino). ANGELO PALETTI. *Ann. Ital. chir.*, 1948, 25: 609.

A clinical discussion of 15 cases of tumor of the mediastinum is presented. The term 'tumor' is used broadly to designate any intramediastinal space-restricting process acting more or less like a tumor. This material included 2 cystic tumors (an echinococcus cyst and a histologically unspecified blood cyst), 3 fibromas, 2 tumors of nervous origin (a neurofibroma and a ganglioneuroma), 3 carcinomas, 4 lymphogranulomas, and 1 inflammatory mass. The usually so prevalent dermoid cyst was absent in this group of patients and retrosternal goiters were not included. Of these 15 cases, 2 were chance findings and 4 did not present symptoms characteristic of mediastinal compression.

The surgical method used in 6 cases was that of approach through the posterior mediastinum, through a curvilinear paravertebral incision, with every precaution not to open the pleura. This method is indicated in the cases in which the mass is not larger than an orange and is located well back in the posterior mediastinum.

In 2 of the patients the method used was that of posterior mediastinotomy with a transpleural ap-

proach This method is indicated in tumors much larger than those mentioned, which have invaded the tissues of the mediastinum more extensively Of the remaining 4 cases which were adjudged operable, 1 was a substernal carcinoma for which anterior mediastinotomy was done and 3 were lymphogranulomas for 2 of which decompressive median sternotomy was done, anterior mediastinotomy was done for the third In none of these was any attempt made to remove the tumor and death occurred soon after the operation in 3 The remaining case (lymphogranuloma) is still under irradiation treatment Of the remaining 3 patients, 2 were adjudged inoperable, and the other did not seem to need any operative procedure as he had a lymphogranuloma which was not causing any symptoms

Viewed causally, the figures on results do not appear encouraging There were 12 surgical interventions However, 5 of these were done as a last resort, with thought only of relief from the eminent asphyxiation, even so, in 3 patients such relief could not be attained In the other 2, a biopsy for diagnostic purposes was all that could be accomplished The operation on the hemorrhagic cyst was certainly a mistake, because of the error in diagnosis The remaining 6 patients seemed more amenable to curative surgery The masses were smaller and were favorably located in the posterior mediastinum In fact, in 4 of these 6 patients clinical cure was obtained, although the echinococcus cyst ruptured into the pleural cavity during removal The patient died later from recurrence at this point Of the re-

maining 2 patients, 1 died of postoperative circulatory collapse and 1 died later of septic sequelae

The report of these 15 cases, observed during the prepenicillin era, may seem an anachronism in view of some of the brilliant, recently published results However, the material will serve as a contrast for the better results which, with the advent of newer therapeutic agents and newer surgical techniques, may be anticipated for the future

JOHN W BRENNAN, M.D

### MISCELLANEOUS

**Surgical Problems of Retained Intrathoracic Foreign Bodies** GEORGE N J SOMMER, JR., and CHARLES S MCCOLLOCH *Am J Surg*, 1949, 77 314

The operative treatment of 187 patients with foreign bodies lodged in the chest is reported Of these, 35 were in the parietes

Foreign bodies causing pain, hemoptysis, or ex pectoration, and asymptomatic foreign bodies 1 cm or more in two dimensions, should be removed Intrathoracic foreign bodies which are adjacent to the heart, the great vessels, or the esophagus afford definite indications for removal

Since pathogenic micro-organisms may be cultured from the sites of about 85 per cent of intrathoracic foreign bodies, even if they are asymptomatic, and since the removal of these foreign bodies is attended by low morbidity and mortality rates, elective removal of them is advised SAMUEL KAHN, M.D

# SURGERY OF THE ABDOMEN

## ABDOMINAL WALL AND PERITONEUM

**The So-Called Hernia of the Semilunar Line of Spigelius** (Sulle cosiddette ernie della linea semilunare di Spigelio) NATALE DI MOLFETTA *Arch ital chir*, 1949, 71 103

The author encountered a patient with a hernia along the semilunar line of Spigelius which stimulated him to study the anatomy of this region, however, the patient refused operation

The author was not satisfied with the explanations offered in the texts, especially as to the anatomy of this region, and performed numerous dissections on cadavers of all ages with no satisfaction. He then resorted to microscopic study of fetuses varying in length from 7 to 30 cm and also made sections on a 2 year old, a 15 year old, and an adult

Following careful study of these sections he concluded that the aponeurosis of the large muscles of the abdomen, which at the lateral margin of the rectus muscle pass dorsally to form the posterior leaf of the rectus sheath, continue to pass in the subumbilical region. They do not pass toward the ventral surface as is usually stated in treatises on anatomy. They thin out and fade, leaving the dorsal surface of the rectus muscle in the suprapubic region unprotected

The same findings are present in the fetus, in which the definite compartment is lower than in the adult

Hernias found along the semilunar line of Spigelius probably arise in the thinned and frayed out portions of the posterior sheath and then point at the semilunar line. Hence, the so-called "hernia of the semilunar line of Spigelius" is a vague entity

On repair of hernias in the lateral margin of the rectus muscle careful study of the anatomy will reveal facts which will illustrate the pathogenesis of these hernias

LUCIAN J. FRONDUCCI, M.D.

**The Strangulation of Diaphragmatic Hernias** (L'ètranglement des hernies diaphragmatiques) JACQUES MICHON *J chir*, Par., 1949, 65 25

A man of 24 years developed acute symptoms of obstructive ileus with pains in the left epigastrium irradiating to the inferior angle of the scapula and to the mammillary region. Roentgenography after a barium enema revealed complete arrest of the barium at the splenic flexure. The laparotomy confirmed the diagnosis of strangulated diaphragmatic hernia of the left extremity of the transverse colon

As it was not possible to disengage the hernia from the abdominal cavity, the paraumbilical incision was extended upward and outward, and a thoracophrenotomy was performed in the seventh interspace. The diaphragm was resected to free the strangulated gut and closed with suture. The patient recovered after a stormy postoperative period

The author discusses the pathogenesis, symptomatology, and treatment of diaphragmatic hernias in general. He emphasizes the importance of early surgery and the danger of pneumothorax with thoracophrenotomy

WERNER M. SOLMITZ, M.D.

**Hiatus Hernia** G. G. RICHARDS and K. A. CROCKETT *Arch Surg*, 1949, 58 411

The authors report on 24 cases of hiatus hernia observed in the last 18 months and note that this was a greater number than was found in the previous 30 years. The ages of the patients varied between 33 and 68 years, 3 patients being under 45 years of age. There were 17 men and 7 women, and 16 patients were overweight. All but 1 patient complained of either epigastric or substernal pain and 7 of these had radiation of pain into the left shoulder or arm. Only 1 had dysphagia. Two patients had gastrointestinal hemorrhages with anemia. The average duration of symptoms was from 6 months to 20 years. Practically all the patients had been treated for other conditions previously

It is pointed out that hiatus hernia must be kept in mind in any case of atypical angina pectoris, duodenal ulcer, dysphagia, disease of the gall bladder, anemia from gastrointestinal bleeding, obscure upper abdominal pain, or pain in the lower part of the chest which might be associated with increased intra-abdominal pressure. Special fluoroscopic technique is essential to determine the true incidence of this condition

JOHN L. LINDBLUM, M.D.

**Differential Diagnosis of Hiatus Hernia and Coronary Artery Disease** ARTHUR M. MASTER, SIMON DACK, JACOB STONE, and ARTHUR GRISHMAN *Arch Surg*, 1949, 58 428

The authors emphasize the increasing incidence of hiatus hernia and coronary artery disease and the fact that the two conditions may coexist, so that the presence of one condition does not exclude the other. By means of objective tests the presence of coronary disease can be ascertained and its relative importance properly evaluated

In a clinical investigation of this problem the two-step exercise and anoxemia tests were used on 57 patients with positive roentgenologic evidence of hiatus hernia. To ascertain the presence or absence of organic heart disease the following clinical determinations were made

A complete history was obtained, physical, tele-roentgenographic and roentgenoscopic examinations were made, the resting electrocardiogram, including augmented unipolar extremity and Wilson precordial leads, was obtained, and the two-step exercise electrocardiogram and the 10 per cent anoxemia test were made

On the basis of symptoms the patients were divided into 4 groups. Group 1 comprised 15 patients



with purely gastrointestinal symptoms, group 2 comprised 29 patients with gastrointestinal and cardiac complaints, group 3, 3 patients with only cardiac complaints, and group 4, 10 patients with symptoms attributable to anemia secondary to hemorrhage.

Evidence of organic heart disease was found in two-thirds of the cases. Four patients of group 1 had pain referred to the left side of the chest, but no evidence of coronary disease was obtainable. In 23 of the 29 patients in group 2, cardiac disease was demonstrated by the objective examinations. In the 6 remaining patients with thoracic pain suggestive of angina pectoris, organic coronary disease could not be demonstrated, which suggested that hiatus hernia may have been the only factor initiating pain.

These negative findings in the latter cases also indicate that the history alone is not a safe means of differentiating hiatus hernia from angina pectoris due to coronary artery disease. Nevertheless, the history may be helpful, for the occurrence of epigastric or substernal discomfort in the recumbent position which is relieved on standing is characteristic of hiatus hernia, whereas constant relation to effort and prompt relief by the use of nitroglycerine is more suggestive of coronary artery disease. Hiatus hernia not infrequently may precipitate coronary insufficiency even in the presence of normal coronary arteries if hemorrhage, severe anemia, or shock develops.

JOHN L. LINDQUIST, M.D.

**The Mechanism of Shock in Peritonitis** RICHARD V. EBERT, PAUL S. HAGEN, and CRAIG W. BORDEN  
*Surgery*, 1949, 25: 399

During the recent world war the observation was made that severe and irreversible shock frequently occurred with penetrating abdominal wounds in which there was fecal contamination of the peritoneal cavity. Certain of the patients had a good initial response to supportive therapy and then developed a secondary fall in arterial pressure which did not respond to further transfusions even though blood volume was elevated and maintained at normal.

This study to elucidate the hemodynamics of the shock occurring in patients with fecal peritoneal soiling was carried out on 15 dogs. The peritoneum was soiled by pouring liquid feces into the abdominal cavity. The dogs were divided into three groups: the untreated, the inadequately treated, and the treated. The treated dogs received enough plasma to maintain the arterial pressure until the terminal fall and the blood plasma volume was as close to normal as possible. The untreated and inadequately treated dogs developed severe shock in from 3 to 10 hours. The shock was characterized by a decrease in arterial pressure, hemoconcentration, low plasma volume, and a fall in the cardiac output. There was an increase in peripheral resistance in 5 dogs and a decrease in 2 dogs. The shock, therefore, resembled the shock caused by hemorrhage.

In the group of 5 animals adequately treated, as defined by a relatively normal blood volume, a marked fall in arterial pressure occurred in from 6 to

11 hours. The plasma volume was normal or only slightly decreased and there was no evidence of hemoconcentration. Although the mean arterial pressure was markedly reduced, the cardiac output remained unchanged or was slightly elevated above control level. Therefore, the total peripheral resistance was reduced in all cases, the average value for the group being 5,490 during the control period and 2,300 during the period of shock. Cultures of the blood consistently yielded bacilli of the colon group. Transfusions did not prolong life.

The authors call attention to the difference between the shock in the adequately treated dogs with peritonitis and the irreversible shock which may follow severe hemorrhage. Hypotension was avoided in the treated dogs, and the cardiac output remained normal by replacement of the plasma lost into the peritoneal cavity. Nevertheless, vasodilatation and consequent decrease in peripheral resistance occurred. The latter phenomena are not explained by this study.

FREDERICK C. HOEBEL, M.D.

**The Surgical Anatomy of the Inferior Mesenteric Artery and Sudeck's Point** (*L'anatomia chirurgica dell'arteria mesenterica inferiore ed il punto del Sudeck*) GAETANO BALICE *Gior. ital. chir.*, 1949, 5: 1

The author studied the circulation of the inferior mesenteric artery in 30 cadavers by injecting methylene blue into the artery. A detailed drawing was made of the artery in each of the cadavers, and all drawings are reproduced in the present article. The so-called normal pattern of the inferior mesenteric artery was found in only 7 (23%) cases, however, Sudeck's point was found in 25 (90%) of the cases. The author stresses the fact that great variations occur, and he believes that even though Sudeck's point is found in a high percentage of cases, it does not exempt the surgeon from exposing it plainly in cases in which a high rectosigmoid resection is performed.

LUCIAN J. FRONDUTI, M.D.

## GASTROINTESTINAL TRACT

**Massive Hematemesis** CYRIL COSTELLO *Ann. Surg.*, 1949, 129: 289

In seeking to learn the best methods of management of massive hematemesis, from the rather vast literature on the subject, one encounters a divergence of opinion as to whether treatment should be medical or surgical, and, if the latter, how the cases are to be selected. Other problems in therapy concern the question of the advisability of using gastric siphonage, oral feeding, blood transfusion, and sedation. Three hundred patients who presented the symptoms of massive and severe hematemesis were selected for the present study. No patient was included in the study who had not vomited large quantities of gross blood and who did not show evidence of blood loss by shock or severe anemia, or both.

The causes of hemorrhage in the patients studied were as follows: (1) chronic duodenal ulcer was the

underlying cause in 171 patients, (2) acute gastritis was believed to be the cause in 42 cases, (3) chronic gastric ulcer was seen in 33 patients, (4) ruptured esophageal varices occurred in 24 patients, (5) chronic gastritis occurred in 12 patients, (6) gastric carcinoma accounted for 4 cases, (7) marginal ulcer for 4, (8) curling ulcer for 2, (9) carcinoma of the esophagus for 3, (10) gunshot wound in 1 patient, and (11) no determinable cause in 4 patients.

The incidence of massive hematemesis was greater between the fourth and eighth decades, nearly a fourth of cases occurring in the sixth decade, 82 per cent of the patients were males and 18 per cent were females.

The overall mortality rate in the 300 cases was 25 per cent. Consistent with other reports on the same subject, it was seen that the mortality rate increased in those patients who had reached or had passed the fifth decade of life. Examination at operation or at autopsy permitted the pathological study of about 85 per cent of those patients who died. The eroded blood vessels in particular were examined, and in nearly all microscopic sections there was seen a partial or complete block of the eroded vessel wall by antemortem thrombus. The author believes that this demonstration of thrombus formation even in large eroded arteries is of paramount importance in arriving at a rational plan of therapy. It was evident that many of these patients did not die, as has been commonly assumed, from acute exsanguination through a wide open artery, but rather because of the complications of diminished blood volume such as shock, cardiac failure, anemia, and pneumonia. This fact was confirmed from the clinical course of patients who died, for death occurred not in a matter of minutes or hours (with one exception) as would be expected from a persistent fulminant hemorrhage, but the fatal outcome ensued after from 2 days to 3 weeks following the onset of bleeding. Hence, the author argues it is a misconception that patients suffering from arteriosclerosis or chronic ulcers should be subjected more promptly to operative closure of the bleeding point. Rather, he believes, therapy should be directed toward support of the depleted blood volume.

The body response to massive blood loss is well known to conserve the remaining blood for vital centers there is a generalized vasoconstriction, an increased heart rate, and absorption of tissue fluids into the general circulation. If inadequate blood volume continues, anoxia with irreversible tissue damage ensues. In view of this universally accepted fact, it is surprising to find recommendations that blood should be used sparingly or not at all. The theory that restoring blood pressures tends to "blow out" a forming thrombus has no scientific substantiation, to wait for a fall of blood pressure to 80 or 100 mm of mercury before administering a "small transfusion," as is often recommended, is a direct contradiction of sound physiologic principles.

If these pathologic facts and physiologic principles are correct the ideal treatment of massive hemate-

mesis should be prompt replacement of as much blood as has been lost until thrombus formation has sealed off the eroded vessels. To test these principles a further 73 patients were selected, corresponding closely in age and sex to the 300 patients previously considered. Operative interference during active bleeding was not undertaken in any of the 73 patients, treatment consisting of adequate and prompt blood replacement. Feedings were usually administered, and the type of feeding varied between the Meulengracht diet, the Sippy diet, a liquid diet, and protein dextrimaltose (pre-digested) liquids. The difference in mortality rate was striking. Only 4 per cent of this group of 73 patients died, as compared to 25 per cent of the 300 patients treated by various methods.

The total quantity of blood required for replacement is often enormous as compared with transfusion standards of a decade ago. As much as 3 or 4 liters were frequently administered during the first 24 hours in the hospital. The author condemns the frequent use of saline solution as this does nothing toward re-establishing blood volume, and encourages pulmonary edema. Plasma is the most valuable fluid for use while blood is being crossmatched. The need for blood cannot be determined by a patient's general appearance, pulse, or blood pressure, and the older methods of blood study, such as the blood count and hematocrit, are either undependable or too time-consuming. The copper sulfate falling drop method for determining specific gravities of whole blood and plasma, frequently repeated, gives the best indication of blood replacement needs. The test is simple, rapid, and readily performed by the initiated house officer.

Adequate continuous sedation is indicated, and this is best accomplished by an initial dose of morphine followed by hypodermic injection of 2 gr of sodium phenobarbital every 2 hours as needed to keep the patient drowsy.

The following procedure during the actively bleeding stage were found to increase the mortality: (1) surgery, (2) indwelling stomach tube with constant suction, (3) gastric lavage, and (4) active gastric diagnostic studies.

Following the control of hemorrhage and the restoration of nutrient and blood essentials, the advisability of elective surgical intervention may be more easily determined. WAYNE FIELD CAMERON, M.D.

**Neurinoma in the Gastrointestinal Tract** JOHAN CEDERMARK *Acta chir scand*, 1949, 97: 473

An account is given of the incidence, pathology, and clinical symptoms of neurinomas in the stomach and in the small intestine, based on a material comprising 2 cases of gastric neurinoma and 4 cases of neurinoma of the small intestine observed by the author, and 14 cases of gastric neurinoma and 6 cases of neurinoma of the small intestine from other Swedish hospitals.

Pathologically, the tumors are described as having derived from Auerbach's plexus or the submu-

cous plexus. In the clinical account, the author emphasizes the long duration of the disease and the occurrence of hemorrhages, especially melena, which may give rise to a considerable anemia.

Roentgen examination may be an aid in the diagnosis of a gastric neurinoma, but in none of the cases of neurinomas in the small intestine has x-ray examination been of any help. The tumors may be accompanied by fatal complications such as severe anemia, peritonitis, and malignant development. The treatment is surgical and, when instituted early, may give a good prognosis.

JOHN J. MALONEY, M.D.

**A Contribution to the Recognition of Severe Complications of Gastrointestinal Neurofibromatosis** (Contributo alla conoscenza delle complicazioni gravi della neurofibromatosi gastrointestinale)  
VINCENTO TRUGLIO *Sicilia med.*, 1949, 6: 57

The author describes a case of neurofibromatosis involving the skin and gastrointestinal tract. The skin nodes first appeared about 20 years before the patient was seen by the author. Ten years later a gastroenterostomy was performed for symptoms of gastric ulcer. The patient felt well until the last year when she began to have recurrence of nausea, vomiting, and hematemesis. Her condition became progressively worse and when she entered the hospital it was too critical to consider surgery. She died of supervening bronchopneumonia.

At autopsy she was found to have extensive neurofibromatosis involving the entire skin except the palms and soles of her hands and feet. The stomach revealed a stenosing ulcer near the pylorus with a neurofibroma at its base. Numerous nodes were present near the ulcer and over the site of the anastomosis. The mucosa of the jejunum near the anastomosis showed numerous ulcerations which corresponded to subserous nodes.

The author wishes to stress the severe complications other than malignancy (pyloric stenosis, hemorrhage, anemia, cachexia) which may complicate gastrointestinal neurofibromatosis.

LUCIAN J. FRONZUTI, M.D.

**The Vascularization of the Human Stomach** A. E. BARCLAY and F. H. BENTLEY *Brit J Radiol.*, 1949, 22: 62

The authors studied the vascularization of the human stomach by their remarkable technique of microarteriography which was so successfully applied to the kidneys a few years previously.

Two kinds of opaque substance were used—one for the visualization of arteries and their branches down to the arterioles, the other for the finer vessels arising from the main plexus. These were injected at a pressure of 150 mm. of mercury into the arteries of the stomach excised at operation (for duodenal ulcer), or removed from the cadaver. Arteriograms of the stomach wall were made first, then selected areas were sectioned transversely and subjected to the process of microarteriography.

The opaque substance chosen for the demonstration of the arteries and their larger branches consisted of a 20 per cent solution of "chlorbismol," a proprietary preparation of bismuth oxychloride. This was injected into one of the gastric or gastroepiploic arteries. The chlorbismol has a particle size too large to enter the capillaries and produces perfect arteriograms. It was noted in cadaver stomachs that the larger arteries form a plexus of very profuse anastomoses which are located in the submucosa and extend over the wall of the entire stomach. These anastomoses are of large size so that on dissection they can readily be seen by the naked eye. Their intercommunication is so extensive that injection of a single gastric or gastroepiploic artery is sufficient to fill the entire plexus of both anterior and posterior stomach walls, and even the other gastric and gastroepiploic arteries, by retrograde pressure.

For visualization of the finer vessels, a suspension of 10 per cent colloidal silver iodide was used which has smaller particle size than the chlorbismol. Very good microarteriograms were obtained. It was found in cadaver stomachs that the finer vessels arise from the main plexus in the submucosa, and run through the muscularis mucosae towards the under aspect of the mucous membrane where they form a plexus of intricate anastomoses. From this plexus arises a rich vascular network, the terminal vessels running perpendicularly through the mucosa towards the surface of the stomach wall.

The injection of the stomachs removed at operation lead to an entirely different pattern. In all specimens (12 altogether) it was difficult to find an area of mucous membrane in which the opaque medium had reached the peripheral circulation. This suggested that the blood from the arteries of the submucosal plexus was shunted directly into the gastric veins.

On the analogy of the work on the renal circulation it was thought that the shunt most probably is the result of operative trauma due to disturbance of the autonomous nervous system. To prove this the change in oxygenation of the blood of the arteriovenous shunt was determined in 6 patients at operation. After opening the peritoneum a sample of blood was taken as quickly as possible from a venous tributary running towards the lesser curvature, and a second sample was taken 3 minutes later from an adjacent vein. The percentage of oxygen saturation of the first sample was 74 per cent, and of the second sample 91 per cent. This rapid change in oxygenation proved that the blood passed directly from the arterial to the venous side.

Additional experiments were performed to demonstrate the sympathetic nature of the shunt. A patient for gastrectomy was anesthetized with a combination of general and high spinal anesthesia (reaching up to the level of the first to second thoracic vertebrae). The resulting microarteriograms showed complete filling of the mucosal vessels in a manner similar to that observed in cadaver stomachs. In other words, blocking of the sympathetic outflow

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TABLE I — ERROR IN DIAGNOSIS OF CANCER

Group	Original diagnosis of benign ulcer	Final diagnosis of cancer	Error in diagnosis Per cent
All cases	512	34	6.6
Cases with resections	295	32	10.8

throughout the operation prevented the occurrence of the arteriovenous shunt  
T LEUCUTIA, M D

Gastric Ulcer CLAUDE E WELCH and ARTHUR W ALLEN  
N England J M, 1949, 240 277

The authors review the management of patients with gastric ulcer, on the basis of cases studied at the Massachusetts General Hospital, Boston, during the 10 year period from 1938 to 1947 inclusive, with special reference to the ulcer-cancer relation, the treatment of the most common complication of gastric ulcer (hemorrhage), and the development of a satisfactory operative technique, especially for ulcers about the cardia.

A total of 512 cases were studied. A large majority of patients were from 40 to 80 years of age, and the average age of patients was 55. The average duration of symptoms before admission was 5 years, placing the average age of onset of the disease at 50 years. This is considerably older than the average age of onset in duodenal ulcer, which is 30. The disease was three times as common in males as it was in females.

The percentage of error in the diagnosis of cancer in gastric ulcers is shown in Table I. This percentage has been reduced from 14 per cent in a previous study to 10.8 per cent in the present study, probably because of improved roentgenographic techniques and gastroscopy.

A short history of gastric ulcer in a patient 50 years of age or over was found to be highly suggestive of cancer. The radiologic diagnostic error was found to be highest in the region of the cardia, less in the prepyloric area, and least along the mid-lesser curvature. Malignant ulcers which were resected averaged 1.8 cm., while benign ulcers averaged 1.6 cm., so that size was not a definite criterion of malignancy. The presence of free hydrochloric acid is of no significance although its absence after the use of histamine is strongly suggestive of cancer. Free hydrochloric acid is found in approximately 90 per cent of patients with benign ulcers and of those with ulcer cancer. About 40 per cent of carcinomas of the stomach are accompanied by histamine achlorhydria.

A positive Papanicolaou smear of the gastric sediment indicates almost certain cancer, as only 4 per cent false positives are found. The presence of an accompanying active duodenal ulcer is strong evidence that the gastric ulcer is benign. Multiple gastric ulcers also suggest that the lesions are benign. Massive hemorrhage appeared in 6 per cent of cases of ulcer-cancer and in 9 per cent of benign ulcers. Pyloric obstruction occurred in 19 per cent of ulcer-cancers and in only 1.2 per cent of benign ulcers. Perforations, nearly always walled off by adjacent viscera, occur with about equal frequency in both groups.

The rate of healing was found to be the most reliable differential feature between benign ulcer and cancer. Although, on careful medical management, healing of a benign ulcer required a period of about 2 months, significant improvement was usually ob-

served after a period of 3 weeks, so that a decision could be made at the end of one month. Exceptions were observed in which cancers appeared to heal and then recurred, and a few benign ulcers failed to heal after months of treatment. From the results of their studies, the authors believe that operation should be performed in all but a small percentage of carefully managed cases.

Perforation of a chronic gastric ulcer along the lesser curvature is nearly always so gradual that the liver or pancreas walls off the lesion. Perforations of so-called acute gastric ulcers close to the pylorus are nearly always duodenal perforations. Pyloric obstruction, significant enough to be noted by x-ray examination, is much more likely to be due to duodenal ulcer or gastric cancer than it is to gastric ulcer. The demonstration of a gastric ulcer by roentgen study, combined with the clinical findings of partial or total pyloric obstruction, is therefore an absolute indication for operation. Hemorrhage is by far the most common and important complication, as it occurred in approximately 30 per cent of this series.

In cases in which the hemorrhage was severe, a difficult diagnostic problem was encountered, as ulcers were demonstrated roentgenographically in only half the cases. The overall death rate from hemorrhage was 9 per cent, the death rate was 4 per cent in patients treated surgically, and 12.5 per cent in those treated conservatively.

The authors believe there are three groups of gastric ulcers for which emergency operation is required. Patients in whom the condition can be diagnosed positively (by x-ray examination) as gastric ulcer and who have been bleeding less than 48 hours should be operated upon immediately. If bleeding has persisted for a longer time than 48 hours, but stops soon after hospital admission, the patient should be observed and treated medically until such time as normal blood and nutritional levels allow an elective gastric resection. Recurrence of hemorrhage indicates immediate operation in this group. A third small group is comprised of patients in whom the gastric hemorrhage fails to stop after the patient is admitted to the hospital and operation is indicated soon after his arrival. The same operative indications hold true in the absence of a positive x-ray diagnosis of ulcer provided pathologic lesions of the esophagus, especially varices and blood dyscrasias, can be excluded.

It appears that the particular ulcers that do poorly on medical treatment are the larger ones, particularly those over 2.5 cm. in diameter, those associated with obstruction, and recurrent ulcers with a long history

TABLE II — OPERATIVE MORTALITY

Operations	No of cases	No of deaths	Mortality Per cent
Partial distal gastrectomy	269	6	2.2
Partial proximal gastrectomy	14	3	21.0
Total gastrectomy	4	0	0
Miscellaneous	8	0	0
Totals	295	9	
Average			3.0

of gastric symptoms. Other factors did not illuminate the problem. It is suggested that a trial of medical therapy be reserved for patients in whom the ulcer is considered grossly benign by a competent roentgenologist and gastroscopist, and in whom symptoms have been present for less than 1 year—an ulcer that is 1 cm, or less, in diameter, located on the lesser curvature, and having a negative cytologic smear. If the x-ray diagnosis is equivocal, ulcerative lesions in a stomach with histamine achlorhydria, or those found elsewhere than on the lesser curvature or high in the cardia should also be treated immediately, by operation. Lesions of the cardia are permitted a period of medical therapy, despite the fact that the incidence of cancer is high, because the operative mortality for these lesions is still great enough to counterbalance the error in diagnosis of cancer. Failure of any of these ulcers to heal is an absolute indication for surgery.

Any operative procedure for gastric ulcer must change the gastric physiology so as to prevent recurrent ulceration and must be extensive enough to excise widely any carcinoma found. This limits the type of operation to some type of gastric resection.

A satisfactory resection consists of excision of at least 50 per cent of the stomach, encompassing the ulcer, and excision of both the greater and lesser omenta to include the regional lymph glands. The authors do not believe that vagotomy, gastroenterostomy, sleeve resection which does not include the omentum, or resection which does not include the ulcer, are adequate types of surgery. They use partial distal gastrectomy for distal lesions, partial proximal gastrectomy for proximal lesions, and total gastrectomy for widespread malignant lesions. The failure of removal of the antral mucosa in partial proximal gastrectomy may be alleviated by the performance of vagotomy, which is automatically done by the nature of the operation. Table II lists the operative mortality.

Eleven per cent of the entire group of patients did well on medical therapy. In 14 per cent the results were probably good, but these patients did not return for later follow-up studies. Twenty per cent did poorly, and refused surgery. In 58 per cent of the entire series surgical therapy was performed, and in 295 cases (all but 8) gastric resections were carried out, all but 4 of these were partial gastrectomies.

In these it appears that 75 per cent will be asymptomatic postoperatively, 15 per cent will have trivial symptoms amenable to dietary therapy, and 10 per cent will have symptoms of a small stomach, i.e., lack of appetite or gastric distress, and loss of strength, endurance or weight that will require medical care.

ERNEST D. BLOOMENTHAL, M.D.

**On the Operative Treatment of Gastric and Duodenal Ulcer at the District Hospital Hämelenlinna, Finland** KALEVA KORTTILA *Ann Chir Gyn Fenn*, 1949, 38 Supp. 1

The present study shows that good primary and late results can be obtained by resection (Billroth II, anterior antecolic, and enteroanastomosis) in patients with chronic gastric and duodenal ulcers—the primary mortality being 3.2 per cent in the series of cases studied, and the late results good in 81.2 per cent of the cases.

There appeared to be no difference in the results obtained in cases in which a radical intervention was performed and the results in cases in which palliative operations (according to the method of Finsterer) were performed. With regard to the extent of the resection, a moderate resection seems to be the most advantageous.

During the period from 1946 through 1945 the total mortality following resection in Finland was 7.09 per cent, which percentage compares favorably with that reported for other Scandinavian countries.

In the treatment of perforating ulcers, a low mortality can be achieved by simple suture. In the present series of cases the mortality among patients with perforating ulcers was 14.1 per cent.

The author believes that since disturbances in gastric evacuation do not occur following simple suture, the performance of a gastrostomy, gastroenterostomy, or primary resection, for fear of this difficulty, is not imperative.

A good late result was obtained by simple suture in about 30 per cent of cases studied, and the condition of those patients whose symptoms persisted could be corrected by means of a secondary resection.

BENJAMIN GOLDMAN, M.D.

**Benign Nonepithelial Tumors of the Stomach** JACOB RABINOVITCH, DAVID GRAYZEL, ALFRED J. SWYER, and BERNARD PINES *Arch Surg*, 1949, 58 529

Twenty cases of benign nonepithelial tumors of the stomach have been observed at the Jewish Hospital of Brooklyn during the past 20 years. These tumors were as follows: 12 leiomyomas, 5 fibromas, 1 neurofibroma, and 2 lipomas.

There were no pathognomonic criteria manifested by these tumors. Among the 12 leiomyomas (60% of the cases), 10 were found incidental to operation or at autopsy. Their most frequent location was in the pylorus and they varied from 1.0 to 9.0 cm in diameter. Of the 5 fibromas none presented clinical evidence of a gastric neoplasm. None of these tumors exceeded 1.0 cm in diameter. The 1 neurofi-

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broma occasioned epigastric pain and hematemesis. The 2 lipomas were incidental findings at autopsy. During the same 20 year period, there were 11 cases of benign epithelial growths of the stomach and 9 cases of malignant nonepithelial tumors. Benign nonepithelial tumors of the stomach appear to be twice as common as benign epithelial growths and approximately 2 5 times as common as malignant connective tissue neoplasms.

FRANK B. QUEEN, M.D.

On Linitis Plastica and on Sclerosing Carcinoma of the Stomach (Carcinoma Disseminatum Krompecher, Carcinoma Fibrosum Konjetzny) KAJ RØJEL. *Acta chir scand*, 1949, 97: 451

The author reviews the literature dealing with benign and malignant sclerosis of the stomach. The term "linitis plastica" has given rise to much obscurity, and the author suggests that its use be confined to benign sclerosis of the stomach. With regard to malignant sclerosis of the stomach, it is suggested that Krompecher's term, "carcinoma disseminatum" and Konjetzny's term "carcinoma fibrosum" be fused into the term "carcinoma disseminatum fibrosum."

The author reports 14 cases of carcinoma disseminatum fibrosum, the histological (and to some extent also the macroscopical) pictures of which are in conformity with the description given in the literature. Microscopically, carcinoma disseminatum fibrosum is characterized by the proliferating tumor tissue and by the reaction of the stomach to this process.

As far as the great majority of tumor cells are concerned, they can be included in, or constitute intermediary forms between, the following two types: (1) a small cell with a dense, often rod-shaped or slightly irregular nucleus rich in chromatin, and (2) a larger cell with a large round or ovoid vesicular nucleus poor in chromatin, often containing a nucleolus. In the protoplasm of some of these tumor cells, deposits of mucus can be observed. In the large cell type these deposits are most frequently in pericellular arrangement and the nucleus is not displaced, in the smaller cell, the nucleus is displaced towards the periphery, so that signet-ring connections. The tumor cells have lost their epithelial connections and are isolated, in some cases lying separately, in others these cells occur in short rows, and in others they occur in small or larger clusters or strands, but always with a tendency to diffuse infiltration of the host tissue, they never display any formation of alveoli, cords, or glandular imitations. The reactive changes against the tumor tissue consist in mononuclear inflammatory infiltration, the formation of granulation tissue, and in the transformation of the latter into a shriveled, fibrous cicatricial tissue which is poor in cells. Lastly, the thickening and hyalinization observed in the muscularis mucosae must probably also be considered part of the reaction of the host tissue against the tumor infiltration. The macroscopical picture was typical of carcinoma dis-

seminatum fibrosum in 8 cases, the wall was more or less thickened, shriveled, and sclerosed, in some cases with distinct borders between its individual layers, and without localized tumor formations or callous ulcers. In 4 cases the macroscopical findings were described as cancerous ulcers, and in the remaining 2 cases the macroscopical description was too defective to allow of classification.

A brief reference is made to the clinical manifestations and the course of the 14 cases. The symptoms and the results of the laboratory examinations do not differ from those of cancer of the stomach in general. Two patients died immediately after the operation. Eight patients died 144, 60, 30, 24, 13, 13, 12, and 10 months after the operation, all of the sequelae of their cancer of the stomach. Four patients were still alive less than 2 years after the operation, but the author states that one of these patients is known to have suffered a relapse.

CHARLES BARON, M.D.

Clinical Notes Three Cases of Cancer of the Stomach Cured by Resection ALFRED R. PARSONS *Irish J. M. Sc.*, 1949, Ser 6: 179

Parsons comments on the increasing number of deaths from cancer during the period from 1937 to 1948. Although cancer deaths are lowest in Eire, cancer of the stomach is responsible for almost one-quarter of the total deaths from cancer in males, and for one-fifth of the total deaths from cancer in females.

Three cases of frank carcinoma are reported in which the tumor had attained a considerable size, nevertheless metastases had not occurred or at most had not passed beyond the glands of the lesser curvature. Stress is laid on the all importance of early diagnosis if successful resection is to be carried out. The 3 cases are the only examples of successful resection of the stomach for malignant disease in the author's clinical experience of over 50 years. The first case was that of a 30 year old patient who had progressive and unresponsive anemia, absence of free hydrochloric acid, and a palpable tumor. It is now 40 years since resection and the patient is enjoying remarkably good health. The second patient showed symptoms only 2 months prior to hospitalization and these pointed to a cardiovascular disturbance rather than a digestive disorder. On examination there was a palpable mass as large as an orange which was resected along with two-thirds of the stomach. The patient was doing exceptionally well 14 years after operation. The last patient had a large easily palpable tumor which lay concealed behind the costal arch. Partial gastrectomy was done September 6, 1934 and the patient is alive and well as of the present writing.

Commenting on these cases, Parsons concludes that the absence of hydrochloric acid in the stomach content is significant in the diagnosis of gastric carcinoma and the presence of a large mass does not necessarily indicate inoperability or a bad prognosis.

STEPHEN A. ZIEMAN, M.D.



**A Preliminary Report on the Advantages of a Small Stoma in Partial Gastrectomy for Ulcer** H W PORTER and Z B CLAMAN *Ann Surg*, 1949, 129 417

In a series of 118 partial gastrectomies for peptic ulcer, evidence was produced to show that a stoma 2.5 cm long has the following advantages

1 The small stoma with a Hofmeister-Finsterer valve reduces the risk of incidence of (a) leakage at the duodenal stump, (b) leakage at the anastomosis, (c) postoperative hemorrhage from the anastomosis, (d) the necessity for routine postoperative suction, and (e) jejunitis

2 The small stoma encourages (a) sphincteric action at the stoma, (b) delayed emptying time, and (c) the ability to eat a full normal diet at an early date, thereby shortening convalescence

3 The small stoma reduces the incidence of the dumping syndrome

JOHN J MALONEY, M D

**Acute Obstruction of the Small Bowel** F A COLLIER and R W BUXTON *J Am M Ass*, 1949, 140 135

The present study of acute bowel obstruction was made at the University Hospital, Ann Arbor, Michigan, and includes 198 patients observed during the years 1934 through 1947. In all cases the diagnosis was confirmed by operation or at autopsy. The high mortality rate (38.3%) is explained by the inclusion of cases of carcinoma in the series. The principal cause of death was peritonitis.

Eight patients who died because of leakage from the suture line following resection and anastomosis had had a side to side type of anastomosis. This type is particularly susceptible to failure because it cuts across the blood supply to the antimesenteric border of the bowel. One discussant mentioned the low incidence of leakage from the anastomosis when an oblique end to end type of anastomosis was performed.

The rate of successful small bowel intubation in this series was 68 per cent. Several cases of successful intubation were followed by perforation of the bowel at the site of the lesion. In mechanical obstruction, decompression by intubation was preliminary to surgical correction of the obstruction. In large bowel obstruction, decompression of the small bowel may result in an obstructed closed loop between the ileocecal valve and the lesion in the colon with possible perforation of the colon as a subsequent complication. Intubation from above seldom decompresses the colon and in these cases cecostomy is necessary.

Enterostomy, although generally condemned, was suggested to deflate a closed loop or, occasionally, in cases of long standing obstruction from multiple obstructions, to deflate the intervening obstructed loops.

Infection, with or without an associated factor of toxemia, is the commonest cause of death. Strangulation remains the most serious complication of obstruction.

Although the use of antibiotics, of long tube decompression, and the correction of dehydration and electrolyte imbalance have improved the outlook in cases of obstruction, early diagnosis of obstruction and of strangulation remain the most important factors in lowering mortality. If early diagnosis is coupled with prompt surgical intervention in those cases in which it is indicated, the mortality is still further improved.

Conservative management must be abandoned at once when (a) progressive decompression of the small intestine is not satisfactory within 36 hours after commencement of effective suction, (b) in the absence of a specific knowledge of the cause of the obstruction, temporary relief is attended by recurrence of the signs and symptoms of obstruction, and (c) the signs and symptoms suggest impairment of the bowel circulation or strangulation.

FREDERICK C HOEBEL, M D

**Pneumatosis Intestinalis Roentgen Diagnosis and Surgical Management** ALBERT I GAZIN, WALLACE S BROOKE, HENRY H LERNER, and PHILIP B PRICE *Am J Surg*, 1949, 77 563

Pneumatosis intestinalis is so little known that when it occurs it presents a challenge to diagnosis and management. The variations in degree and type, the discrepancy between the sparse clinical and the extensive operative findings, the diversity of pathologic conditions all invoke the exercise of keen judgment based on an appreciation of the fundamental nature of the disease.

Since pneumatosis is defined as the presence of gas in an abnormal location in the body, the diffuse spread of gas into the intestinal tissues is labeled pneumatosis intestinalis. The arrangement of this gas in cystlike accumulations within the wall of the intestine and its mesenteric attachments may be designated as pneumatosis cystoides intestinalis. This entity has been reported in the literature as "gas cysts of the intestine," "emphysema intestinorum," "cystic pneumatosis of the bowel" and "pneumatosis cystoides intestinorum hominis."

The first American report of a roentgenologic preoperative diagnosis of pneumatosis intestinalis is presented. The characteristic roentgenographic features are described.

The various etiologies of this entity are discussed and a theoretical concept of its development is presented. It is suggested that the process is as follows:

A break develops in the mucous membrane of the bowel, associated with some form of partial or complete obstruction of a part of the intestinal tract distal to this mucosal defect. The obstruction may occur from stenosis or adhesions. Because of the obstruction, hyperperistalsis takes place and forces gas out of the lumen of the bowel into the wall where it comes to lie either in the subserosal or the mucosal layers. The presence of the gas causes obstruction of the lymphatics and associated inflammatory changes. Normally the gas is reabsorbed. If, however, the

inflammatory and stenotic factions persist in the lymphatic system and become marked, absorption of the gas is blocked and the process becomes irreversible

The problem of conservative versus radical surgery in the treatment is raised. It is the opinion of the authors that the management of this entity demands a careful evaluation of the stage to which any given case has progressed. If the features of the case appear to be irreversible, radical surgery is indicated. In many cases simple relief of the obstruction may be sufficient. The case presented in this report is one in which conservative surgical management (lysis of adhesions) was tried at first, only to require the more radical procedure of extensive small bowel resection at a later date.

BENJAMIN GOLDMAN, M D

#### Malignant Tumors of the Small Intestine IRWIN E SIRIS *Am J Surg*, 1949, 77 573

The author presents 4 cases of malignant tumors of the small intestine. The underlying morbid process was different in each case. The difficulty in early recognition of tumors of this type, and the reasons for the grave prognosis are as follows: (1) the early symptoms are vague intermittent abdominal distress and distention bearing no relation to meals, followed by progressive weakness and severe anemia, (2) radiographically early, the disease is variously diagnosed and a correct radiographic interpretation is rarely made before the onset of partial obstruction, (3) with the onset of obstruction the disease is generally too far advanced to achieve a successful outcome, (4) the disease frequently extends to the mesentery which is foreshortened, (5) the lymphatic spread precludes radical extirpation of the inaccessible lymphatics, (6) metastasis and early recurrence within a few weeks to 2 years is to be expected if thorough extirpation of the involved lymphatics cannot be effected, (7) the disease is resistant to radiotherapy.

Extirpation of malignant tumors of the small intestine, even in advanced stages, is attended with a relatively low immediate operative mortality, therefore, earlier recognition of the disease may enhance the ultimate result. This may possibly be accomplished by (1) close evaluation of the history, (2) improvement in radiographic studies in order to ferret out the early intraluminary or extraluminary encroachments, and (3) comprehensive repeated laboratory investigations, particularly for occult blood in the stools and significant physicochemical changes in the blood in other than readily diagnosed entities.

BENJAMIN GOLDMAN, M D

#### The Management of Bleeding Duodenal Ulcers ROBERT W FRASER and JOHN P WEST *Ann Surg*, 1949, 129 299

The surgeon faces few therapeutic problems which are more perplexing than the management of a sudden, massive hemorrhage from a duodenal ulcer. When confronted with the individual case, statistics

do not provide the answer as to which course of treatment is most likely to lead to recovery. Without operation, the present mortality rate of 8 to 12 per cent (as variously reported) represents a distinct improvement over the mortality rate of 15 to 74 per cent of a decade ago, and appears to be largely due to the more generous use of blood transfusion since World War II.

There is no sure way of differentiating the fatal type of hemorrhage from the bleeding which will subside with nonoperative measures. Continuous recurrent, or sudden massive, hemorrhages occurring while the patient is under a strict medical regime are generally accepted as prime indications for surgical intervention. With a reliable bank and adequate blood replacement available, both the internist and the surgeon are allowed more time to plan the patient's therapeutic course, and this factor alone will undoubtedly result in improved mortality figures for both the operative and nonoperative cases.

The authors have reviewed the records of 177 cases of severe hemorrhage from duodenal ulcers. In all patients, the diagnosis was established by roentgenography, at operation or at autopsy, and the criteria for severe bleeding was a drop in hemoglobin to 65 per cent or less, and a reduction in red cells to 3,500,000 or less. One hundred and sixty-five patients were treated by nonoperative measures with 7 fatalities, a mortality rate of 4.2 per cent. Twelve patients did not show a satisfactory response to conservative treatment, and were operated upon while actively bleeding. All were operated upon in the late period, that is, after more than 48 hours of rapid blood loss, and 4 patients died, a mortality rate of 33.3 per cent. Ninety-three of the total series of patients were under 50 years of age, 9 of these were operated upon with 3 deaths, but there were no deaths in the group of 84 patients treated without operation. Eighty-four patients of the total series were over 50 years of age. Of these, 81 patients were treated by nonoperative measures, with death of 7, and 3 patients were operatively treated, with death of 1 patient.

The authors conclude that the occasional indications for surgical treatment of bleeding duodenal ulcers are limited, with few exceptions, to patients over 50 years of age. Operation apparently saved the lives of 4 patients in this series, but at the same time it appears probable that some of the patients subjected to operation might have survived without surgical intervention.

WAYNE FIELD CAMERON, M D

#### Two Cases of Persistent Jejunitis Following Partial Gastrectomy J L STEPHEN *Brit J Surg*, 1949, 36 325

Two cases are described in which chronic jejunitis followed partial gastrectomy. Antecolic retroperistaltic gastrectomy of the Hofmeister type was done in both cases, but it is noted that in 246 other gastrectomies, 148 of which were done according to the same procedure, no other similar case was en-



countered. Both patients complained of persistent diarrhea and rather vague tenderness down the left side of the abdomen. The diarrhea was characterized by a loose bowel movement after nearly every meal and was checked only by repeated small doses of bismuth and opium, sulfasuxidine, even in large doses, had had no effect. The tenderness on the left side corresponded in position to the first 20 cm. of the jejunum below the gastric stoma as seen on barium meal screening. No ulcer or special point of tenderness could be found. In neither case were pathogenic organisms found in the stool.

Both patients have been otherwise improved by the operation, have maintained their original weight, and have been able to continue with their previous work. The author believes that the condition is an extension of a pre-existing gastritis.

JOHN L. LINDQVIST, M.D.

**Polypoid Lesions of the Terminal Portion of the Colon.** LOUIS A. BUIE, NEWTON D. SMITH, RAYMOND J. JACKMAN, and JOHN R. HILL. *J. Am. Med. Ass.*, 1949, 139: 702.

Knowledge of the pathologic manifestations and of the diagnosis of polypoid disease of the colon has progressed, but results of treatment of the condition still are discouraging. Fulguration (which the authors define as a nonsurgical procedure) is described and reasons for its use are given. Also, how the proctologist can aid in combating this grave disease is outlined.

Polyps may occur singly or in numbers, and they may be sessile or pedunculated. The entire colon may be involved by polypoid disease, there are grossly two types of this condition. In one type, the polyps are discrete and gross evidence of pathologic change in the intervening tissues is absent. In the other type, there is a diffuse hyperplastic involvement, which may be segmental or total, and many polyps of all types, sizes, and shapes are found. Often, no part of the wall of the colon is free from disease. Such complete involvement is important and must be evaluated in relation to treatment.

The authors urge periodic examination of all patients who have had polypoid lesions of the terminal portion of the colon. The frequency of examinations depends on the seriousness of the condition. Roughly speaking, examination in from 1 to 3 months after completion of treatment is urged for all patients whose lesions were 1 cm. or more in diameter. There is more need for the examination if the lesion was sessile than if it was pedunculated. Regardless of the size of the lesion, it is not recommended that examination be deferred longer than a year. Roentgenologic examination of the colon never should be overlooked in cases in which polyps are found in the course of proctoscopic examination.

The term "fulguration," as the authors employ it, designates a procedure intended to destroy a growth by means of an electric spark which emanates from the electrode of a monopolar (Oudin) current. A bipolar current may be used. While a lesion is being

fulgurated, the tip of the electrode should be held so that the spark will leap approximately 5 to 6 mm. from the electrode to the surface of the growth. In this manner, the superficial layers of the polyp are first dried and later charred. Soon, an actual flame extends between the tip of the electrode and the tissues. After fulguration has been completed, a charred mass of tissue replaces the polyp. Fractional fulguration for indefinite periods may be necessary in order to destroy large lesions. In the case of pedunculated lesions, the site of attack may be the junction of the polyp and the pedicle. If this juncture cannot be exposed, and sometimes even if it can, and the polyp or pedicle is large, the body of the polyp should be fulgurated. Care must be exercised when fulgurating a pedicle, because often the pedicle carries a large artery. Sometimes, also, the peritoneal surface of the bowel wall is drawn into the pedicle.

A proctoscope which is suitable for use while performing fulguration includes a built-in suction tube through which smoke and gas can be exhausted from the bowel during fulguration. If such suction is not available, gas within the bowel may ignite or explode. Also, a means must be provided for exhausting stool and fluids from the bowel. The surface of the lesion must be kept dry during fulguration.

In most instances, anesthesia is not necessary or desirable. General anesthesia never should be employed. When the lesion is close to the anus or actually involves it, or when adequate exposure cannot be obtained, caudal anesthesia may be employed.

Complications of the procedure are rare.

Fulguration is an effective method, but great care must be used when selecting patients for this type of treatment.

Usually a pedunculated polyp may be fulgurated, regardless of its size or position in the bowel, provided that adequate exposure of the polyp and the entire pedicle can be obtained.

Large sessile polyps require more careful consideration. If such a polyp must be fulgurated, the ideal situation for it is on the posterior wall of that portion of the rectum which is not covered by mesentery. In that location there is little danger of injuring a vital structure, should it be considered necessary to destroy the wall of the bowel during the process of fulguration.

Malignant lesions deserve even more serious consideration than that which is given large sessile polyps. In order for treatment of these lesions to be at all successful, that portion of the wall of the bowel to which the growth is attached must always be destroyed. Consequently, such lesions should not be attacked by fulguration unless they involve the posterior wall of the rectum and only that portion of the rectum which lies distal to the peritoneal reflection. It is possible that malignant lesions which are not so ideally situated may respond favorably to fulguration, but they should not be so treated unless proper radical surgical measures are contraindicated or are rejected by the patient.

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Large disseminated polypoid lesions, whether benign or malignant, and those which are associated with diffuse hyperplasia of the mucous membrane respond poorly to fulguration, either when it is used alone or in conjunction with radium therapy. Radical surgical treatment is indicated in such cases. In fact, the same attitude should be adopted in regard to such conditions as that which is maintained in connection with the management of malignant disease.

### Complete Excision of Pelvic Viscera in the Male for Advanced Carcinoma of the Sigmoid Invading the Urinary Bladder

ALEXANDER BRUNSCHWIG  
*Ann Surg*, 1949, 129 499

Brunschwig narrates in detail a case of complete excision of pelvic organs in a male for an advanced carcinoma of sigmoid which was found to be invading the urinary bladder. The patient was able to return to his usual occupation with relief from pain and episodes of chills and fever of urinary tract origin with complete recovery in 14 months after operation. The case illustrates how certain abdominal neoplasms may progress locally to a marked degree before liver metastasis becomes manifested and, moreover, it shows the feasibility of complete excision of pelvic viscera in the male as a counterpart of the procedure devised for advanced pelvic cancer in the female.

STEPHEN A. ZIEMAN, M.D.

### The Selection of an Operative Procedure for Patients with Lymphogranuloma Venereum of the Rectum

LESTER BREIDENBACH and LOUIS R. SLATTERY  
*Surg Clin N America*, 1949, 29 399

The authors state that while the simplest surgical treatment of rectal strictures caused by venereal lymphogranuloma is excision of the rectum by the abdominoperineal technique of Miles, they prefer a surgical method that eliminates the stricture and preserves sphincteric function. Thus, they pushed the frontiers of surgical therapy for this crippling inflammatory rectal lesion far ahead of its place at the time they tackled this problem.

Usually, most of these patients do not present themselves for treatment until the disease is far advanced. The local pathologic changes consist of a tubular stricture involving the rectal ampulla for varying distances proximally and may be accompanied by fistulas to the perianal skin. Under such conditions, definitive or palliative local surgical procedures are contraindicated, the first objective being the institution of complete diversion of fecal stream and complete rest for the involved portion of the terminal bowel, which is accomplished by a defunctioning colostomy. A right-sided transverse colostomy is performed by completely dividing and separating the transverse colon through a transverse incision and implanting the end of each loop at each angle of the wound. The abdominal wall is closed in layers between the 2 stomas, and internal herniation is avoided by including the raw edge of the mesocolon in the peritoneal closure. This colostomy is closed intraperitoneally by freeing, and end-to-

end anastomosis of, the severed ends of the bowel. The authors consider this type of closure safer than the blind procedure which involves crushing of spurs.

The preliminary, temporary colostomy relieves chronic obstruction and allows the infection to subside. Since it is believed that gain in weight by the patient is the most accurate index of general improvement, the authors allow their patients to regain, or even exceed, their normal weight. Complete nutritional rehabilitation of the patient and control of the regional infection is accomplished in several weeks or months.

Roentgenographic studies through the distal colostomy and rectum determine the extent of involvement and influence the decision as to whether the strictured area may be removed by the perineal route alone or by the abdominoperineal routes. The status of the anal canal determines whether a low intestinal anastomosis or a "pull-through" procedure will be possible. Disease of the anal canal and perianal strictures calls for a "pull-through" operation, as described by Wright, while a normal anus and a terminal 3 cm of rectum permit the re-establishment of intestinal continuity by anastomosing the bowel above the mucocutaneous junction. Sacral exposure through a y-shaped incision permits access to those strictures that are limited to the rectal ampulla, but is inadequate for mobilization of the rectosigmoid or sigmoid. For the latter, the abdominal approach is necessary. Mobilization of the normal sigmoid for restitution of continuity is possible only by performance of a laparotomy. After freeing of the stricture and mobilization of the normal bowel, the abdomen is closed, the patient is then placed in the prone position and operation is continued through the perineal approach. The authors state that preservation of the anal canal gives more satisfactory sphincteric control than the pull-through procedures.

Extensive involvement of the left colon, either in continuity or segmentally (skip areas), pose a difficult therapeutic problem. After excision of large segments of the left-sided colon, considerable normal colon above the area of involvement must be mobilized to re-establish continuity. When the inferior mesenteric artery must be sacrificed, the proximal colon is mobilized with great care to preserve the marginal artery through which adequate blood supply is maintained by its anastomosis with the left branch of the middle colic artery. The mobilized segment of the bowel can be anastomosed to the rectum just above the anal canal or pulled through.

Only palliative procedures are indicated in a small number of elderly patients.

The preoperative and postoperative care is discussed briefly, it is essentially similar to that for colonic resection for the treatment of cancer.

The authors describe their results with 21 patients after the elimination of the strictured area and the restoration of intestinal continuity. There have

been 17 good results, one fair and one undetermined result, and 2 failures. The result is considered good when there is good sphincteric control without evidence of disease. The result is considered fair when there is narrowing of the bowel following surgical intervention in the presence of good sphincteric control. One failure resulted from sloughing of the bowel after it had been pulled through the sphincters under tension. Another patient had prompt recurrence of the disease after insufficient resection, and this patient was successfully reoperated upon after the reappearance of the granulomatous process at the site of the anastomosis. No deaths occurred in the group of 21 patients in whom intestinal continuity was re-established. Death occurred in 2 other patients, one acutely ill patient died following colostomy, while the other patient died following revision of a loop colostomy.

ROBERT TURELL, M D

**Operative Treatment of Carcinoma of the Distal Colon and Rectum** SAMUEL STANDARD and JOHN H MULHOLLAND *Surg Clin N America*, 1949, 29: 323

When dealing with carcinoma, the authors believe that the rectum "proper" should be separated from the lower sigmoid and the rectosigmoid. Difficulty in delineating the exact boundaries of the rectosigmoid could be eliminated by including that portion of the bowel which is completely covered by peritoneum. It is the authors' present policy to remove tumors of the lower sigmoid and rectosigmoid by anterior resection and primary anastomosis, which is defined as a surgical procedure in which it is necessary to mobilize the rectum from the hollow of the sacrum in order to achieve the anastomosis. This practice will eliminate colostomy in more than one-third of the patients now being treated by abdominoperineal resection.

Tumors of the rectum proper are divided into 4 groups:

1 Tumors situated from 1 to 3 inches (2.5 to 7.5 cm) from the anus, which require abdominoperineal resection.

2 Tumors situated from 3 to 5 inches (7.5 to 12.5 cm) from the anus which should be treated by abdominoperineal resection if they are large, if the fascia propria is involved, or if there is attachment to the adjacent pelvis. On the other hand, if the tumor in this area is small in size, localized, does not penetrate through the serosa, and can be removed with 3 to 5 cm (1+ to 2 inches) of rectum below the edge of the neoplasm, it should be extirpated by anterior resection.

3 Tumors that are situated 5 inches (12.5 cm) above the anus and which should have the preference of anterior resection and primary anastomosis if they are locally resectable. Only in cases of advanced lesions should abdominoperineal resection be performed.

4 Tumors, regardless of their location, when associated with incurable metastases and which should

be accorded the operation of anterior resection whenever it is technically feasible, because cure is no longer a consideration.

The authors report their experience with 40 anterior resections. In this series, the location of the tumors ranged from 3 to 10 inches (7.5 to 25 cm) above the anus. Earlier in their experience the tumors situated at lower levels were also removed by this procedure. Two of their patients died, one on the fifth and the other on the sixth postoperative day. Five of the 40 patients had had hepatic metastases at the time of operation. Four of these patients lived from 4 to 8 months and had normal bowel movements. The fifth patient was alive 10 months after operation at the time this article was completed. Five patients required resection of other organs because of adherence. Two patients required decompressing colostomy for acute obstruction on admission to the hospital. No proximal colostomy had been performed at the time of the primary operation. In one case the omission of the construction of a proximal vent was admittedly an error of surgical judgment. The authors believe that routine proximal colostomies are unnecessary, but that they should be done when a doubt exists about the viability of the anastomotic edges or about the adequacy of the suture line. There were 3 complicating fistulas in this series of cases, one drained sacally and closed in 34 days, another drained abdominally and closed in 12 days, and the third one failed to heal and was found to originate in a recurrence at the site of anastomosis. A bladder injury was repaired and healed uneventfully. No impotence was observed in 2 men aged 37 and 47 years, respectively. In 3 early cases the neoplasm was situated too close to the anus and at the present time the patients are being treated by abdominoperineal resection. None of the recovered patients have developed strictures at the site of the anastomosis.

The preoperative and postoperative preparation as well as the technique of anterior resection with primary anastomosis are recorded in detail.

The authors put into the general group of colonic tumors any lesion in the sigmoid which can be removed with a sufficiently wide margin of healthy colon without mobilization of the rectum from the sacrum. For these, resection and primary anastomosis has been done during the past 5 years. Neither the original or the modified Mikulicz procedure nor the Lahey two-stage abdominoperineal resection is now utilized.

ROBERT TURELL, M D

**LIVER, GALL BLADDER, PANCREAS, AND SPLEEN**

**Internal Biliary Fistulas** EARL E BARTH and ABRAM H CANNON *Q Bull Northwest Univ W School*, 1949, 23: 8

Although the presence of a fistulous connection between the biliary tree and the abdominal viscera is considered a rare occurrence, the true incidence is believed to be higher than is generally supposed.

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There is nothing in the clinical picture which will unequivocally establish the diagnosis, although in many cases roentgen examination of the abdomen may suggest the diagnosis, and at times definitely establish the diagnosis of internal biliary fistula by the demonstration of gas or barium in the biliary tree. Since these fistulas are usually buried in dense adhesions they are difficult to recognize at operation or at autopsy. The true incidence is difficult to ascertain further because the fistulas close spontaneously when the exciting factor has been relieved.

Almost all the intra-abdominal organs have been involved in biliary fistulas, although the vast majority of fistulas consist of an abnormal tract between the gall bladder and the duodenum. The cholecystocolic, choledochoduodenal, and the cholecystogastric types are next in incidence. Gallstones are the primary initiating factor in fistula formation. As a result of the accompanying cholecystitis, adhesions are formed between the gall bladder and adjacent viscera, and during an acute attack a fistula results from the necrotizing action of the gallstone or an associated empyema. A concurrent obstruction of the common duct, usually by an impacted stone, is an important factor in the production of fistula. Penetrating peptic ulcers account for about 6 per cent of spontaneous fistulas. Usually the ulcer is situated on the posterior wall of the duodenal bulb and perforation occurs into the common duct. Gastric ulcer, or cancer of the stomach, pancreas, or common duct may produce fistulas.

Emphysematous cholecystitis may simulate an internal biliary fistula, but the absence of gas in the bile ducts, the symptoms of acute cholecystitis, and perhaps some pericholecystic extension of the gas should serve to differentiate these two entities. Lipomatosis of the gall bladder may produce a superficial radiolucency of the gall bladder but no outline of the bile ducts will be seen, and the central part of the gall bladder shadow will have its normal density. Other causes of error in the differential diagnosis are the presence of barium beyond the duodenal wall in perforated ulcer, large duodenal diverticula which may simulate a gall bladder filled with barium, or reflux of barium through a dilated sphincter of Oddi.

The authors emphasize that in patients with obscure symptoms referable to the gall bladder, a scout film may afford evidence of gas in the biliary tree which will lead to the correct diagnosis.

WAYNE FIELD CAMERON, M D

**The Role of Roentgenology in the Prevention and in the Diagnosis of Postoperative Pain Syndromes in Cholecystectomies** (Il compito della radiologia nella prevenzione e nella diagnosi dei postumi della colecistectomia) GIUSEPPE MUSCETTOLA *Gior ital chir*, 1949, 5 73

The author's discussion of possible causes for the occurrence of failures and pain syndromes following cholecystectomies, considered from the roentgenologic standpoint, is supplementary to that by the surgeon, Imperati who presented the surgical aspects

of the problem (*Gior ital chir*, 1948, 4 479 and 547). From a study of the literature on the subject, most of which has already been discussed in the above cited article by Imperati, and a consideration of his own experience, the author offers certain conclusions peculiar to the field of roentgenology.

It is believed that in the cholecystopathies, especially those in which cholecystectomy is generally indicated, a roentgenologic examination (when coordinated with the clinical picture, and performed in a technically correct and adequate form) is valuable not only as a preoperative diagnostic and orientative surgical measure, but also as a means of forestalling the painful sequelae which so plague the surgeon in dealing with the biliary tract.

With reference to the per-operative roentgen manometry practiced so intensively by the Lyonnais school of French surgeons (Pierre Mallet Guy, René Jeanjean, and Pierre Marion), it is recognized that the surgery of the biliary tract has been essentially advanced by this technique. The author frankly admits that his own experience with this method has been meager, and he does not wish to imply that he thinks the French surgeons are overly enthusiastic, however, from a study of their reports and conclusions, he believes that a certain amount of caution in appraising the results to be anticipated in the use of the per-operative procedure is justified. Its lack of precision and variability would seem to diminish its value in the study of functional disturbances of the biliary tract in general. The difficulty of precision in its application to the study of the cholecysticus and of the cystic duct suggests caution in the interpretation of its findings in this portion of the biliary canal. The chief value of the method would seem to lie in its application to the study of cases of lithiasis, of inflammation and of stenosis (both intrinsic and extrinsic) of the choledochus, hepatic ducts, and intrabepatic biliary branches. The limitations and the inconveniences of the method would seem to suggest considerable caution in the choice of patients for its application.

The most frequent causes of recurrences and of pain syndromes, as brought to light by roentgenology, are the unrecognized and unremoved bile stone, the associated inflammatory affections of the bile tract and of associated organs (pancreatitis, angiocholitis, hepatitis), the accompanying—perhaps preoperatively unrecognized, or incompletely recognized—pain syndromes of other abdominal organs (duodenitis, peptic ulcer, appendicitis), and the diffuse adhesion syndromes of the right side of the abdomen (periduodenitis, pericholecystitis, ascending adhesive processes originating in the appendix), all of which may have been present before the operation and, on occasion, aggravated and extended by the operation itself.

In these postoperative syndromes of pain caused by a process of adhesions, a protracted course of Marconi therapy, associated with small doses of roentgen therapy may give valuable assistance.

JOHN W BRENNAN, M D

**The Surgical Treatment of Pancreatitis** HENRY DOUBILET and JOHN H. MULHOLLAND *Surg Clin N America*, 1949, 29: 339

The authors believe that pancreatitis is a common disease varying in intensity from mild attacks to severe abdominal catastrophes. Recurrent pancreatitis is frequently confused with the postcholecystectomy syndrome or biliary dyskinesia. An understanding of the etiology and pathology of recurrent acute pancreatitis and its sequelae helps one to diagnose and treat this condition rationally by definitive surgery.

The salient experimental and clinical observations are enumerated and briefly discussed. Cholangiographic studies conducted by the authors point to reflux of bile into the pancreas as a predominating etiologic factor. This reflux is frequently brought about by abnormal spasm of the sphincter of Oddi in the presence of a common biliary pancreatic passageway above the sphincter.

The correct diagnosis during the acute attack is frequently difficult to make as during the height of the attack this condition may closely resemble a perforating peptic ulcer, acute cholecystitis with or without perforation, acute intestinal obstruction, mesenteric thrombosis, or cardiac infarction. The estimation of the serum amylase values is of real help in the differential diagnosis. A high serum amylase value suggests acute pancreatic disease, however, a low value does not always exclude pancreatitis, especially if the test is done several days after the onset of the disease. In spite of its limitations, the serum amylase test should be performed in all acute upper abdominal conditions.

The outstanding characteristics of the interval phase of recurrent acute pancreatitis is pain after eating and the loss of weight due to fear of eating. There is usually an absence of a high serum amylase level even during an attack which lasts 2 or 3 days. Under these circumstances, the secretin test assumes great value. A diminished flow of pancreatic juice in response to a standard dose of secretin is of diagnostic importance. It should be kept in mind, however, that frequently the secretin test falls within normal limits. A diminished concentration of bicarbonate or a very low concentration of amylase in the pancreatic juice is indicative of pancreatic disease.

The treatment of the acute phase of pancreatitis is nonsurgical. Dehydration and shock are treated with intravenous fluids, blood, and plasma. Complete rest of the alimentary tract is instituted. Antispasmodic drugs, such as atropine in dosages of 1-3 mgm (1/150 gr) and papaverine in dosages of 120 mgm (2 grains) are given every 4 hours. It should be recalled that these drugs may be ineffectual when the sphincter of Oddi is rendered spastic by inflammation. The administration of penicillin, 300,000 units every 6 hours, will help to prevent infection of the necrotic pancreatic tissue and exudate. These therapeutic measures plus supportive therapy are kept up continuously until the patient improves and the serum amylase test, performed

daily, has returned to normal levels. When the patient has recovered and is able to walk, other diagnostic studies, such as roentgenography, secretin test, sugar tolerance curve, and so forth, are instituted.

The operation is performed about 3 weeks later. The operative technique of endocholedochal sphincterotomy is described in detail. Allusion is made to the difficulties that may prevent section of the sphincter of Oddi. Considerable reliance is placed on the cholangiogram for the delineation of the size, direction, and tortuosity of the common duct. Sphincterotomy is said to cure the patient and will prevent further attacks of pancreatitis.

ROBERT TURELL, M.D.

**Cystic Fibrosis of the Pancreas** J. HOWARD and L. HESSELVIK *Uppsala läk fören förh*, 1949, 1: 53

Cystic fibrosis of the pancreas is a congenital disease characterized by the total absence or gross deficiency of the external pancreatic secretion, resulting in symptoms referable to the digestive or respiratory systems, or both. These symptoms are present at birth or manifest themselves during the first year of life.

The distribution of the disease is world wide. There is no sex predominance, and in approximately 50 percent of the cases it occurs as a familial disease.

The many theories as to the cause of the disease can be reduced to five leading ones: (1) obstruction of the large and small pancreatic ducts, which in some cases is on the basis of atresia, (2) inspissated secretion, which may be on the basis of a disturbance of parasympathetic innervation, (3) avitaminosis A, which leads to desquamation of ductal epithelium and subsequent mechanical blocking of the ducts, (4) fibrosis following inflammatory change, (5) Glanzmann's theory, which states that antibodies similar to the Rh antibody pass by way of the aspirated amniotic fluid into the lumens of the intestine, lungs, and pancreas and there react with local cellular antigens, thus injuring the developing glands.

The authors believe that in those cases in which there is no atresia of the ducts an imbalance of the nervous control of pancreatic secretion is the most plausible theory of etiology.

The chief pathologic findings in early life are dilatation of the acini and smaller ducts, and the presence of eosinophilic concretions blocking their lumens. The number of acini remains normal, and there is a marked proliferation of fibrous tissue. In older infants, the atrophic acini are replaced by fat. Thick inspissated meconium blocks the intestinal tract. The commonest lesion in the respiratory tract is a tracheobronchitis.

The clinical picture usually fits into one of three groups: (1) cases with meconium ileus, (2) cases with onset of a respiratory infection before the sixth month, (3) those with onset of respiratory symptoms after 6 months.

The most significant laboratory finding is the demonstration of the absence of, or greatly decreased,

trypsin content in the duodenal juice. The diagnosis of cystic fibrosis of the pancreas cannot be correct if there are normal amounts of trypsin. Other pancreatic enzymes in the duodenal juice are also diminished. Steatorrhea is present to some degree, and this may be demonstrated by microscopic or chemical analysis of the stool.

Röntgenographic examination of the lungs generally is negative at birth. Later, obstructive emphysema or localized patches of atelectasis may be demonstrated. Roentgen examination of the intestinal pattern may show clumping of barium as it does in other subgroups of celiac syndrome.

Treatment of the disease is based on two principles: first, the nutritional condition of the patient must be corrected, and second, measures must be taken to control the respiratory infection. The diet for these patients should be high in calories to remedy the poor food utilization, it should contain twice as much protein as is usually prescribed for the patient's age, it should be rich in carbohydrates, but no starch should be given until after the third year, a low fat intake is important, vegetables and fruits are well tolerated, vitamins, especially A and D, should be given. Pancreatin sometimes produces striking results.

Penicillin orally, intramuscularly, and by nebulization has been used for the respiratory stages of the disease. Streptomycin has not yet had an adequate trial.

Fourteen years is the longest survival for an untreated child with cystic fibrosis of the pancreas. Most children survive about 2 years if untreated. Surgery is the only hope for infants with meconium ileus, and even with successful surgery the condition is apt to recur. Penicillin has improved the prognosis of those with severe respiratory disease. If the disease is diagnosed early and given adequate treatment, the child has a fairly good chance of reaching adulthood.

Case reports of 7 carefully studied cases are given. Three patients died. Four patients were treated medically, but satisfactory control of the condition was obtained in only one.

FREDERICK W. PRESTON, M.D.

#### Indications and Results of Left Pancreatectomy

Report of 16 Cases (Indications et résultats de la pancréatectomie gauche, d'après 16 observations personnelles). P. MALLET GUY and R. LACOUR. *Lyon chir.*, 1949, 44: 169.

Left pancreatectomy consists of mobilization of the pancreas and resection of all of the gland to the left of the midline, and usually all of the gland except that portion adjacent to the duodenum. Indications for the operation in 16 cases included 1 patient with benign tumor, 1 patient with hyperinsulinism, 12 patients with inflammatory disease, and 2 patients with malignant disease of the pancreas. There was 1 operative death. Postoperative complications included postoperative hemorrhage, pseudocystic degeneration of the pancreatic remnant, infection in

the remnant, and persistent fistula. Each occurred in one patient.

For lesions localized in the left portion of the pancreas, the operation is preferable to marsupialization or to enucleation. The exception to this statement is adenoma of the islands of Langerhans. Occasionally these adenomas can be palpated as discrete lesions and, if so, an enucleation may be done. If the adenomas are multiple, left pancreatectomy, left and right pancreatectomy, or total removal of the gland may be indicated, depending upon the extent of the lesion.

The treatment of acute pancreatitis by pancreatectomy was abandoned by most surgeons many years ago. However, the authors cite one case in which an acute hemorrhagic pancreatitis was complicated by persistent bleeding. The bleeding was stopped and the patient was cured by left pancreatectomy.

Four patients with chronic pancreatitis who had recurring attacks of acute pancreatitis were subjected to left pancreatectomy, with good results.

The operation had also been tried for patients with severe pain caused by chronic relapsing pancreatitis. However, the most effective treatment introduced to date for these patients is unilateral splanchnic nerve section.

Occasionally when calculi are present in the duct of Wirsung, the treatment of choice is left pancreatectomy. Simple extraction of these stones is often impractical because of the multiplicity of the calculi, and often the procedure is unsuccessful because of persistent external pancreatic fistula. If calculi are present in the head of the pancreas, left pancreatectomy may be combined with right pancreatectomy or with pancreaticolithotomy. Two of the authors' patients who were subjected to left and right pancreatectomy for calculi obtained excellent results.

Carcinoma of the pancreas usually cannot be cured by any operation short of total pancreatectomy. In 2 of the authors' cases left pancreatectomy was done for pseudocyst, and on histologic study carcinoma was found to be present. In one of these patients the carcinoma promptly recurred, the other, who is still alive, is one of the few patients with carcinoma of the pancreas ever cured by this operation.

FREDERICK F. PRESTON, M.D.

Present Concepts in Surgery of the Spleen. LOUIS M. TOUSSELOT. *Surg. Clin. N. America*, 1949, 29: 369.

The author stated that the surgical treatment of splenopathies has been changing in the past few years. Generic terms of only a decade ago are being broken down into less ambiguous and more definitive groups.

Splenectomy is indicated in the following conditions: (1) carcinoma of the stomach, colon, or pancreas (it is used as an adjunct to other surgery in these conditions, also, pancreatic resection for hyperinsulinism may so compromise the splenic vein that splenectomy is inevitable); (2) anomalies; (3) rupture, traumatic or spontaneous, unrelated to trauma; (4)

hemolytic icterus, the congenital or acquired forms, (5) idiopathic purpura hemorrhagica, and (6) congestive splenomegaly (portal hypertension)

All aspects of hemolytic icterus, including the value of a new diagnostic blood test used to differentiate the congenital from the acquired types, are discussed. Considerable discussion is also devoted to portal hypertension (congestive splenomegaly) with an allusion to the couplings that have been described to date by various surgeons. The one stage splenectomy with portacaval shunt is advocated for the treatment of this condition.

ROBERT TURELL, M D

### MISCELLANEOUS

**Multiple Aortointestinal Fistulas Secondary to Swallowed Foreign Body** JOHN D. HOLLE.  
*Surgery*, 1949, 25: 608

A single case of aortoduodenal fistula which was secondary to a swallowed needle is presented as a case report.

A 21 year old white male had complained of gastrointestinal tract bleeding for 6 weeks. The patient was very thoroughly examined from the gastrointestinal and laboratory standpoint. A Sippy diet and blood transfusions were the principal treatment. An exploratory laparotomy was essentially negative. Mas-

sive hemorrhages continued. The patient was again prepared, and a second laparotomy was performed. On this occasion a sharp, pointed object was encountered in a third portion of the duodenum beneath the superior mesenteric vessels. Re-examination of the x-ray films showed a sewing needle which had been present but disregarded in all previous x-ray examinations. A pulsating aortointestinal fistula extended from the abdominal aorta to the posterior wall of the duodenum. This was excised. The needle was lost. X-ray re-examination showed the needle to be one vertebra lower than previously. The patient received a total of 26,500 c.c. of whole citrated blood and 1,200 c.c. of pooled plasma. He was discharged from the hospital and after a period of 4 months he began to pass blood. A fourth laparotomy was performed. This time a pulsating mass was found over the distal portion of the abdominal aorta which measured 9 cm. in diameter. A false aneurysm and two loops of ileum were resected. Part of the needle was removed. The patient made an uneventful recovery. Another x-ray revealed a  $\frac{1}{2}$  cm. fragment of the needle still present. Three months following his last discharge he again passed bloody stools. A fifth laparotomy was performed. Two months following this last laparotomy he appeared to be well with the fragment of the needle still present.

RICHARD J. BENNETT, JR., M D



# GYNECOLOGY

## UTERUS

**Complications of Endometriosis** CLYDE L. RAN  
DALL *J Am M Ass*, 1949, 139 972

Complications of endometriosis are disturbances resulting whenever disseminated superficial lesions or a single penetrating nodule interferes, symptomatically or mechanically, with the function of the reproductive, urinary, or digestive tracts. Often there seems little correlation between the severity of the symptoms and the extent of the disease. Menstrual irregularities are not often due to the disease.

Endometriosis frequently gives rise to pain which is aggravated at the time of the menses but, like pelvic inflammation or neoplasm, it tends to recur throughout the month. Frequent as menstrual pain may be, a history of dysmenorrhea warrants the suspicion of endometriosis in cases in which the patient describes a classic and progressive "acquired" type of pain.

Dyspareunia can be relieved only by eradication of the responsible implants.

The evidence suggests that the development of endometriosis is favored by infertility. Endometriosis does not regularly interfere with ovulation, and it does not close the genital tracts and actually prohibit conception. Existing foci of endometriosis undergo noticeable resolution during pregnancy.

Although digestive disturbances are rarely due to endometriosis, the rectosigmoid, and occasionally other areas, may be involved. When the former is involved, the symptoms and signs may simulate those of diverticulitis or cancer of the bowel.

Urinary distress is not often due to endometriosis, but bladder function and the caliber of the lower ureter may be affected by the disease.

Roentgen irradiation in subcastration dosage is of little value. However, when castration is permissible, surgical treatment can be avoided by roentgen treatment.

At the present time it is difficult to evaluate endocrine therapy, and further investigation is indicated.

In surgery for endometriosis dysmenorrhea, thorough exploration and adequate resection of the involved tissues are important. If the uterus and any ovarian tissue are to be preserved, a presacral nerve resection is necessary.

Although castration avoids further progress of the disease, gynecologists have recommended resection of the ovaries rather than oophorectomy, with the result that pregnancy has resulted in at least one-third of the patients. However, reoperation may be necessary in at least 30 per cent.

Endometriosis of the rectosigmoid must be differentiated from carcinoma. Castration accomplishes symptomatic relief in endometriosis of the bowel.

Implants producing cul-de-sac adhesions often infiltrate the muscularis of the bowel wall and extend retroperitoneally along the parametrium until the induration makes the uterosacral region rigid and, occasionally, the ureter is compressed. In such circumstances, castration or extensive retroperitoneal dissection is necessary to relieve the patient, and either procedure proves effective.

T FLOYD BELL, M D

**Surgical Treatment of Endometriosis** CLAYTON T BEECHAM *J Am M Ass*, 1949, 139 971

As observations on the behavior of endometriosis increase, the indication for surgical treatment declines. Pregnancy is the best therapeutic measure. However, there are limitations of, as well as failures in, nonoperative medical and hormonal treatment of endometritis.

The author reports an incidence of endometriosis of from 5 to 8 per cent in his series of patients. One-half of the cases were successfully managed without operation.

The following conditions are indications for surgical treatment after failure of medical therapy: (1) dysmenorrhea, (2) pain in the lower quadrant of the abdomen, (3) dyspareunia, (4) menorrhagia, (5) rectal pain and tenesmus, and (6) metrorrhagia.

Surgical procedures must be carefully individualized. The important factors that will aid the surgeon in the selection of a given procedure are: (1) the age of the patient, (2) her marital status, (3) the number of children she has borne, (4) infertility, (5) acceptance of a conservative policy as regards the operation and what it might mean in the event of failure to relieve all the symptoms, and (6) the emotional balance of the patient.

Any patient, regardless of age, with symptoms of partial bowel obstruction from endometriosis is operated on as soon as possible. In cases of severe involvement in the cul-de-sac, total hysterectomy is much better than the subtotal operation. Drains do more harm than good.

T FLOYD BELL, M D

**Doubtful Malignant Changes in the Endometrial Epithelium. A Report on 60 Cases from the Radiumhemmet** GILBERTO MARRUBINI *Acta radiol*, Stockh, 1948, 31 65

In this article 60 "debatable cases," which are markedly suspicious but not characteristic of malignant changes of the endometrium, are discussed from the clinical and the microscopic standpoints. These are borderline cases between the benign and the malignant, and comprise 54 per cent of the total series of cases of cancer of the uterine body observed by the author. The strong suspicion of malignancy, both from the pathologic and the clinical standpoints, was in every case an indication for the line of therapy adopted. Treatment with radium was given



in doses commonly used for uterine cancer, and followed up for at least 5 years

Ten per cent of the 60 cases reported here, in spite of the radical treatment given, showed the development of adenocarcinoma later, 5 cases in the endometrium and 1 case in the fallopian tube

For the histological examination the material has been divided into 3 groups, as follows

1 Cases in which there are suspicious changes in a functional endometrium

2 Cases showing a very marked glandular proliferation in a nonfunctioning endometrium

3 Cases in which the changes suspicious of malignancy are found in an endometrial polyp

In all the cases, changes occurred solely in glands and glandular epithelium. The glands were very frequently increased in number, sometimes enormously so, and more often so closely packed as to resemble the structure of a highly organized adenocarcinoma. Great differences were observed in their shape and size, cystic changes were noted in some of these cases, as well as irregular packing of convoluted glands. There were irregularities of the glandular epithelium. Abundant mitoses were often found and differences in staining were frequent, as well as other atypical features.

The most important general reasons why a definite diagnosis of adenocarcinoma could not be made were

1 The epithelial changes were always confined to the glands without any obvious destruction of the membrana propria

2 The different types of changes described did not all occur in the same case

The findings seemed to indicate that the suspicion aroused by these pseudomalignant lesions is graver in cases showing endometrial polyps or atypical glandular proliferations in a nonfunctioning endometrium than in cases with an endometrium of functioning type

The occurrence of these pseudomalignant lesions in the postmenopausal period should be regarded with more suspicion than such occurrence during the menopause or before. This fact is substantiated by the finding that 5 of the 6 patients who developed a true carcinoma had passed the menopause

The symptomatology was usually limited to irregular bleeding of varying duration. In the postmenopausal patients this symptom was far more suspicious of uterine neoplasm than in the patients in the menopausal period

No definite conclusions can be drawn from this study as to whether these cases should be considered to have been truly malignant *ab initio*. Radical treatment in all cases seems justified. As these lesions appear to be confined to the endometrium, a radical effect following the treatment is to be expected

Furthermore, since these changes are not unequivocally benign, and since careful radium therapy involves little risk, the author believes all patients with these changes should be given the benefit of this treatment

T FLOYD BELL, M D

#### Unsuspected Cervical Cancer in Gynecological Patients HAROLD SPEERT *Am J Obst*, 1949, 57 947

Fourteen cases of unsuspected cervical carcinoma are reported which were discovered postoperatively by pathologic examination. Approximately 2 per cent of all cervical cancers were discovered in this manner. In 5 cases, total abdominal hysterectomy had been performed. In 8 instances, the tumor was found in tissue removed incidental to plastic operations. In 1 case, the tumor was revealed on postoperative biopsy after subtotal hysterectomy.

Meticulous examination of the cervix by means of biopsy of suspect areas should precede all major gynecological operations, while routine curettage is a worthwhile preliminary to vaginal plastic operations to exclude unsuspected endocervical and endometrial cancer.

GEORGE BLINICK, M D

#### Four New Cases of Malignant Neoplasm on the Cervical Stump (Quattro nuovi casi di neoplasia, maligna, sul moncone cervicale) FRANCO OLIVELLI *Ginecologia*, Tor, 1948, 14 584

The intervals between operation and the onset of clinical manifestations in 4 patients varied from 15 months to about 9 years. The carcinoma found after 15 months might be suspected of having been present at the time of operation, since some authors regard 2 years as the minimal free interval to exclude a pre-existing malignant tumor, but considering the variability in the speed of development of cancer and accepting, with Tagliaferro, the period of one year as a sufficient free interval, it must be admitted that no diagnostic error was made in this case. However, there is another question, i e., whether at the time of hysterectomy there was any sign suggesting the possibility of later development of cancer in the cervical stump.

Case histories revealed the following conditions in the first patient, a marked familial tendency to carcinoma, in the third patient, a glandular endometritis, in the fourth, a hypertrophic portio with a small erosion in which diagnostic curettage disclosed an interstitial endometritis, and in the third and fourth patients, cervical lacerations.

The indications for hysterectomy had been fibromyoma of the uterine body in 1 patient, metroendometritis with hemorrhagic content in 2 patients, and bilateral ovarian cystoma with apparently intact uterus in 1 patient. This variability is in contrast with the observations of most authors who have found that in the majority of cases carcinoma appears in stumps of previous hysterectomies for fibromyoma, but it is evident that this finding is due to the fact that fibromyomas present the most frequent indication for subtotal hysterectomy.

Various theories have been advanced to explain malignant degeneration of the stump. In the opinion of some authors, elimination of ovarian function would be a factor predisposing to cancerization by atrophy occurring in the stump, or by loss of the influence of the ovary on the connective tissue defense

TABLE I — AN ANALYSIS OF RESULTS BY THE TWO MAJOR TYPES OF THERAPY

		Number of cases	Cured	Percentage
A Radiation treatment (344 of 396 or 86.9%)	Group I	79	61	77.2
	Group II	174	78	44.8
	Group III	77	17	22.1
	Group IV	14	0	0
	Group I-IV	344	156	45.3
B Operative treatment (38 of 396 or 9.6%)	Group I-II (Wertheim)	23	14	60.9
	Group I-II (Schauta)	12	6	50.0
		35	20	57.1
	Palliative hysterectomy	3	0	
C Untreated (14 of 396 or 3.5%)	Group IV	14	0	
	Total	396	176	44.4
A+B+C				

TABLE II — COMPARISON OF RESULTS OF TREATMENT FOR VARIOUS PERIODS

	Number of cases	Cured	Percent age	Relative cure rate	
				I/II in per cent	III/IV in per cent
1913-1928	623	140	23.9	41.3	10.6
1925-1930	339	101	29.7	40.4	13.9
1930-1936	329	121	36.8	49.0	—
1936-1942	396	176	44.4	55.2	15.7

**Results of Treatment of Carcinoma of the Cervix Uteri in the Period from 1936 to 1941 (Be-handlungsergebnisse beim Carcinoma colli uteri, 1936-1941)** H. RUNGE and H. WIMHOEFER *Geburtsh. & Frauenh.*, 1949, 9, 84

The authors report on their results of therapy in 396 cases of cervical carcinoma observed from 1936 to 1941 at the Gynecological Clinic of the University of Heidelberg. Less than 10 per cent of the patients were treated by surgery and nearly all the remainder by combined x-ray and radium irradiation. The absolute cure rate amounted to 44.4 per cent, and the relative cure rate for the operable cases was 55.2 per cent and that for the inoperable ones, 15.7 per cent.

Grouping of cases was determined clinically, as follows:

- Group I Carcinoma limited to the cervix
- Group II Spread of the carcinoma to the vagina or slight invasion of one or both parametrial areas
- Group III Unilateral or bilateral parametrial spread directly to the bony pelvic wall
- Group IV Frozen pelvis, invasion of the bladder or rectum and distant metastases

The similar results in similar cases treated by radiation or surgery is to be noted. Clinical grouping and not histologic grading is important in determining the prognosis. Cervical carcinoma in women

under 50 years of age or accompanied by an inflammatory reaction during or following radiation therapy also points to a poor prognosis.

A comparison of the statistics for the period from 1936 through 1941 with those of a previous period is presented in Table II. There has been a marked improvement in the results through the years.

WARREN R. LANG, M.D.

**Wertheim's Operation in Retrospect.** VICTOR BONNEY *Lancet*, Lond., 1949, 1, 637

The author reviews the early history of Wertheim's operation and reports his own first successful operation in 1907. He departed somewhat from that of Wertheim. He removed routinely the regional glands and from one-half to the whole of the vagina. In 1941, Bonney reported the results of 500 operations on a 5-year basis, and of 415 operations on a 10-year basis. The 5-year cure rate was 40 per cent, or 43 per cent according to the method of calculation, and the operative death rate was 14 per cent. On the 10-year basis the cure rate was 31 per cent or 36 per cent, and the operative mortality slightly less than 14 per cent.

The cures in the group of cases without gland involvement were far greater in number than those in the cases with gland involvement. There was a greater

difference, too, in the respective operative mortalities, those of the first group amounting to 10 per cent and those of the second group, 20 per cent

Surgery can effect one 5-year cure in every 4 unselected patients, and one 10-year cure in every 5 unselected patients. In addition, there is another group from which patients can be salvaged by irradiation. The author believes that certain cases of cancer of the cervix are best treated by surgery, while others are best treated by irradiation. Among the cases which should be treated by surgery are those in which the growth is refractory to irradiation, and it is of the utmost importance that some method be found by which refractoriness or vulnerability can be distinguished before any treatment is decided on.

The author hopes for the day when a specific cure for cancer will be found. Till then, surgery and radiotherapy must be relied upon.

T FLOYD BELL, M D

### ADNEXAL AND PERIUTERINE CONDITIONS

**Limitation and Extension of the Syndrome of Demons-Meigs** (Limitation et extension du syndrome de Demons-Meigs) P FUNCK-BRENTANO *Presse méd*, 1949, 57 341

Now that the period of the reporting of curious syndromes has passed (which was the purpose of the reports of Demons a half century ago), and we are introduced to a well defined clinical entity, the syndrome described by the American, Meigs—because of its vital, practical importance therapeutically—needs to have its frontiers rigidly defined.

The conditions necessary for qualification of the disease as the syndrome of Demons-Meigs are the presence of a benign ovarian fibroma accompanied by a bilateral, or unilateral, hydrothorax and an ascites. However, the author believes that to these conditions as an entity should be added (under the term "syndrome of Demons-Meigs") the partial syndromes of ovarian tumor plus hydrothorax, and of ovarian tumor plus ascites. The manifestations should, of course, be immediately and definitively curable by ablation (castration) of the ovarian tumor.

In the Demons-Meigs syndrome, the hydrothorax may precede the ascites (this naturally disposes of the theory of transudation of the fluid exclusively and immediately from the tumor surface itself) or the ascites may precede the hydrothorax. Neither the fluid from the pleural cavity, nor that from the peritoneal cavity will contain blood or tumor cells. This will perhaps have differential diagnostic importance. Another characteristic of this condition which may have diagnostic significance is the vast predominance of the hydrothorax limited to the right side of the chest.

The author quotes extensively from the writings of Demons, in the years 1901 to 1903, to show that he was actually discussing the condition which has recently been erected into a syndrome by Meigs.

JOHN W BRENNAN, M D

### Peritoneal Bodies and Cysts of the Broad Ligament

R. R. GREENE, B. M. PECKHAM, and G. H. GARDNER. *Am J Obst*, 1949, 57 890

This excellent article on peritoneal bodies and cysts of the broad ligament is timely and has as a background a tremendous amount of original research by the authors. They do not believe that men's names such as "Walthard" should be applied to anatomic or pathologic structures. They believe, and it is the modern trend in nomenclature, that terms should be descriptive, or of etiologic significance.

The material was derived from routine slides of one or both salpingo-oophorectomy specimens from 150 patients. In addition, the lateral half of the tube, broad ligament, and ovary from 16 patients were serially sectioned and studied. Routine sections were stained with hematoxylin and eosin, in addition, Milligan trichrome and iron hematoxylin with mucicarmine have been used.

The authors found these solid or cystic bodies in specimens from 78 patients. A total of 58 solid bodies and 78 of their cystic derivatives were found. These do not include the findings from two serially sectioned specimens. One surface of one broad ligament and both surfaces of the other were literally covered by these solid or cystic structures. In the routine tissues the number of solid bodies varied from 1 to 3 per specimen and the number of cystic structures from 1 to 12.

The solid bodies were a mass of epithelial cells with distinct cell membranes, faintly staining cytoplasm, and vesicular nuclei with little or no chromatin. There was infolding of the nuclear membrane resulting in bizarre nuclear shapes. There were no intercellular bridges, no basement membrane surrounded the body, and there was no true capsule.

The process of cavity formation and cystic dilatation could be observed in various specimens. In early cavity formation the adjacent epithelial cells were cuboidal or even columnar. This is thought to be a degenerative phenomenon. As fluid accumulated the number of cells in the wall became fewer until in the larger ones the epithelium consisted of usually two layers and, more rarely, a single layer.

The authors state that the impression is current that these structures are found only on or just below the serosa of the tube. A group of 67 solid or cystic bodies in which the position could be accurately determined was tabulated, 33 were on the tube and 34 on other areas of the broad ligament. Of the latter, 9 were on the mesovarium and 25 on the mesosalpinx. The authors note that most of their blocks were cut to include the tube, mesosalpinx, mesovarium, and at least part of the ovary. It was thus possible to survey the serosal surface of all the constituents of the broad ligament in a single section.

A few of the solid bodies showed direct continuity with the mesothelium, only a portion of the mass being subserosal. In other routine sections solid bodies and some showing a moderate degree of cystic dilatation were located immediately under but not

continuous with the mesothelium. Some that were serially sectioned showed continuity with the mesothelium and some did not and still others were not serially sectioned.

Gross pathology reports and microscopic specimens from 35 patients were examined particularly for evidence of present or past inflammatory reactions, which were found in 32 specimens. The evidence of active inflammatory reaction was quite obvious, it was usually a subacute perisalpingitis associated either with ectopic pregnancies or, more frequently, with endometriosis. Adhesions alone or in association with other old inflammatory residuals were found in others. These too were associated with residues of pelvic inflammatory disease or with endometriosis. In 3 cases no evidence was found but it is possible, of course, that it had been present and left no evidence.

The authors recently described the detailed histologic characteristics of cysts of the broad ligament derived from the mesonephric duct, mesonephric tubules, and aberrant paramesonephric epithelium (tubal or Muellerian). Cysts of mesonephric or paramesonephric origin have a true capsule whereas peritoneal cysts do not. The epithelium of cysts of mesonephric duct origin is single layered and cuboidal and has a basement membrane. That of mesonephric tubule origin is more columnar and is composed of two types of cells—lightly staining ciliated cells and darkly staining nonciliated cells. The epithelium of cysts of paramesonephric origin is identical to that of the oviduct or tube and is composed also of two types of cells, ciliated and secretory. The epithelium of the peritoneal cysts, on the other hand, is composed of flattened cells, usually two layers in thickness.

Four main theories have been proposed to explain the histogenesis of the so-called Walthard bodies.

Rossa (1898) proposed that these bodies come from accessory adrenal tissue and that the cysts result from atrophy of this tissue. This theory has been generally discarded.

Schickele (1902) proposed that they came from ovarian germinal epithelium which in some manner had been transferred to the site of origin. The authors think this theory too complicated.

Ralph Reis recently suggested that they might develop from misplaced ectodermal cells of cloacal origin because of the close similarity of these structures to the cell balls of Limbeck and Brunn which are found under the vesical and ureteral mucosa. The authors think this theory unlikely and state that because two structures are morphologically similar does not prove they are of the same embryonic origin.

The fourth and commonly accepted theory was proposed by Werth in 1887. He showed that these bodies develop as proliferations of the peritoneal epithelium. Robery Meyer (1903) published a thorough and convincing study on the subject.

The authors' studies and findings followed closely those of Werth and Meyer. Various stages in devel-

opment have been noted from the early localized areas of proliferation of the mesothelium—the downgrowth of epithelial masses, the subserosal masses of epithelial cells no longer connected to the mesothelium, early cystic degeneration, and the final result, peritoneal cysts. BYFORD F. HECKETT, M.D.

## EXTERNAL GENITALIA

Two Cases of Benign Connective Tissue Tumor of the Female External Genitalia (Due casi di tumore connettivale benigno dei genitali esterni femminili) CESARINA MUSANTE *Ginecologia*, 101, 1948, 14 574

The first patient presented, on the free border of the left major labium between the anterior and middle thirds, a pedunculated tumor (the size of a nut) which was painless and had the characteristics of a fibroma or fibrolipoma. It had first been noted as a small nodule 3 years previously and had slowly increased in size. It was removed under local anesthesia, and histologic examination showed it to be a pure fibroma.

The second patient presented, on the edge of the prepuce of the clitoris, to the right of the median line, a neurofibroma which was round, pedunculated, and the size of a pea. It was excised, and histologic examination confirmed the diagnosis.

Tumors of the female external genitalia are infrequent compared to those of the internal genitalia, and benign tumors of the vulva are less frequent than malignant tumors. Benign tumors of epithelial nature are rare while benign connective tissue tumors are relatively more common. Usually they occur in adults, principally in the third decade. The order of frequency of their occurrence is as follows: fibroma, fibrolipoma, lipoma, myxoma, and angioma. Myomas, fibromyomas, neurofibromas, ganglioneuromas, enchondromas, and osteomas are rarer. The prevailing site of these tumors is the major labium, although they may involve (in order of frequency) the minor labium, the clitoris, and posterior vulvar commissure. Their volume may vary from that of a small nut to that of a large orange. Large tumors become pedunculated and may assume the aspect of the head of a polyp. Growth is slow and the tumors come under observation several years after their onset, largely because they cause no particular disturbance. They generally show a periodic increase in size during menstruation and pregnancy. Voluminous tumors impede ambulation, and sometimes also micturition, abrasion and circulatory disturbances of the pedicle may result in edema, ulceration, and discharge. With the exception of neurofibromas, they are painless, they are mobile on the underlying tissues, but may have connections with the formations of the inguinal ring. Their consistency may be soft, cystic, elastic, or fibrous. Calcification, rapid increase in volume from trauma, hematoma and, more often, malignant degeneration have been reported. According to Leonard, sarcomatous degeneration occurs in 22 per cent of vulvar fibromas.

Treatment is surgical, there have been recurrences of leiomyoma. The diagnosis in most cases presents no difficulties. In tumors of the anterior portion of the major labium, inguinolabial hernia, cyst of Nuck's canal, and neof ormation originating in the terminal part of the round ligament must be taken into consideration. In tumors of the posterior portion of the major labium, neoplasm of the gland of Bartolini must be excluded. In many cases the benign tumors originate from the connective tissue formations of the region. RICHARD KEMEL, M D

**Carcinoma of the Vulva** ARTHUR B LUNIN *Am J Obst*, 1949, 57 742

Carcinoma of the vulva occurs most often in elderly women but may also be seen in younger age groups. Forty-two per cent of the 50 cases in this series occurred in patients under the age of 50, the average age being 53 years. In 2 patients the disease of the vulva was complicated by pregnancy. In the New Orleans area the disease is as common in colored women as it is in white women. Fifty-eight per cent of the colored women had granulomatous venereal lesions of the vulva.

All lesions of the vulva that fail to respond to treatment in a reasonable period of time should be subjected to biopsy, and it is to be emphasized that one negative result does not rule out malignancy.

Treatment is surgical and should consist of complete vulvectomy with bilateral lymph node resection. Radiation has some value in palliation but will seldom effect a cure.

In a group of 22 patients treated prior to 1942 by a variety of methods, 4 (18%) were living without evidence of disease 5 years later.

JOHN R WOLFF, M D

### MISCELLANEOUS

**Vascular Congestion and Hyperemia The Clinical Aspects of the Congestion-Fibrosis Syndrome** HOWARD C TAYLOR, JR *Am J Obst*, 1949, 57 637

A series of 105 patients were interviewed, examined, and followed up by the author in order to outline the clinical characteristics of the congestion-fibrosis syndrome. The findings were gradually accumulated during the last decade and represent the more severe and clearly defined cases of this disorder.

This concept of pelvic disease suggests that congestion as it is seen in the breast, ovaries, uterus, and parametria is a similar condition and that it tends to occur simultaneously in the same patient in more than one of these sites. The cases reported here are all examples primarily of pelvic congestion. All but one of these patients were in the years of ovarian function. The majority were married. Sterility and infertility were common.

The essential symptoms included increased menstrual discomfort with pain (usually premenstrual in type), a change in the character of the menstrual pattern, intermenstrual spotting, lower abdominal

pain, backache, and painful intercourse. Associated symptoms of tension and other psychosomatic disorders were common to this group of patients.

Parametrial fibrosis with thickness of the uterosacral ligaments was the most important finding in this condition. The uterus was usually enlarged, tender, and often retrodisplaced. Some degree of endocervicitis was usually present. The ovaries were always tender and somewhat cystic.

Patients with these symptoms and local findings in the reproductive organs and with general signs of autonomic instability present a consistent and characteristic clinical picture which seems properly termed, at least provisionally, the "congestion-fibrosis syndrome." JOHN R WOLFF, M D

**Vascular Congestion and Hyperemia Etiology and Therapy** HOWARD C TAYLOR, JR *Am J Obst*, 1949, 57 654

Pelvic congestion is a disorder of the pelvic circulation due to multiple causes, several of which may have to be present in a single patient to produce symptom-giving conditions. Predisposing constitutional factors are probably present in the autonomic nervous system and perhaps in the blood vessel structure of the susceptible patient. The tendency toward congestion is increased by loss of support of the pelvic structures after parturition, by malposition of the uterus, possibly by damage to the veins from postpartum phlebitis, and by occupations requiring the erect position and leading to excessive fatigue. The estrogens maintain the pelvic tissues in a state receptive to these stimuli and their physiologic premenstrual rise places most of the complaints in that part of the cycle, however, this disease is not due to any primary ovarian or other endocrine disorder. The autonomic nervous system is responsible for both acute and chronic vasodilatation as a result of unphysiologic sexual behavior as well as nonspecific emotional states.

The various aspects of chronic pelvic congestion have been and remain notoriously resistant to treatment. The development of a rational plan of therapy depends upon the understanding of the underlying physiologic disorder and the multiple factors which contribute to it.

Just as there is no single etiologic factor, there is no single method of treatment for the clinical syndrome based on congestion of the female reproductive tract. A plan of therapy for the individual patient must be built up from a careful evaluation of two aspects, namely, (a) the principal causative agent, and (b) the severity or the duration of the condition.

These disorders of the circulation and of the autonomic nervous system in the reproductive organs appear to be the basis of a considerable portion of all minor gynecological conditions and include many conditions now commonly classed as endocrine or inflammatory. Within this field are mastodynia, premenstrual breast engorgement and certain types of chronic mastitis, uterine congestion and hyper-

trophy, many cases of menorrhagia and cervical hypertrophy, the majority of cases of "endocervicitis," congested and "cystic" ovary, and many of the cases of dyspareunia, dysmenorrhea, and obscure pelvic pain

The revaluation of gynecologic conditions to include this concept would constitute a major and, the writer believes, an essential revolution in gynecologic thinking

JOHN R. WOLFF, M.D.

**Histophysiology of the Sexual Zone of the Adrenal Cortex** (Histophysiology de la zone sexuelle de l'écorce surrénale) JOSÉ BOTELLA LLUSIA *C rend Soc fr gyn*, 1949, 19 17

The close relationship between the adrenal cortex and the secretion of sexual hormones is a well established fact. Two different androgenic hormones as well as estrogen and progesterone have been isolated from the cortex of normal human beings and of different animals (cattle, pigs, horses). The presence of these hormones in the cortex is not surprising in view of the chemical similarity between the adrenal steroids and the sexual hormones.

Various investigators have attempted to establish a relationship between the secretion of sex hormones and certain histological layers of the cortex. Deanesley and Howard, in studies on the white mouse, described the "zone X," or "transitory zone," between the cortex and the medulla which seems to be derived from the reticular layer of the cortex. It develops during the embryonal stage and reaches its climax at the time of birth. After birth it atrophies but reappears when the animal is castrated. If the castrated animal is treated with testosterone, the tissue disappears again.

Under the name of "androgenic zone" Grollman described a layer between the cortex and medulla which reaches its greatest development in the human embryo of 3 or 4 months, especially in males, and disappears completely after birth. He believes that pathologic proliferation of rests of this zone causes adrenal virilism and, in females, pseudohermaphroditism.

Vines found characteristic fuchsinophil cells in 33 of 34 patients who had been operated upon for adrenogenic virilism. These cells were present in cases of simple hyperplasia as well as in adenoma or carcinoma of the cortex.

These physiologic and histologic researches of different writers have led to a certain confusion. In the first place, it is not clear whether the zone X, the androgenic zone, and the fuchsinophil tissue are identical or of different origin and significance. Furthermore, it is not certain if these tissues have relations to the secretion of androgenic hormones only, or to the formation of estrogen and progesterone as well.

In order to bring these questions nearer to a solution, the author studied the histology of the adrenal gland in human embryos (28 cases) as well as in adults (20 cases), 2 of whom suffered from adrenogenic virilism. Furthermore, in animal experiments

on rats and mice, he followed the development of the zone X during embryonal life and after castration, and the action of sexual hormones on involution. He arrived at the following conclusions:

Sexual hormones are secreted by a tissue of interstitial type situated between the cortex and the medulla. The "androgenic zone" (Grollman), the "zone X" in mice (Deanesley), and the fuchsinophil cells (Vines) are identical. This tissue is found in embryos of both sexes, although it is more developed in male embryos. The injection of sexual hormones causes the disappearance of the zone X as well as of the fuchsinophil inclusions.

This tissue is a physiological entity which appears in different forms, according to the species and the period of life. It represents a sort of "third gonad" with its main activity before and after the period of testicular or ovarian activity. Since it is found in both sexes, the author suggests calling it the "sexual cortical zone" rather than the androgenic zone.

WERNER M. SOLMITZ, M.D.

**The Ureter, the Gynecologist, and the Urologist**  
President's Address. TERENCE MILLIN *Proc R Soc M*, LOND, 1949, 42 37

Lesions and injuries of the ureter which are of interest to the gynecologist are discussed in detail. The more frequent use of intravenous urograms, both preoperatively and postoperatively, will yield much useful information.

Congenital abnormalities of the ureter may produce diagnostic difficulties, such as supernumerary or ectopic ureters opening into the urethra or vagina and causing persistent incontinence. The supernumerary ureter and the congenital megaloureter are prone to injury at abdominal operation if unrecognized.

Operative accidents to the ureter may be recognized at the time of operation. If the ureter is cut high up, the correct procedure is immediate anastomosis over an indwelling ureteral catheter. The suture line is extraperitonealized and a drain is placed appropriately. If the ureter is sectioned low in the pelvis, it may be preferable to reimplant the ureter into the bladder. Ligation of the proximal end of the cut ureter can very rarely be justified today. If the ureter has been caught in a clamp and the injury is minimal, it will probably only be necessary to place an extraperitoneal drain. If the clamping has been complete, it will be best to excise the crushed area and perform an end-to-end anastomosis.

A second group of operative accidents to the ureter are not recognized until later when renal pain, infective phenomena, or fistula make the diagnosis plain. A small proportion of ureterovaginal fistulas heal spontaneously. However, at present the author advises early operation, i.e., before stenosis, leading to upper urinary tract dilatation and infection, has occurred. The extraperitoneal approach is preferred and since the damage to the ureter is usually low down, the best procedure in most cases will be a reimplantation into the bladder. Ureteroureteral or ureterocolic

anastomosis may be performed. When there is doubt as to whether reparative surgery or nephrectomy is indicated, a modified Gibson incision is employed.

Dilatation of the ureters is found in pregnancy, in pelvic inflammations and tumors, in genital prolapse, and in carcinoma of the cervix. In the latter, it may be the result of malignant compression, but not infrequently it results from postirradiation fibrosis. Investigation of the genitourinary tract and appropriate therapy will lead to improved results.

Postoperative anuria is a serious complication. Certain varieties are well known, chiefly those following excessive therapy with sulfonamides. Lesser known varieties are even more important. One has to determine whether the cessation of urinary output is prerenal or postrenal. If doubt exists, a prompt recourse to surgery will often be warranted. A rapid examination of the upper ureter will be the key to the problem. If it is dilated, then we are dealing with a postrenal obstructive phenomenon, if it is not dilated, then we have a prerenal lesion to contend with. In the former, a ureterostomy, or a nephrostomy will relieve the obstruction and be lifesaving, in the latter, a prompt decapsulation is most likely to yield satisfactory dividends although beneficial results have, on occasion, followed splanchnic block and spinal analgesia.

GEORGE BLINICK, M.D.

#### Urethral Diverticulum in the Female. A Clinical Study. VIRGIL S. COUNSELLER. *Am J Obst*, 1949, 57: 231.

Diverticula of the female urethra are not common, nor are they actually uncommon. The symptoms appear bizarre and yet they are diagnostic when carefully studied. It seemed to the author, with these facts in mind, that the findings in 71 cases of diverticulum of the female urethra in which surgical treatment was employed at the Mayo Clinic, and the impressions formed from study of these cases would be of interest. A much larger group of patients who had small sacculations, deformities, and postoperative irregularities or scars which responded to local treatment and dilatations of the urethra were studied, but data on these patients are not included in this report.

The average age of the 71 patients was 41 years. Thirty patients were from 31 to 40 years of age, 27 from 41 to 50 years of age, 6 were 30 years of age or less, and 8 were more than 50 years of age. None of the patients were children.

The duration of symptoms is important. Symptoms may exist for only a few weeks and can last for 33 years or more, as in one of the author's cases. Most of the patients in his group had symptoms for more than 5 years, the usual period was from 5 to 10 years. The cardinal symptoms were pain and frequency of urination, leakage of urine, dyspareunia, and, finally, a vaginal mass.

The urinary symptoms may range from mild to severe. Often the urethra does not show any local inflammation at all but the voided specimen will contain large amounts of pus even though contami-

nation from the vagina is excluded. The catheterized urine may be entirely negative and this fact may lead to a mistaken diagnosis. On account of the symptoms of urethritis, and without much evidence of anything else, the urethritis of most of the 71 patients in the author's group had been excessively treated with local applications and with heat and tampons.

Pain is a significant symptom and its presence should make the physician at least suspect the presence of a diverticulum of the urethra. It is of 4 types: (1) low abdominal or suprapubic, like that usually produced by cystitis, (2) perineal, which appears to extend down through the perineal region and rectum, (3) vaginal, which usually consists of a sense of pressure or weight in the vagina, and (4) pain which frequently starts upward from the urethra and through the vagina to the pelvic organs. Pain in the sites and of the types described occurred in 55 per cent of the 71 cases.

Leakage of urine or a discharge from the urethra was noted in 40 per cent of the cases.

Dyspareunia was experienced by 10 per cent of the patients and was a complaint of those who had rather acute inflammatory reactions in the anterior vaginal wall.

A mass in the anterior vaginal wall was noted by 40 per cent of the patients.

The severity of the complaint is also significant. It is out of all proportion to that which the physical findings concerning the urethra indicate should actually be produced. There is no relation between the complaint and menstruation.

Vaginal examination with careful palpation of the anterior vaginal wall under the entire urethral region may reveal some induration or a definite mass. Pressure on the mass will cause foul smelling urine or pus to exude from the external urethral orifice unless the orifice of the diverticulum has been occluded by the inflammatory process. If there is only induration, the diverticulum can be more easily identified if a urethroscope is placed in the urethra and then the urethra is palpated over it.

Cystoscopy is not always successful in identifying the diverticulum. Sometimes the orifice is not easily seen.

Any local treatment, such as massage, dilatation, or instillations, is of no value when a true diverticulum exists. Transurethral incision of very small diverticula for more adequate drainage may be useful. The best treatment, however, is complete surgical excision of the diverticulum and repair of the urethra. This can be accomplished in practically all cases except the few in which abscesses are present. In these few instances, the orifice of the diverticulum may be necrotic and cannot be closed by suturing. A urethral fistula then would result and this fistula should be repaired only after all evidence of inflammation has subsided. When the inner wall of the diverticulum extends posteriorly along the urethra, it usually is intimately attached to the urethra and no attempt should be made to separate the wall of



the diverticulum from the urethra. To do so may cause multiple fistulas.

Surgical excision may be difficult unless the diverticulum can be seen readily. A retention catheter, between Nos. 18 and 22, should be placed in the bladder as a preliminary procedure, so that the identity of the lumen of the urethra is always known. The anterior vaginal wall should be mobilized, preferably between two small clamps or hemostats, and should be opened from just behind the external urethral meatus to the area of the trigone of the bladder. The fascia over the urethra is incised and separated from it and the vaginal wall, as in the repair of urethrocele. As the surgeon cuts with a sharp scalpel directly down on the urethra, the diverticulum as a rule begins to bulge into view. With the catheter in place in the urethra, the diverticulum can be distinguished from the urethra. At this point the diverticulum can be grasped with a clamp and further separated from the surrounding tissues.

When the diverticulum is definitely identified, it should be opened and its contents, if any, evacuated. The extent and direction of the sac can be accurately determined by examination of the interior of the sac under direct vision. The relation of the inner wall to the urethra can be observed. If the diverticulum is firmly adherent to the urethra and at all inflammatory, all of the sac should be excised except that small segment along the urethra. The orifice in the urethra can be closed with interrupted fine catgut sutures. This region should be reinforced by a running suture which closes the fascia over the entire urethra including the defect. A catheter is maintained in the urethra for only 4 to 5 days, the patient then is advised to go to the bathroom and void. Subsequent catheterizations are inadvisable.

Urethrovaginal fistulas which occur subsequent to repair of cystocele, urethrocele, or vaginal hysterectomy could easily be due to a urethral diverticulum which was overlooked previously.

**The Operative Treatment of Female "Stress" Incontinence** HERMAN WAHREN *Acta chir scand*, 1949, 97: 331

Stress incontinence is believed to be due to a change in the position of the neck of the bladder relative to the symphysis and to changes in the musculature surrounding the bladder, particularly the levator ani, rather than to insufficiency in the sphincter musculature. Therefore, the surgical cure should be directed toward restoring and supporting the position of the fundus and the neck of the bladder. This is best accomplished by the transposition (interposition) operation.

In cases in which the transposition operation is contraindicated, the author has grafted bone chips between the cervix uteri and the wall of the bladder in 7 cases with satisfactory results, according to the following technique.

The portio is drawn down. A small transverse incision is made in the anterior fornix, and the posterior wall of the bladder is laid free from the cervix uteri so that a piriform space is shaped behind the neck of the bladder, 5 to 7 c.c. bone chips are inserted in this space. The bone tissue can conveniently be taken through a small osteotomy on the medial side of the upper part of the tibia. The material should, for the greater part, consist of cancellous bone which combines better in healing with the soft parts than the cortical chips. The material can easily be excised with a spoon.

GEORGE BLINICK, M.D.



# OBSTETRICS

## PREGNANCY AND ITS COMPLICATIONS

**Ectopic Pregnancy with Special Reference to Abdominal Pregnancy** JULIUS JARCHO *Im J Surg* 1949 77 273, 473

This article is based upon a comprehensive review of the literature and a detailed analysis of 173 cases of ectopic pregnancy (6 abdominal) representing an incidence of 1 in 60 obstetrical admissions, 1 in 44 gynecological admissions, or 1 in 113 combined admissions.

The etiological factors were not always evident, but 52.7 per cent of the patients had an old salpingitis, 20.8 per cent had infertility, and 19.6 per cent had undergone previous pelvic or abdominal operations. The diagnosis was correct in 92 per cent of cases, and was made on the basis of the history, and physical and laboratory findings. The greatest diagnostic problem was the atypical case in which most errors were made. The signs and symptoms most frequently encountered were amenorrhea (73%), abdominal pain (88%), vaginal staining or bleeding (73%), abdominal tenderness or rigidity (48%), faintness and weakness (47%), nausea and vomiting (32%), and tenderness on motion of the cervix (29.5%).

The leucocyte count ranged from 5,000 to 10,000 in intact tubes or in tubes with slow leakage, was about 15,000 in moderate recent hemorrhage, and from 15,000 to 30,000 with massive recent hemorrhage. The sedimentation rate varied from 5 to 30 minutes.

Other aids in diagnosis are cul-de sac puncture and colpotomy. Curettage, peritoneoscopy, and hysterosalpingography have little value.

Treatment consists of prompt laparotomy with complete removal of the tube for tubal pregnancy, cornual resection or hysterectomy for interstitial pregnancy, and ovariectomy for ovarian pregnancy.

Advanced abdominal gestation presents complicated problems in therapy, but in general no attempt is made to remove the placenta and the wound is closed without drainage.

Blood, plasma, and other intravenous fluids are of utmost importance in keeping the mortality low. In this group of patients it was 2.9 per cent. Among the 9 patients with abdominal pregnancies there was one death. J. ROBERT WILLSON, M.D.

**Cervical Pregnancy** DANIEL G. MORTON *Im J Obst*, 1949, 57 910

Cervical pregnancy is a comparatively rare type of ectopic gestation which is of special interest because of its uncertain etiology, the difficulties in making a correct diagnosis, and the high mortality of 20 per cent. The author presents a report of one "probable" case and one proved case of cervical pregnancy.

The first patient was admitted after several weeks of stuning, with a mass of placental tissue lying in the cervical canal. An attempt to remove the placental tissue resulted in profuse bleeding and digital palpation of the interior of the cervix revealed a cavity 3 cm in diameter. With repeated packing of the endocervix and transfusions, she recovered. Subsequently, she became pregnant again and delivered spontaneously at term without difficulty.

The second patient was approximately 31 months pregnant when she experienced vaginal bleeding and abdominal cramps. On her second hospital admission the products of conception appeared to protrude from the external os. A macerated fetus was removed and severe bleeding necessitated vaginal packing and transfusion. On two successive days attempts at removing the placenta produced profound shock from excessive hemorrhage. A laparotomy was performed, at which time the diagnosis of cervical pregnancy was made. Because of technical difficulties it was necessary to amputate the uterus at an undetermined point in the cervix as low as could be reached. Numerous transfusions were required postoperatively and there was continued vaginal bleeding. On the thirty-sixth postoperative day, a second laparotomy was performed and because of the inflammatory induration about the cervix it was deemed advisable to evacuate the cervix and close it without further operative procedure. She was discharged 14 days later, having received 11,000 cc of blood. The pathological report was cervical pregnancy with partial separation.

Cervical pregnancy is usually confused with abortion. However, the products of conception are not readily expelled from the cervix since the force of uterine contractions is absent. Thus undue delay in the completion of abortion may be of diagnostic value, particularly if a small uterine fundus can be palpated above the ballooned-out cervix. Forceful removal of the placenta usually results in copious hemorrhage since there is no muscular mechanism in the cervix designed to clamp off the subplacental blood sinuses at separation of the placenta, as there is in the corpus.

Every effort should be made to diagnose the condition before any manipulation is undertaken. Separation of the placenta should be avoided, and indeed the placenta might profitably be tightly packed against the cervical wall, particularly if there has been a partial separation. Thrombosis of vessel and gradual absorption should occur in the same manner as they do with a placenta left in the peritoneal cavity after an abdominal pregnancy. Finally, at removal, preparations for immediate transfusion and repacking should be at hand, since exsanguination may occur in a very short period of time. It is possible that in time the placental tissues would be absorbed completely. GEORGE BURNICK, M.D.

**A Variant of the Hofstaetter-Cullen Sign in Intra-Abdominal Hemorrhage from Ectopic Pregnancy** JOHN FALLON and JOHN J. MANNING *N England J M*, 1949, 240: 747

The Hofstaetter-Cullen sign need not be blue, can appear elsewhere than at the umbilicus, and is far from pathognomonic of extrauterine pregnancy. Probably, it can be caused by any condition producing colored intra-abdominal fluid.

A variant of the sign is reported, it consists of symmetrical, red, circular stains at either side of the umbilicus, over points where vessels often perforate the rectus sheath.

The location of the stains in the author's case and in 2 somewhat similar cases, as well as the more ordinary localizations over hernias, in scars, and at the umbilicus, suggests that the pigments that usually produce the phenomenon may reach their destination by following ordinary fascial planes and openings rather than by depending upon exceptional lymphatic function or subvisible peritoneal apertures.

CHARLES BARON, M D

**Capillary Fragility and the Use of Rutin in Toxemias of Pregnancy** W. J. DIECKMANN, Z. AKBASLI, and G. T. ARAGON *Am J Obst*, 1949, 57: 711

The capillary fragility was found to be increased in 33 per cent of the patients who had essential hypertension during pregnancy. The duration or severity of the hypertension seemed to be of no significance. Pregnancy seemed to accentuate the capillary fragility, possibly because of an associated, relative, or absolute anemia.

Capillary fragility was not increased in patients with either mild or severe pre-eclampsia, nor was it associated with abruptio placentae.

Rutin was used in 13 patients, in 12 of whom it was found efficacious in reducing the increased capillary fragility.

JOHN R. WOLFF, M D

**Certain Aspects of Eclampsia** H. J. STANDER and R. W. BONSNES *Am J Obst*, 1949, 57: 482

The etiology of eclampsia is unknown, although the number of theories (past and present) proposed to explain its causation is legion. The authors state that many of the theories postulated in the past have, at present, only an historical interest, yet we are still left with a long list of theories. They discuss several of the modern beliefs and consider that what we need is more data, especially data to explain the consistently observed phenomena which occur during eclampsia.

Studies on nonprotein nitrogen, urea nitrogen, uric acid,  $\text{CO}_2$  combining power, urea clearance, and blood chloride determinations in eclamptic patients are presented. The method of delivery, maternal and fetal mortality, and the subsequent course in 76 cases of eclampsia are summarized.

A plea is made for the study of more factual data in eclamptic patients. The etiology of eclampsia, although unknown at present, should be discoverable

by the application of the scientific method. A theory of eclampsia should be, then, a working hypothesis to be tested by experiment.

JOHN R. WOLFF, M D

**Anemia of Pregnancy Treated with Molybdenum-Iron Complex** WILLIAM J. DIECKMANN, HAROLD D. PRIODLE, ROSE TURNER, and BETTY TREPTOW *Am J Obst*, 1949, 57: 541

In 1936 a survey of pregnant patients at the Lying-In Hospital, Chicago, showed that 11.5 per cent of the patients were anemic, according to the standards for normal pregnant women. In 1947, using similar methods and standards only, 4.6 per cent were found to be anemic.

The 1936 survey showed that iron salts were of little value in the treatment of anemia of pregnancy.

The present study was made for the purpose of determining the value of a molybdenum-iron complex in the treatment of these anemias. There were 39 patients in the control group and 49 in the group receiving treatment. Forty-five of the patients who received treatment gained an average of 2.11 gm hemoglobin before delivery (minimum, 0.6 gm, maximum, 5.5 gm).

In determining the question of anemia, it is believed that a hematocrit determination performed every 3 months, one at or near term, and one also at 6 weeks postpartum is the most accurate.

A hemoglobin which is less than 12 gm (hematocrit, 37 per cent) in the first 12 weeks, or which is not at this level 6 weeks postpartum is indicative of anemia. From the twelfth to the thirty-sixth week the lower limit of the hemoglobin in pregnancy is 10 gm (hematocrit, 30 per cent). The lower limit from 36 weeks to term is 10.5 gm (hematocrit, 32 per cent).

A molybdenum-iron complex has been found to be very effective in causing significant increases in the hemoglobin concentration of most patients within a 3 week period. If the hemoglobin does not show a significant increase in this period of time, further hematologic studies are indicated.

JOHN R. WOLFF, M D

**Operation for Severe Varicose Veins during Pregnancy** HAROLD DODD *Lancet*, Lond., 1949, 1: 606

Numerous reports from the literature are cited in which successful and good results were obtained by ligation, injection, or both, of severe varicosities in pregnant women. Other opinions have been to the effect that any treatment of this type during pregnancy is contraindicated.

Dodd reports 17 cases treated by him in which the patients showed good improvement. There were no complications in either mother or child, and all of the babies were born uneventfully. The operations were done between the second and the seventh months of pregnancy.

The author tests the patency of the deep system of veins by tourniquet and differentiates seven different types of varicose veins. The operation can



plete dilatation, (2) at the transition from the first to the second stage of labor, or the "pain period of labor," which is referred to the lumbosacral region as backache, (3) when the advancing head meets the pelvic floor (the reaction is one of escapism, and leads to complaints of utter exhaustion or frustration), and (4) at the time of early crowning of the head when there is a feeling of an inevitable splitting of something, sometimes accompanied by an acute stinging or burning pain.

The author believes that the patients should be comforted at these various menaces and offered encouragement or relief if they want it. He states that few ask for relief and some resent the suggestion.

The co-operation of the patient in labor depended on antenatal preparation: (1) the education in, and understanding of, the process of pregnancy and labor, (2) the ability to relax during the first-stage contractions and between the second-stage contractions, (3) physical preparation by a few simple exercises designed to give full, free, and controlled respiratory movements, mobility of the pelvic joints, and general muscular fitness. The unrestrained happiness of the good co-operator at birth of her child is not only a delight to witness but also has an important physiological and emotional significance. In many cases the husband and wife took tea together within 10 minutes after the expulsion of the placenta, mutually happy with the newborn beside them. There was no evidence of infection of the babies by the attentions of their parents.

All babies except 9 were breast-fed. The author believes the so-called "slow starters" should not be given complementary feedings because the milk often increases when the mother gets home to her natural environment.

Among the 52 cases in which forceps deliveries were done, 26 of the patients had emotional breakdowns. However, 13 expressed disappointment at the interference and 4 wept when they were told that they would not see the baby born. Twenty-two had an occiput-anterior presentation with no disproportion, 5 had an occiput-anterior presentation with some relative disproportion, 7 had transverse arrest at the midcavity, and 18 had persistent occiput-posterior presentations. In 3 cases the operation was done for fetal distress. Of 6 women who were ill and who underwent forceps deliveries 1 had been ill with pyelonephrosis for 3 months, 2 had toxemias of pregnancy, and 3 were mentally unstable and had been treated in mental homes.

The author states that ordinarily an incidence of 5.4 per cent for cesarean section would demand explanation. He believes there was a high incidence of borderline cases, and women who had experienced difficulty or had had cesarean section came under his care. Of 18 primiparas all had been classified as "small," either clinically or roentgenologically. A generally contracted or deformed pelvis was found in 6 and section was done, 2 women had forceps delivery and 10 had physiological labor. The 13 multiparas had had cesarean section for their first

and only child. Of these, 7 had a febrile puerperium and untrustworthy scars and a second section was done, 1 had a deformed pelvis and section was done, 4 had easy physiological labors, and 1 had a low forceps delivery. One small woman, having had 2 sections, was allowed a natural labor. Two elderly primiparas obsessed with the horror of labor were sectioned to avoid the risk of a serious breakdown. Diabetes mellitus, toxemia, and antepartum hemorrhage were the indications for 7 cases of section.

BYFORD F. HESKETT, M.D.

#### Five Thousand Consecutive Deliveries Without Maternal Death. NORMAN EMBLIN. *Brit. M. J.*, 1949, 1: 260

In the Halifax Municipal Obstetric Service, during the period between September 12, 1946 and October 5, 1948, there were 5,000 consecutive deliveries after the twenty-eighth week without a maternal death due to pregnancy. This number includes all women after the twenty-eighth week of pregnancy (a) who were admitted to the Halifax General Hospital from inside or outside the borough, whether to the general medical and surgical wards, the maternity department, or the special unit for the reception of septic cases, and (b) who were delivered in their own homes by the Halifax Domiciliary Service or independent midwives. No emergency case has ever been refused admission. In this series there was one death from acute myeloblastic leucemia and therefore not attributable to pregnancy.

The rate of forceps deliveries was 4.16 per cent and that of cesarean section, 1.96 per cent. There were 4 cases of eclampsia, 3 of these in unbooked cases. The stillbirth rate was 23.07 per cent and the neonatal death rate, 11.91 per cent. A brief summary of the treatment of some major complications is given. The belief is expressed that the most important single factor in reducing maternal mortality is the provision of a skilled staff to deal with abnormalities.

GEORGE BLINICK, M.D.

#### Extraperitoneal Cesarean Section in the Profoundly Infected Patient. MILTON L. McCALL. *Am. J. Obst.*, 1949, 57: 520

The author presents a survey of the value of extraperitoneal cesarean section in the profoundly infected patient. Eighteen such cases are reported in detail. All patients were in prolonged labor with the membranes ruptured. The cases showed evidence of either neglect or exceedingly bad management. Unsterile vaginal examinations, attempts at manual cervical dilatation, or unsuccessful instrumental delivery had been done. High fever, tachycardia, and signs of dehydration and sepsis were present in each instance.

Since 38 per cent of all deaths following cesarean section are due to peritonitis, and since many or all of the contraindications for transperitoneal cesarean section (either classical or low cervical) were exceeded, this procedure was not to be considered in any of these patients. Many of the patients had

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already received antibiotics and sulfonamides without value

Cesarean hysterectomy, embryotomy, and extraperitoneal cesarean section were the available methods

The management of these cases prior to the time of the extraperitoneal operation is not condoned by the author. Unfortunately, such instances still develop and their solution previously has been a fearful one

All of these severely infected patients were treated by means of the modern extraperitoneal cesarean section. There was no maternal mortality

Ninety-one consecutive cases of extraperitoneal cesarean section are reported without a maternal mortality. In 64 patients, contraindications to transperitoneal cesarean section were present. The fetal mortality was 8.8 per cent, 9.4 per cent of the patients with infection had babies who died of infection or as the result of prolonged labor

The fact that women with the foulest of infections may be delivered safely by this method, all the while preserving the child-bearing organ, truly marks the newer technique of extraperitoneal cesarean section as a significant advance in modern obstetrics which should be recognized by all obstetricians until some simpler method, not yet known, appears to take its place

JOHN R. WOLFF, M.D.

### Vaginal Delivery Following Cesarean Section

HERBERT E. SCHMITZ and GEORGE R. BABA, *Am J Obst*, 1949, 57: 669

Should a patient with a history of cesarean section be subjected to an attempt at vaginal delivery?

During 18 years, 51 (32.4 per cent) of 157 patients with a history of cesarean section were successfully delivered via the vaginal route at the Lewis Memorial Maternity Hospital, Chicago, Illinois. Three instances of ruptured uterus occurred, but not in the patients subjected to a trial of labor. In these 3 cases, the rupture occurred close to term. In 2 cases the fetus was saved, and there was no maternal mortality or morbidity

Vaginal delivery may be permitted under certain conditions when the management is under an experienced obstetrician at a hospital equipped to meet all emergencies. These conditions are (1) early engagement of the presenting parts, (2) a history of vaginal delivery preceding the section, (3) the diagnosis of a fetal death or a monstrosity in utero, and (4) reasonable assurance of a well healed scar (when the surgical technique is known to be good and the postoperative course was uneventful and afebrile). This, plus the absence of the original indication for section, will indicate a trial of labor

In these 86 vaginal deliveries following 51 cesarean sections, labor and the puerperium were uneventful. There were 3 fetal deaths, an intrauterine death before labor, death of an 8 weeks old premature infant with hydrops fetalis, and death of a 10 weeks old premature 3 pound infant. The dictum "Once

a cesarean section always a cesarean section" should be changed to "Once a cesarean section, not necessarily always a cesarean section"

JOHN R. WOLFF, M.D.

### PUERPERIUM AND ITS COMPLICATIONS

A Report on 159 Third-Degree Lacerations  
INGRAM, MILTON M. GARDNER, and GEORGE HEUS, *1st J Obst*, 1949, 57: 730

There were 159 third degree lacerations in 9170 deliveries at the Lincoln Hospital, New York, New York, from January, 1942 to July, 1947. Of these, 50 were classified as complete in that the rectum itself was lacerated. The remainder were classified as incomplete as only the sphincter was involved. In the latter group, 142 of the patients with third-degree lacerations had median episiotomies, 14 had medial lateral episiotomies, and 3 patients had none

Third-degree lacerations must be repaired immediately following this accident. Fine catgut sutures are recommended. The essential points are the closure of the rectal wound, anatomical repair of the lacerated sphincter muscle, and routine episiotomy repair. The postoperative care is simple and consists of the use of a low residue diet, mineral oil, and oil retention enemas after the third day

Of the 159 patients, there were 26 who ran a moderately morbid course, yet the infection in no way affected wound healing. There was only one perineum that healed poorly. Three patients developed symptoms requiring secondary surgical repair. Nineteen patients had subsequent deliveries at this hospital. There was no recurrence

JOHN R. WOLFF, M.D.

### MISCELLANEOUS

Plasma Volume and Extravascular Fluid Volume During Pregnancy and the Puerperium  
LIAM L. CATON, CHARLES C. ROBY, DUNCAN E. REID, and JOHN G. GIBSON, II, *Am J Obst*, 1949, 57: 471

The purpose of this study was to investigate the changes that occur during normal pregnancy in the circulating red cell mass, and in plasma and extravascular fluid volumes. Results of the simultaneous determinations of plasma volume and extravascular fluid volume are presented

Ten subjects were used in this study, and from 6 to 12 observations were made on each. Plasma volume was measured by using the blue dye T 1824. Extracellular fluid was measured by the use of intravenous 5 per cent sodium thiocyanate. Observations were made at 5 to 6 week intervals during pregnancy, close to the onset of labor, during the puerperium, and from 1 to 3 months postpartum. The plasma volume increased markedly during pregnancy and reached a maximum volume during the sixth-eighth to fifth day prior to the onset of labor. This increase was 49 per cent compared to nonpregnant values obtained 30 days after delivery

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This increased plasma volume decreased 25 per cent in the last weeks of pregnancy and returned to normal 30 days after delivery.

There was an increase in the extravascular fluid up to the time of onset of labor. This rate was accelerated during the last trimester, with no evidence of any prelabor decrease. In the first week of the puerperium there was a 2,500 c.c. decrease in this extravascular fluid volume. This volume, when measured from 1 to 3 months postpartum, was 59 per cent below the maximum prepartum value.

The vascular and extravascular spaces show a retention of fluid which varies in amount in each trimester of pregnancy. During the first and second trimesters, the percentage increase of plasma volume exceeds the percentage increase of extravascular fluid volume. In the last trimester, the percentage increase in extravascular fluid volume is greater than the percentage increase in plasma volume.

JOHN R. WOLFF, M.D.

#### Danger of Dicumarol Treatment in Pregnancy

ALFRED P. KRAUS, SAMUEL PERLOW, and KARL SINGER. *J. Am. M. Ass.*, 1949, 139: 738

The effect of continuous dicumarol administration on the intrauterine growth and development of the fetus was studied in pregnant rabbits. When given in doses which produced an "unsafe" level of prothrombin (below 10 per cent of normal) in the mother, even for not more than 2 days, the fetuses died in utero. They were small and showed conspicuous maceration of the skin and decomposition of the organ tissues. When "safe" prothrombin levels were maintained in the mother, the infant rabbits revealed an extreme decrease of their prothrombin at birth, with a definite hemorrhagic tendency. The mothers, however, did not experience excessive intrapartum or postpartum hemorrhage.

Dicumarol affects the prothrombin level of the infant to a much greater extent than that of the mother. Although animal experiments may not be directly applicable to human beings, it would appear that dicumarol treatment is not advisable in the pregnant woman, since it may seriously interfere with the normal development of the fetus or cause fetal death.

GEORGE BLINICK, M.D.

#### The Role of Massive Blood Transfusions in the Management of Ruptured Uterus and Other Serious Obstetric Shock

CURTIS J. LUND and FRED O. BRUMFIELD. *South M. J.*, 1949, 42: 263

Hemorrhage and shock in obstetrics hold a comparable position to infection with regard to mortality. The authors believe that the number of deaths from hemorrhage would be greater if more accuracy was practiced in reporting cases.

They recommend the use of large volume transfusions in the treatment of hemorrhagic obstetrical emergencies. The blood loss is often very rapid and attempts at hemostasis are often retarded by the patient's condition. The requirements of the patient must be judged by her condition and not by the

amount of blood that she has already received. Case histories are cited in which transfusions of from 3,500 c.c. to 7,500 c.c. were given in the immediate treatment of shock. The lack of postoperative morbidity is influenced by the degree to which the patient's blood picture is returned to normal.

Four instances of rupture of the uterus were reported. None of these was of traumatic origin. One occurred in a premature macerated stillbirth. A second rupture in a Couvelaire uterus, with continuation of the tear into the broad ligament, occurred following abruptio placenta. The patient received 7,500 c.c. of blood and recovered.

GEORGE B. BRADBURN, M.D.

#### Target and Resistant Red Cells in Pregnancy, Posthemorrhagic Anemias and Blood of the Umbilical Vein (Globuli a bersaglio e globuli resistenti in gravidanza, nelle anemie postemorragiche e nel sangue della vena ombelicale)

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The author used three salt solutions (0.85, 0.50, and 0.35 per cent) and thus was able to determine the amount of red cells resistant to the 0.50 per cent solution, which he called medium resistant, and the amount of red cells resistant to the 0.35 per cent solution, which he called maximum resistant. The presence or absence of target cells was determined in stained slides by studying three different parts of the preparation for 7 minutes each. The author searched for resistant and target cells in the peripheral blood of 15 healthy women, 15 normal pregnant women, and 26 women with posthemorrhagic anemia, and also in the blood of the umbilical vein of 15 placentas immediately after section of the cord. In the order given for the four different groups, the red cells resistant to the 0.50 per cent solution averaged 62.8, 50.9, 62.3, and 48.1 per cent, respectively, and the red cells resistant to the 0.35 per cent solution averaged 17, 15, 3.4, and 10.7 per cent, respectively. Target cells were absent in the first two groups and present in the last two.

The author draws the following conclusions from his study. Target cells really exist and can be easily found on prolonged examination of the preparations, although their number is small and their distribution very irregular. They are nearly always connected with an increase in the resistance of the red cells to hypotonic salt solutions, but they may also be found in cases in which the resistance of the red cells is at the limits of normal or even slightly decreased. Normal pregnancy has no influence on the target and the resistant cells, but the latter have a tendency to decrease slightly. In posthemorrhagic anemias the percentage of resistant cells is usually increased in the fraction of maximum resistance and it is easy to find target cells, although they are still scarce. The placental blood is very rich in target and maximum resistant cells, and this new property may be added to the characteristics already studied which impart to this blood a particular type differing from the blood of the circulation.

## INTERNATIONAL ABSTRACTS OF SURGERY

already received antibiotics and sulfonamides without value  
 Cesarean hysterectomy, embryotomy, and extraperitoneal cesarean section were the available methods

The management of these cases prior to the time of the extraperitoneal operation is not condoned by the author. Unfortunately, such instances still develop and their solution previously has been a fearful one

All of these severely infected patients were treated by means of the modern extraperitoneal cesarean section. There was no maternal mortality

Ninety-one consecutive cases of extraperitoneal cesarean section are reported without a maternal mortality. In 64 patients, contraindications to transperitoneal cesarean section were present. The fetal mortality was 8.8 per cent, 9.4 per cent of the patients with infection had babies who died of infection or as the result of prolonged labor

The fact that women with the foulest of infections may be delivered safely by this method, all the while preserving the child-bearing organ, truly marks the newer technique of extraperitoneal cesarean section as a significant advance in modern obstetrics which should be recognized by all obstetricians until some simpler method, not yet known, appears to take its place

**Vaginal Delivery Following Cesarean Section**  
 HERBERT E. SCHMITZ and GEORGE R. BABA, *Am J Obst*, 1949, 57: 669

Should a patient with a history of cesarean section be subjected to an attempt at vaginal delivery? During 18 years, 51 (32.4 per cent) of 157 patients with a history of cesarean section were successfully delivered via the vaginal route at the Lewis Memorial Maternity Hospital, Chicago, Illinois. Three instances of ruptured uteri occurred, but not in the patients subjected to a trial of labor. In these 3 cases, the rupture occurred close to term. In 2 cases the fetus was saved, and there was no maternal mortality or morbidity

Vaginal delivery may be permitted under certain conditions when the management is under an experienced obstetrician at a hospital equipped to meet all emergencies. These conditions are (1) early engagement of the presenting parts, (2) a history of vaginal delivery preceding the section, (3) the diagnosis of a fetal death or a monstrosity in utero, and (4) reasonable assurance of a well healed scar (when the surgical technique is known to be good and the postoperative course was uneventful and afebrile). This, plus the absence of the original indication for section, will indicate a trial of labor

In these 86 vaginal deliveries following 51 cesarean sections, labor and the puerperium were uneventful. There were 3 fetal deaths, an intrauterine death before labor, death of an 8 weeks old premature infant with hydrops fetalis, and death of a 10 weeks old premature 3 pound infant. The dictum "Once

a cesarean section always a cesarean section" should be changed to "Once a cesarean section, not necessarily always a cesarean section"

JOHN R. WOLFF, M.D.

## PUERPERIUM AND ITS COMPLICATIONS

**A Report on 159 Third-Degree Lacerations** HAROLD A. INGRAHAM, MILTON M. GARDNER, and E. GEORGE HEUS, *Am J Obst*, 1949, 57: 730

There were 159 third degree lacerations in 9,170 deliveries at the Lincoln Hospital, New York, New York, from January, 1942 to July, 1947. Of these, 59 were classified as complete in that the rectum itself was lacerated. The remainder were classified as incomplete as only the sphincter was involved. In the latter group, 142 of the patients with third-degree lacerations had median episiotomies, 14 had medial episiotomies, and 3 patients had none

Third-degree lacerations must be repaired immediately following this accident. Fine catgut sutures are recommended. The essential points are the closure of the rectal wound, anatomical repair of the lacerated sphincter muscle, and routine episiotomy repair. The postoperative care is simple and consists of the use of a low residue diet, mineral oil, and oil retention enemas after the third day

Of the 159 patients, there were 26 who ran a moderately morbid course, yet the infection in no way affected wound healing. There was only one perineum that healed poorly. Three patients developed symptoms requiring secondary surgical repair. Nineteen patients had subsequent deliveries at this hospital. There was no recurrence

JOHN R. WOLFF, M.D.

## MISCELLANEOUS

**Plasma Volume and Extravascular Fluid Volume During Pregnancy and the Puerperium** WILLIAM L. CATON, CHARLES C. ROBY, DUNCAN E. REID, and JOHN G. GIBSON, II, *Am J Obst*, 1949, 57: 471

The purpose of this study was to investigate the changes that occur during normal pregnancy in the circulating red-cell mass, and in plasma and extravascular fluid volumes. Results of the simultaneous determinations of plasma volume and extravascular fluid volume are presented

Ten subjects were used in this study, and from 6 to 12 observations were made on each. Plasma volume was measured by using the blue dye T 1824. Extracellular fluid was measured by the use of intravenous 5 per cent sodium thiocyanate. Observations were made at 5 to 6 week intervals during pregnancy, close to the onset of labor, during the puerperium, and from 1 to 3 months postpartum. The plasma volume increased markedly during pregnancy and reached a maximum volume during the sixty-eighth to fifth day prior to the onset of labor. This increase was 49 per cent compared to nonpregnant values obtained 30 days after delivery

## OBSTETRICS

This increased plasma volume decreased 25 per cent in the last weeks of pregnancy and returned to normal 30 days after delivery.

There was an increase in the extravascular fluid up to the time of onset of labor. This rate was accelerated during the last trimester, with no evidence of any prelabor decrease. In the first week of the puerperium there was a 2,500 c.c. decrease in this extravascular fluid volume. This volume, when measured from 1 to 3 months postpartum, was 59 per cent below the maximum prepartum value.

The vascular and extravascular spaces show a retention of fluid which varies in amount in each trimester of pregnancy. During the first and second trimesters, the percentage increase of plasma volume exceeds the percentage increase of extravascular fluid volume. In the last trimester, the percentage increase in extravascular fluid volume is greater than the percentage increase in plasma volume.

JOHN R. WOLFF, M.D.

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The target cells are undoubtedly young cells, as demonstrated by their analogies with the reticulocytes (hyper-resistance to hypotonic salt solutions, regular contours, increase in average diameter, decrease in thickness) This is confirmed by the fact of having found them in discrete amounts in the posthemorrhagic anemias, in which there is always a more or less marked medullary reaction, and in the blood of the umbilical cord in which there is always a polyglobulism through acceleration of the hemoglobin metabolism (increased hemolysis and increased formation) and deficit of oxygen in the fetus, hence there is a destruction of the older and more labile cells and an increase of the younger and more resistant cells

RICHARD KEMEL, M D

**Specific Gravity, Hemoglobin, Hematocrit, and Proteins in the Blood of Fetuses in Various Months of Intrauterine Development** (Peso specifico, emoglobina, ematocrito e proteine nel sangue dei feti nei vari mesi di sviluppo della vita intrauterina) G ANZISI *Arch ostet gin*, 1948, 53 373

The number of fetuses examined, especially those in the third, fourth and fifth month of development, is naturally small because of the difficulty of obtaining a living fetus in that period of development. In one study, the copper sulfate gravimetric method was used to obtain the values for protein, hemoglobin, and hematocrit with a minimal quantity of blood. The values obtained, although not rigorously exact, can be accepted as useful and sufficient for clinical studies, since control investigations with other methods in common use, and considered exact, have confirmed the reliability of the data reported. Besides, the object of this study was only to obtain data of an orientative, general character on the variations of the protein, hematocrit, and hemoglobin in the fetal blood.

Hemoglobin values obtained by the gravimetric method are 1 gm higher than those found with the Hellige method, values for the hematocrit are similarly higher, while those for the proteins are about the same as with the refractometric method, but higher than those given by the method of Kjeldhal. Blood samples were taken from the umbilical cord in older fetuses and from the heart before death in younger fetuses. This has made no difference in the results.

The study showed that the values for the specific gravity of total blood and of plasma rose gradually from the third to the ninth month, presenting an average of 1042 for total blood and of 1015 for plasma in the third month, and averages of 1064 and 1028.3 respectively in the ninth month, the increases from month to month have no constant relationship. The hemoglobin and hematocrit values exhibit a similar behavior from 11 gm per cent for hemoglobin and from 33 gm per cent for the hematocrit in the third month, there is a gradual rise to 17.9 gm per cent for hemoglobin and to 53.3 gm per cent for the hematocrit in the ninth month. The protein content

rises from 2.7 gm per cent in the third month to 7.2 gm per cent in the ninth, with the greatest increases in the fourth, fifth, and sixth months in which the difference from month to month amounts to 1.2 gm per cent.

The higher values for protein in the fourth month could in some way be explained by the activity of the liver and spleen, which is important in the genesis of the plasma proteins. Another explanation would be the increased requirements of the new organism for its development.

RICHARD KEMEL, M D

**Importance of the Pelvimetry of the Inferior Strait, with Special Attention to Two New Diameters: the Sacrobiparietal and the Symphyseobiparietal** (L'importanza della pelvimetria dello stretto inferiore con speciale riguardo a due nuovi diametri: il sacro- e il sinfisio biparietale) ROBERTO PICCOLI and GUGLIELMO LONGO *Arch ostet gin*, 1948, 53 347

With a pelvimeter similar to that of Thoms, the authors determined the normal values of the two new diameters, the height of the pubic symphysis, and the length of the bi-ischiatic diameter in 120 women. The height of the symphysis was 5 cm in 60 women, and in the remaining 60 this measurement ranged from 3 to 6.5 cm, with a preponderance of from 5 to 6.5 cm. The symphyseobiparietal diameter measured 5 cm in 34 women, ranged from 3 to 4.5 cm in 44 women and from 5.5 to 8.5 cm in 42. The sacrobiparietal diameter was 7 cm in 35 women, was over 7 cm in 57 women, and under 7 cm in 28 women.

In flat pelves, the symphyseobiparietal diameter tended toward values below 5 cm more frequently than in normal pelves, and the bi-ischiatic diameter was shorter more often in normal than in flat pelves. The sum of the normal values for the symphyseobiparietal and sacrobiparietal diameters is 12 cm (5 and 7 cm, respectively), and the authors have found a preponderance of 11 to 12 and 13 cm diameters in their cases. From the practical point of view, it would be expected that in cases in which the symphyseobiparietal diameter is above 5 cm, the sacrobiparietal diameter would also be above 7 cm, but in the 42 cases in which the former was between 5.5 and 8.5 cm, the latter was equal to, above, or under 7 cm, with the same frequency. This shows the importance of measuring the former diameter, since, in the usual absence of compensation by the latter, its excessive length would not only expose the patient to perineal damage, but would also influence the duration and modality of labor. The theoretical importance of the symphyseobiparietal diameter is also evidenced by the fact that in 42 cases in which it was over 5 cm, the bi-ischiatic diameter was shorter than normal in 61.9 per cent of cases. It follows that anybody who would take into account only the length of the latter would expose himself to the error of accepting as normal the width of the pubic arch even in cases in which

## OBSTETRICS

adaptation of the suboccipital region to the pubic arch is impeded

The practical usefulness of the determination of the two new diameters for the prognosis of perineal lacerations is evidenced by a study of 68 primiparas, 18 to 30 years old, in whom delivery at term did not require any medical or surgical treatment. Perineal lesions were found in 50 per cent of the cases in which the symphysis was higher than normal, and in 37.5 per cent of those in which the height of the symphysis was normal. Nothing remarkable was learned from a comparison of the perineal lesions in women with a symphyseobiparietal diameter above normal and normal, since the incidence of lesions was 39.1 per cent in the first, and 38.4 per cent in the second. The same applies to the sacrobiparietal diameter in 16 women with this diameter shorter than normal, perineal lesions were found in 39.2 per cent and in the remaining 52 women, perineal lesions were found in 37.5 per cent.

RICHARD KEMEL, M.D.

#### A Review of 445 Pregnancies Complicated by Fibromyomas

DEAN J. GRANDIN *Am J Obst*, 1949, 57:532

In a review of 20,763 obstetric admissions to the Sloane Maternity Hospital, New York, 445 patients (2.1 per cent) had complicating fibromyomas. In 258 of these the complication was rated as significant.

The average age of these patients was 32 years, and 75 per cent of the patients were over 30 years of age. Age and the degree of significance did not correlate. Parity and gravidity decreased as the significance increased. Fifty-one per cent of the patients were primigravidae. Relative infertility and fibroids seemed to go hand in hand.

The duration of labor was not increased by the fibroids. In 14 instances (3.1 per cent), premature labor was not increased above average. Malpresenta-

tions were observed with two to three times the usual incidence.

Postpartum hemorrhage developed in 19 patients, the usual incidence, but a retained placenta occurred with twice the expected incidence.

Only 5 per cent of the patients aborted. Toxemia and hypertensive disease showed the generally prevailing rates.

Enlargement of the fibroid during pregnancy is frequently but not always temporary. Only 1 of 4 fibroids evidenced degeneration.

Forty-four (10 per cent) of the patients were operated upon during their antepartum courses. Eighteen had hysterectomies. Three patients had myomectomies and, of these, only one continued to term and was terminated by cesarean section. Of 24 patients on whom myomectomies were performed, 11 subsequently became pregnant, 10 of these were delivered by section, and 1 patient delivered spontaneously.

Ninety per cent of the patients came to delivery, 247 delivered spontaneously and 155 were operative deliveries. Of the latter, 95 were cesarean sections.

Cesarean section was performed in 21.3 per cent of the patients, but the corrected rate for fibroids as a part or the whole of the indication was 12.8 per cent.

The morbidity rate was 26 per cent, three times greater than the usual rate. The morbidity rate for cesarean section plus myomectomy was less than that for cesarean hysterectomy.

There were 3 maternal deaths in 1 case death followed a therapeutic abortion and sterilization for hypertension and fibromyomas, in 2 cases death followed vaginal delivery. In the last 2 patients, fibromyomas were important causative factors. The fetal mortality was the same as the overall fetal mortality rate, yet it is noteworthy that there were no fetal deaths following cesarean section.

JOHN R. WOLFF, M.D.

period of years. Eliminating patients who were treated palliatively, the survey is limited to 115 cases in which the diagnosis was confirmed by operation or at autopsy.

Four main groups are proposed, with some detailed subgrouping. The tumors in group I are derived from the excretory epithelium of the parenchyma. The major subgroup includes the "renal-celled carcinoma" embracing clear cells and granular cells with subvarieties arranged in solid cords, tubules, or papillary cysts. Both types may occur simultaneously. Tumors in group II arise from the transitional epithelium of the conductive apparatus, beginning with the distal portion of the collecting tubules. Except for a tubular tumor of the renal pyramid, the transitional epithelium is retained. With metaplasia, the epidermoid variety with keratinization and pearls, or, less frequently, the mucous glandular form may develop. Tumors in group III, derived from embryonal rests, are poorly understood genetically. The tumor make-up may vary from a homogeneous embryonal carcinoma to one with great diversity of architecture and disparity of elements. Persistence of mesonephric elements or histological transmutations, particularly muscular cells from neighboring somites, may account for this. Group IV comprises growths arising in the muscular wall of the pelvis and ureters, in the perirenal connective tissue or capsule, or invasion from other organs.

Among these 115 cases, eliminating those in which death occurred from other causes without recurrence within 5 years and those lost to follow-up without evidence of recurrence, there remain 77 "determinate" cases upon which calculations may be made. Among these there were a few, the inclusion of which were questionable. In all types there was a 35 per cent 5 year survival. Among 47 patients with renal-celled carcinomas, there were 15 survivals (32%). Only 1 of the 10 patients with transitional carcinomas survived. Of 12 patients with embryonal tumors, 3 were living.

A life expectancy graph for survival following nephrectomy in renal-celled carcinoma is presented. This includes a group of 17 patients operated upon 10 years previously, as well as 37 patients operated upon 5 years previously, with some overlapping of individual cases. It is noted that there is a fairly sharp descent in survival to the 5 year period where the rate levels off in the 10 year group at about 40 per cent until after 7 years. There is then a further sharp decline until the tenth year. It appears to the reviewer that about 25 per cent of patients have survived.

ALLAN K. SWERSIE, M.D.

#### Congenital Stenosis of the Ureter at Its Origin (Stenosi congenita dell'uretere all'origine) EROS BENEDINI *Arch. ital. urol.*, 1949, 23, 54

The author reports that the results of the clinical, roentgen, and laboratory studies justified the clinical diagnosis of renal lithiasis and pyonephrosis with secondary cystitis on the right side in a woman of

40 with marked anemia and debility caused by the morbid condition of her kidney. The function of the left kidney was sufficiently good to allow removal of the right kidney, and nephrectomy was proposed. At operation, the kidney was of normal size, and palpation gave the impression of numerous cavities containing calculi. The pelvis was dilated and also contained calculi. The ureter was inserted into the pelvis in the vicinity of the hilus and markedly constricted at its origin for a distance of about 1 cm. The ureter contained no calculi, and there were no adhesions, cords, constricting vessels, or causes of angulation. Nephrectomy was performed and the wound closed in layers, a drainage tube being left in its upper angle.

Section of the specimen showed numerous hydro-pyonephrotic cavities filled with calculi of yellowish gray color, hard, and the size of small cherries; the cortex was reduced in thickness especially in its lower third. The pelvis contained small calculi and turbid urine. The diagnosis was changed to calculo hydro-pyonephrosis with constriction of the juxta-pelvic part of the ureter on the right side. The ureter of cylindric form was sectioned transversely every 4 to 5 mm from its junction with the pelvis to the point where it appeared to be normal, the lumen decreased in size as it approached the pelvis, and with the decrease in size there was a gradual decrease in the thickness of its wall. Microscopic study of the ureter demonstrated that the constriction was of a congenital nature.

Partial or total stenosis of the ureter is accompanied by dilatation of the tract above the constriction. In the present case there was evident dilatation of the pelvis with damage to its wall probably due to distention of the cavity and infection of the urine. The presence of calculi is easily explained by the sojourn of urine in the hydronephrotic cavities, this has favored the implantation of bacteria and the deposition of salts resulting in the organization of calculi.

The symptomatology of the case has not shown any characteristics attributable more to the pyelorenal condition caused by the ureteral stenosis than to the presence of calculi. It was of no help to suggest the possibility of ureteral constriction. Even catheterization did not throw light on the existence of ureteral stenosis, and the delay in the appearance of dye was justified by the lithiasis discovered on roentgen examination. The relative slowness of the flow of urine from the catheter was attributable to many factors, such as obstruction of the catheter, spasm, and angulation. Unfortunately, no ascending pyelography was performed, which might have revealed the stenosis, it was thought unnecessary in view of the fact that the most apparent lesion requiring urgent treatment (lithiasis with pyonephrosis) was sufficiently demonstrated by the studies already made. However, even if the stenosis had been discovered before intervention the therapeutic indication would have been the same.

RICHARD KEMEL, M.D.

**Tumors of the Ureter** FRANK COLEMAN HAMM and LAWRENCE L. LAVALLE *J Urol*, Balt., 1949, 61 493

To an approximate 180 cases of ureteral tumors reported to date, the authors add 6 cases which have been observed at the Brooklyn Hospital, New York. The first case was metastatic, secondary to a carcinoma of the breast. The second case was so diagnosed by its clinical course, but it was unconfirmed by operation or autopsy. The 4 other cases were proved to be primary ureteral tumors which varied in type from a benign polyp to a very malignant papillary carcinoma. These cases are presented in clinical detail and with photographs of the gross specimens, pyeloureterograms, and tissue histology.

There are no recognized signs and symptoms characteristic of ureteral tumor. Pain and hematuria are common. In 3 of the cases pain was apparently due to urinary obstruction and in the fourth case, to extensive local metastasis. Hematuria was severe in 2 cases and mild in the other 2. Seventy-five per cent of ureteral tumors occur in the lower third of the ureter, and in approximately one-third of them the tumor protrudes from the ureteral orifice, which permits biopsy for the correct diagnosis. In other instances, repeated cystoscopic study may be necessary.

For practical purposes, all tumors of the urinary tract should be regarded as malignant. Despite origins from different germinal layers, the epithelium of the ureter and of the bladder are alike and give rise to essentially the same neoplasms. From the structural point of view, tumors may be classified as papillary, sessile, and polypoid. The first two varieties are derived from the lining epithelial structures, the papillary type being less malignant. The polypoid tumor is derived from the submucosal structures and is covered by normal epithelium.

In view of the potential malignancy, treatment should consist in early complete surgical removal. The general condition of the patient and the status of the remaining kidney so permitting, nephrectomy, ureterectomy, and excision of a cuff of the bladder should be done at the same time.

ALLAN K. SWERSIE, M D

**Pedicle Graft Cutaneous Ureterostomy** GEORGE W. FISH and THOMAS W. STEVENSON *J Urol*, Balt., 1949, 61 749

In the hope of producing a better functioning stoma with less tendency toward stricture formation, a 2 stage operation was devised for connecting the ureter to the skin through a pedicled graft on the lower abdomen.

The pedicle is made from a skin flap approximately 8 by 12 cm, it includes fat and subcutaneous tissue and usually is constructed on the abdominal wall just above the belt line and lateral to the rectus muscle.

At the second stage, the ureter is freed through a low lumbar incision and is brought out through a stab wound which traverses the length of the pedicle and the underlying abdominal wall.

This type of cutaneous ureterostomy has been exceptionally efficient in 3 cases. A fourth patient with bilateral ureterosigmoidostomy and rectal incontinence was provided with similar pedicled grafts in the flank areas and the short ureters were brought out through the pedicled tubes without difficulty.

ORMOND S. CULP, M D

**The Technique and Results of Ureterocolic Anastomosis by the Extraperitoneal Route** E. W. RICHES *Brit J Urol*, 1949, 21 51

The main cause of death after intraperitoneal transplantation of the ureters into the colon has been infection of the peritoneal cavity. This can be avoided by carrying out the actual anastomosis outside the peritoneal cavity, if leakage should occur it is not fatal. It is believed that simplicity is the key note of success in this operation, and that it is more important to avoid compression or tension on the ureter than to try and obtain a long valvular track through the intestinal wall.

The technique used is as follows: a right oblique inguinal incision about 8 inches long is made and carried down through the muscles. The peritoneum is retracted medially and the ureter is freed and divided as near the bladder as possible. An attempt is made to leave the periureteral fat attached to the ureter. The peritoneum is opened and the lowest coil of colon in the pelvis is sought and withdrawn into the wound. This coil is sutured without tension to the cut edges of the peritoneum. The actual implantation is done either by the Coffey I method, or by the Stiles technique. The wound is closed, leaving a rubber drain to the site of anastomosis. A similar procedure is carried out on the left side.

The author has used this method in 60 cases. In 45 of the patients the operation was performed for carcinoma of the bladder. There have been 5 deaths, a mortality of 8.3 per cent, 3 of these were due to uremia, 1 death was due to intestinal obstruction, and 1 to cardiac failure. JOSEPH E. MAURER, M D

**Transplantation of Ureter** ARTHUR JACOBS *J Urol*, Balt., 1949, 61 517

Jacobs states that tuberculous vesical contracture with a progressive diminution in the capacity of the bladder is a common sequel of renal tuberculosis, the ever-present demands of the bladder to be emptied reduce the patient to a state of chronic invalidism, and a result of the vesical contracture may be a stricture of the ureteral orifice, back pressure from the bladder, and gradual destruction of the remaining (nontuberculous) kidney. Jacobs performs a ureteral transplantation for this condition, occasionally, ureterostomy is done instead. He adheres to the Coffey I technique with care, to retroperitonealize the site of anastomosis by stitching the edge of the lateral flap of the posterior parietal peritoneum to the bowel medial to the suture line.

Twenty-five transplantations for tuberculous vesical contracture have been performed, with a mortality of 16 per cent. He does not hesitate to transplant

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period of years. Eliminating patients who were treated palliatively, the survey is limited to 115 cases in which the diagnosis was confirmed by operation or at autopsy.

Four main groups are proposed, with some detailed subgrouping. The tumors in group I are derived from the excretory epithelium of the parenchyma. The major subgroup includes the "renal-celled carcinoma" embracing clear cells and granular cells with subvarieties arranged in solid cords, tubules, or papillary cysts. Both types may occur simultaneously. Tumors in group II arise from the transitional epithelium of the conductive apparatus, beginning with the distal portion of the collecting tubules. Except for a tubular tumor of the renal pyramid, the transitional epithelium is retained. With metaplasia, the epidermoid variety with keratinization and pearls, or, less frequently, the mucous glandular form may develop. Tumors in group III, derived from embryonal rests, are poorly understood genetically. The tumor make-up may vary from a homogeneous embryonal carcinoma to one with great diversity of architecture and disparity of elements. Persistence of mesonephric elements or histological transmutations, particularly muscular cells from neighboring somites, may account for this. Group IV comprises growths arising in the muscular wall of the pelvis and ureters, in the perirenal connective tissue or capsule, or invasion from other organs.

Among these 115 cases, eliminating those in which death occurred from other causes without recurrence within 5 years and those lost to follow-up without evidence of recurrence, there remain 77 "determinate" cases upon which calculations may be made. Among these there were a few, the inclusion of which were questionable. In all types there was a 35 per cent 5 year survival. Among 47 patients with renal-celled carcinomas, there were 15 survivals (32%). Only 1 of the 10 patients with transitional carcinomas survived. Of 12 patients with embryonal tumors, 3 were living.

A life expectancy graph for survival following nephrectomy in renal celled carcinoma is presented. This includes a group of 17 patients operated upon 10 years previously, as well as 37 patients operated upon 5 years previously, with some overlapping of individual cases. It is noted that there is a fairly sharp descent in survival to the 5 year period where the rate levels off in the 10 year group at about 40 per cent until after 7 years. There is then a further sharp decline until the tenth year. It appears to the reviewer that about 25 per cent of patients have survived.

ALLAN K. SWERSIE, M D  
**Congenital Stenosis of the Ureter at Its Origin**  
(Stenosi congenita dell'uretere all'origine) EROS  
Benedini Arch Ital urol, 1949, 23 54

The author reports that the results of the clinical, roentgen, and laboratory studies justified the clinical diagnosis of renal lithiasis and pyonephrosis with secondary cystitis on the right side in a woman of

40 with marked anemia and debility caused by the morbid condition of her kidney. The function of the left kidney was sufficiently good to allow removal of the right kidney, and nephrectomy was proposed. At operation, the kidney was of normal size, and palpation gave the impression of numerous cavities containing calculi. The pelvis was dilated and also contained calculi. The ureter was inserted into the pelvis in the vicinity of the hilus and markedly constricted at its origin for a distance of about 1 cm. The ureter contained no calculi, and there were no adhesions, cords, constricting vessels, or causes of angulation. Nephrectomy was performed and the wound closed in layers, a drainage tube being left in its upper angle.

Section of the specimen showed numerous hydro pyonephrotic cavities filled with calculi of yellowish gray color, hard, and the size of small cherries, the cortex was reduced in thickness especially in its lower third. The pelvis contained small calculi and turbid urine. The diagnosis was changed to calculi hydropyonephrosis with constriction of the juxta pelvic part of the ureter on the right side. The ureter of cylindric form was sectioned transversely every 4 to 5 mm from its junction with the pelvis to the point where it appeared to be normal, the lumen decreased in size as it approached the pelvis, and with the decrease in size there was a gradual decrease in the thickness of its wall. Microscopic study of the ureter demonstrated that the constriction was of a congenital nature.

Partial or total stenosis of the ureter is accompanied by dilatation of the tract above the constriction. In the present case there was evident dilatation of the pelvis with damage to its wall probably due to distention of the cavity and infection of the urine. The presence of calculi is easily explained by the sojourn of urine in the hydronephrotic cavities, this has favored the implantation of bacteria and the deposition of salts resulting in the organization of calculi.

The symptomatology of the case has not shown any characteristics attributable more to the pyelorectal condition caused by the ureteral stenosis than to the presence of calculi. It was of no help to suggest the possibility of ureteral constriction. Even catheterization did not throw light on the existence of ureteral stenosis, and the delay in the appearance of dye was justified by the lithiasis discovered on roentgen examination. The relative slowness of the flow of urine from the catheter was attributable to many factors, such as obstruction of the catheter, spasm, and angulation. Unfortunately, no ascending pyelography was performed, which might have revealed the stenosis, it was thought unnecessary in view of the fact that the most apparent lesion requiring urgent treatment (lithiasis with pyonephrosis) was sufficiently demonstrated by the studies already made. However, even if the stenosis had been discovered before intervention the therapeutic indication would have been the same.

RICHARD KEMEL, M D

## GENITOURINARY SURGERY

**Tumors of the Ureter** FRANK COLEMAN HAMM and LAWRENCE L. LAVALLE *J Urol*, Balt., 1949, 61: 493

To an approximate 180 cases of ureteral tumors reported to date, the authors add 6 cases which have been observed at the Brooklyn Hospital, New York. The first case was metastatic, secondary to a carcinoma of the breast. The second case was so diagnosed by its clinical course, but it was unconfirmed by operation or autopsy. The 4 other cases were proved to be primary ureteral tumors which varied in type from a benign polyp to a very malignant papillary carcinoma. These cases are presented in clinical detail and with photographs of the gross specimens, pyeloureterograms, and tissue histology.

There are no recognized signs and symptoms characteristic of ureteral tumor. Pain and hematuria are common. In 3 of the cases pain was apparently due to urinary obstruction and in the fourth case, to extensive local metastasis. Hematuria was severe in 2 cases and mild in the other 2. Seventy-five per cent of ureteral tumors occur in the lower third of the ureter, and in approximately one-third of them the tumor protrudes from the ureteral orifice, which permits biopsy for the correct diagnosis. In other instances, repeated cystoscopic study may be necessary.

For practical purposes, all tumors of the urinary tract should be regarded as malignant. Despite origins from different germinal layers, the epithelium of the ureter and of the bladder are alike and give rise to essentially the same neoplasms. From the structural point of view, tumors may be classified as papillary, sessile, and polypoid. The first two varieties are derived from the lining epithelial structures, the papillary type being less malignant. The polypoid tumor is derived from the submucosal structures and is covered by normal epithelium.

In view of the potential malignancy, treatment should consist in early complete surgical removal. The general condition of the patient and the status of the remaining kidney so permitting, nephrectomy, ureterectomy, and excision of a cuff of the bladder should be done at the same time.

ALLAN K. SWERSIE, M.D.

**Pedicule Graft Cutaneous Ureterostomy** GEORGE W. FISHER and THOMAS W. STEVENSON *J Urol*, Balt., 1949, 61: 749

In the hope of producing a better functioning stoma with less tendency toward stricture formation, a 2 stage operation was devised for connecting the ureter to the skin through a pedicled graft on the lower abdomen.

The pedicle is made from a skin flap approximately 8 by 12 cm., it includes fat and subcutaneous tissue and usually is constructed on the abdominal wall just above the belt line and lateral to the rectus muscle.

At the second stage, the ureter is freed through a low lumbar incision and is brought out through a stab wound which traverses the length of the pedicle and the underlying abdominal wall.

This type of cutaneous ureterostomy has been exceptionally efficient in 3 cases. A fourth patient with bilateral ureterosigmoidostomy and rectal incontinence was provided with similar pedicled grafts in the flank areas and the short ureters were brought out through the pedicled tubes without difficulty.

ORMOND S. CULP, M.D.

**The Technique and Results of Ureterocolic Anastomosis by the Extraperitoneal Route** E. W. RICHES *Brit J Urol*, 1949, 21: 51

The main cause of death after intraperitoneal transplantation of the ureters into the colon has been infection of the peritoneal cavity. This can be avoided by carrying out the actual anastomosis outside the peritoneal cavity, if leakage should occur it is not fatal. It is believed that simplicity is the keynote of success in this operation, and that it is more important to avoid compression or tension on the ureter than to try and obtain a long valvular track through the intestinal wall.

The technique used is as follows: a right oblique inguinal incision about 8 inches long is made and carried down through the muscles. The peritoneum is retracted medially and the ureter is freed and divided as near the periureteral fat attached to the ureter as possible. The peritoneum is opened and the lowest coil of colon in the pelvis is sought and withdrawn into the wound. This coil is sutured without tension to the cut edges of the peritoneum. The actual implantation is done either by the Coffey I method, or by the Stiles technique. The wound is closed, leaving a rubber drain to the site of anastomosis. A similar procedure is carried out on the left side.

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a dilated ureter and presents several case histories in which marked symptomatic improvement resulted from the transplantation

DAVID ROSENBLUM, M D

## BLADDER, URETHRA, AND PENIS

**Transurethral Resection for Neurogenic Bladder**  
JOHN L. EMMETT, RICHARD V. DAUT, and RANDALL G. SPRAGUE *J Urol*, Balt, 1949, 61: 244

It is now more than 80 years since it was first observed that a characteristic type of nerve disorder occurs as a complicating factor in some cases of diabetes mellitus. Among these early observations was that of a type of vesical dysfunction or paralysis that seemed to be one of the neurologic manifestations of diabetes in some cases. During the past two decades considerable interest concerning this problem has been stimulated by the studies of several investigators, among whom may be mentioned Woltman and Wilder in 1929, Jordan and Crabtree in 1935, Rudy and Muellner in 1941, and Rundles in 1945.

Woltman and Wilder stated, "Diabetic neuritis is mainly a sensory disturbance without corresponding motor impairment, pain, paresthesia and areflexia are its main characteristics. It shows also a marked predilection for the lower extremities."

By virtue of the fact that the disease involves chiefly the sensory side of the nervous system, motor disturbances as a rule are not conspicuous. The most common finding on neurologic examination is diminution or absence of the tendon reflexes in the lower extremities. Rundles found that the Achilles reflexes were absent in 81 per cent of his 125 patients with diabetic neuropathy. In 56 per cent of the same group the patellar reflexes were absent on one or both sides. Other common findings are diminution or absence of the vibratory sense at the ankles, areas of diminished or absent cutaneous sensibility to touch, and extreme muscle tenderness, especially of the muscles of the calf. The patient experiences severe pain which may be dull and aching or which may simulate the darting or lightning pains of tabes. Argyll Robertson pupils (fixed to light but reacting normally in accommodation) are present occasionally. Vesical dysfunction of varying degree may accompany the clinical syndrome.

The clinical picture suggests that the lesion involves principally the sensory portions of the peripheral nerves, the posterior roots, and possibly also the posterior columns of the spinal cord. In some instances, particularly if Argyll Robertson pupils and vesical dysfunction are present, there may be considerable difficulty in distinguishing the disorder from true tabes dorsalis of syphilitic origin. Because of the similarity of the two conditions, the term "diabetic tabes" (pseudotabes diabetica) has been coined. Tenderness of the muscles of the calf in diabetic tabes often serves to distinguish it from syphilitic tabes dorsalis. Ordinarily, there is little difficulty in distinguishing diabetic neuropathy from other forms

of true neuritis. To quote again from Woltman and Wilder: "Striking clinical dissimilarity between neuritis of diabetes and that produced by alcohol, lead, diphtheria, and other common causes of neuritis is the almost exclusive predilection in the diabetic neuritis for sensory disturbances."

In diabetic neuropathy the total protein content of the cerebrospinal fluid is frequently increased beyond the normal maximum of 40 mgm per 100 c c. It exceeded this value in 24 of 41 cases studied by Swartz at the Mayo Clinic, the values ranging from 45 to 180 mgm per 100 c c.

Clinical observations support the view that the visceral sensory nerve fibers which are components of the sensory portions of the peripheral nerves and the posterior roots may also be involved in the pathologic process. Evidence which favors this hypothesis includes such facts as deficiencies in sweating and loss of vasomotor and pilomotor control, dependent edema, and the presence of vesical dysfunction or "paralysis."

The treatment, by transurethral resection of the vesical neck, of 3 patients who had neurogenic vesical dysfunction associated with diabetes mellitus and diabetic neuropathy is reported. The atonic type of vesical dysfunction observed in these cases closely simulated that which is seen in association with tabes dorsalis of syphilitic origin. In 1 case transurethral resection of the vesical neck resulted in moderate improvement of vesical function, in this case the amount of tissue resected was not adequate for an optimal result. In the 2 other cases resection of the vesical neck resulted in restoration of essentially normal micturition.

In the absence of effective methods of therapy of the diabetic neuropathy which is responsible for the vesical dysfunction in these cases, resection of the vesical neck provides a means of improving vesical function and thereby protecting the patient against the inconvenience and hazards involved in carrying infected residual urine in the bladder.

**Indications, Limitations, Technique, and Results of Bloodless Surgery (Instrumentation) in the Treatment of Vesical Calculi. Lithotripsy and Operative Endoscopy (Indicazioni, limiti, tecnica e risultati della chirurgia incruenta [strumentale] della calcolosi vescicale. litotripsia ed endoscopia operatoria).** FEDERICO VACCARI *Ann Ital chir*, 1948, 25: 689

Two methods of treatment of bladder stones are at the disposal of urologists: they are (1) suprapubic cystotomy, and (2) instrumentation, the latter in the form of (a) lithotripsy or (b) endoscopic surgery.

Of 229 patients with urinary calculi, 211 were men. The greatest number of male patients was in the age group between 61 and 80 years, while the women were equally distributed among various periods of life. Single calculi were predominant, but 1 patient had 75 stones. Cystitis was present in the great majority of cases and was located at the base of the bladder.



## GENITOURINARY SURGERY

Instrumentation was employed in 30.8 per cent of all male patients, cystotomy in 66.6 per cent, and other procedures, such as nephrostomy, perineotomy, or endoscopic resection of the vesical neck, in 2.52 per cent. In women the corresponding figures were 66.6 per cent, 26.6 per cent, and 6.6 per cent, respectively.

Recurrences after lithotripsy were recorded only in 5 patients. The method offers the advantage of a rapid postoperative recovery. It should not be employed in young individuals with acute cystitis because an infected bladder does not stand distention well. In the presence of diverticulum a stone may be overlooked. The coexistence of a neoplasm and a stone also forms a contraindication to lithotripsy. The method should not be employed in the presence of a suprapubic or rectovesical fistula, fracture of the pelvis, or paraplegia. The author used this method in 63.8 per cent of patients with single stones and in 36.7 per cent with multiple stones. If vesical lithiasis is associated with hypertrophy of the prostatic gland, cystotomy is the method of choice.

**Clinicoexperimental Study of the Action, Prolonged for Years, of Some Amines on the Bladder of Workmen** (Studio clinico-sperimentale dell'azione prolungata per anni di alcune amine sulla vescica degli operai) Giorgio Di Maio *Arch ital urol*, 1949, 23: 124

For 17 years the author has followed up 902 workmen who were employed in two dye factories and were exposed to benzidine, alpha and beta naphthylamine, and aniline. Among 186 individuals examined cystoscopically he found 34 vesical tumors, of which 18 were carcinomas, 9 sessile and 7 pedunculated tumors, and 68 congestive lesions which he regarded as precancerous. Of the individuals exposed to benzidine he examined 40 per cent, and of these 25 per cent showed tumors, 40 per cent congestive lesions, and 35 per cent an intact bladder. Of those exposed to alphanaphthylamine he examined 70 per cent, and of these 9 per cent showed tumors, 30 per cent congestive lesions, and 60 per cent an intact bladder. Of those exposed to betanaphthylamine he examined 80 per cent, of these 27 per cent showed tumors, 48 per cent congestive lesions, and 25 per cent an intact bladder. Of those exposed to aniline he examined 7 per cent and found 1 case of sessile tumor (2 per cent) in which electrocoagulation was done 15 years ago, it has not recurred. Observation has revealed that the tumors may appear after an exposure ranging from 3 to 26 years, and even 18 years after contact with amines has ceased.

The age of the individual at the beginning of exposure to the amines, his familial history as to cancer, and his personal pathologic history seem to be without importance as predisposing factors for the occurrence of vesical tumor. Exposure to more than one oncogenous substance does not seem to accelerate the onset of vesical carcinoma.

The author's distinction between carcinomas and sessile and pedunculated tumors is not intended as an anatomic classification, but as a simple clinical distinction. The anatomic and histologic characteristics of the carcinomas and the endoscopic morphology of the other sessile or pedunculated tumors caused by amines do not differ from those of the common bladder tumors.

In 8 cases, which finally proved to be carcinomas and which were examined for many years, the author observed the following sequence in the first stage there was intermittent congestion of the bladder, in the second stage, sessile papilloma, sometimes recurring but always curable by diathermocoagulation, and in the third stage, carcinoma.

In about one-half of the cases of tumor, subjective and objective symptoms are absent. In about one-fifth of the cases of congestive lesions, symptoms are found. In one-fifteenth of the workmen with a normal bladder, there are symptoms which are not due to a vesical lesion or to the prostatic urethra. Even recurrences of sessile and pedunculated tumors may be silent, at least in the beginning. Therefore, in the absence of symptoms it is necessary to perform cystoscopy periodically in all workmen who have been exposed to amines.

The prognosis seems to be favorable for pedunculated tumors, reserved for sessile tumors, unfavorable for nonoperative carcinomas, and reserved for operative carcinomas. Partial cystectomy was performed in 7 patients with carcinoma, 3 are living and, as 10 years have elapsed since the operation on 2 of them, these may be considered as cured. The congestive lesions are not modified by the usual local or general treatments which are given.

RICHARD KEMEL, M.D.

**Mucus-Secreting Adenocarcinoma of the Bladder** HERMAN L. KRETSCHMER *J Urol*, Balt., 1949, 61: 754

Primary mucus secreting adenocarcinoma of the bladder is extremely rare, resembles more common gastrointestinal tumors, and can be accepted as authentic only after other possible primary foci have been excluded by meticulous histologic study. Such a case is reported by the author and the various theories of pathogenesis are discussed.

ORMOND S. CULP, M.D.

**Primary Carcinoma of the Male Urethra (Carcinoma primitivo de uretra masculina)** JOSÉ MIGUEL GÓMEZ and MAURICIO FIRSTATER. *Prensa méd argent*, 1949, 36: 319

Leucoplakia of the male urethra with the resulting stricture is frequently considered the cause of cancer. Posttraumatic strictures, nonspecific urethritis, and papillary and polypoid formations are other factors frequently mentioned in the discussion of the cause of cancer of the urethra, but chronic gonorrhea constitutes the greatest factor.

The site of election of the tumor is the penile-bulbar portion of the urethra.



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Three histologic varieties of the tumor may be distinguished squamous cell epithelioma, papillary carcinoma, and columnar cell carcinoma. A secondary infection is frequent and may lead to a diffuse phlegmon of the scrotum and the perineal region.

The tumor may invade the scrotum, the corpora cavernosa and spongiosa, the perineum, the prostatic gland, and the urinary bladder.

Usually the early symptoms are those of a urethral stricture, viz, dysuria, pain at micturition and ejaculation, and urethral secretion.

The tumefaction of hard consistency is frequently accompanied by an edema, thus simulating a periurethral inflammatory process. Painful spontaneous erections are frequently recorded. Fistulas may form.

The differential diagnosis should consider tuberculosis, syphilis, polyps, and adenomas. Blood tests, roentgenograms of the chest, examinations of the sputum and of the urethral discharge urethroscopy, and biopsy help to establish the diagnosis.

In early stages a urethrectomy, with or without plastic reconstruction or cystotomy, may be considered. In more advanced stages an amputation of the penis or a total emasculation may be required. The operation should be followed by x-ray treatment. Radium should be employed only in inoperable cases.

The authors found a cancer of the urethra, 2 cm from the meatus, in a 35 year old man. A total penectomy with implantation of the bulbar urethra into the perineum, according to Groves' technique, was performed. Thirteen months after the operation the patient had no signs of recurrence.

JOSEPH K. NARAT, M.D.

## GENITAL ORGANS

**Extirpation of the Granulomatous Prostate** REED M. NESBIT and JACK M. LYNN. *J Urol*, Balt., 1949, 61: 766.

While most granulomatous lesions of the prostate may be tuberculous, the authors point out that identical histologic pictures can occur in syphilis and in nonspecific granulomatous prostatitis. Exact diagnosis depends on guinea pig inoculation with the material in question before it has been fixed in formalin. Nonspecific granulomatous prostatitis, therefore, may be more common than current statistics imply. The hazard of military tuberculosis following operation on tuberculous prostates has led to conflicting recommendations in the literature. The authors, however, performed 9 operations on 7 patients with a tuberculous prostate gland without a fatality or a fistula. These procedures included 1 perineal prostatectomy, 2 suprapubic enucleations, and 6 transurethral resections. In 3 of these 7 cases, the prostate gland was the only genitourinary organ involved. When the published statistics were added to this group from the University of Michigan, it was found that 21 suprapubic operations on patients with al-

leged tuberculous prostate glands were followed by 3 deaths, and 7 transurethral resections on patients with similar glands were followed by 1 fatality.

The authors' cases are presented in detail. One of these was thought to be the first published description of a vesical neck contracture due to tuberculosis.

ORMOND S. CULP, M.D.  
HUGH J. JEWETT  
*J Urol*, Balt., 1949, 61: 277.

**Radical Perineal Prostatectomy**  
Analysis of 132 radical perineal prostatectomies for proved carcinoma, which were performed prior to May 1, 1943, revealed 54 patients with extraprostatic extension and 78 with cancer confined to the prostate gland. In properly selected cases, the 5 year survival rate (without recurrence) was 51.3 per cent and the 10 year survival rate was 28 per cent. The operative mortality was approximately 3 per cent, and the incidence of postoperative disability due to incontinence, stricture, or fistula was low.

In most instances, palpation alone was unreliable for determining the limits of the carcinoma. Microscopic extension of the tumor beyond the area of intubation was common. No tumor cells were found in the lumen of the seminal vesicles or vasa but perineural lymphatics were involved frequently. The author insists that the radical operation must include wide excision of all fascial coverings of the seminal vesicles. If this step of the operation is performed properly, the seminal vesicles are never exposed.

ORMOND S. CULP, M.D.

## MISCELLANEOUS

**Female Urethra** NORBORNE B. POWELL and ELIZABETH B. POWELL. *J Urol*, Balt., 1949, 61: 557.

The Powells state that the symptomatology of the urethral syndrome is quite protean. They believe that true prostatic glands occur in some female urethras but that they are far from being a universal finding in obstructive lesions. In their series of resected cases, in which tissue was available for study, 25 per cent showed true prostatic glands. The preponderance of opinion is to the effect that there are periurethral glands in the posterior urethra which often become infected and occasionally undergo hyperplasia. The posterior urethra is a frequent source of urologic complaint and the authors studied 603 nonconsecutive private patients. The more common symptoms were bladder discomfort, referred pain, frequency, burning, urgency, and nocturia. Bladder discomfort was present in over 95 per cent of the cases and varied in severity from a mild change during micturition to an excruciating consciousness of the urinary bladder, usually gradual in onset, and recurrent in type. In 60 per cent there was referred pain to the suprapubic or groin area, thighs, hips, loins, or the lumbosacral or sacroiliac areas. At times it simulated ureteral colic. The authors advise calibration of the urethra for the differential diagnosis when pelvic pain or backache is present. Urinary frequency was complained of by

## GENITOURINARY SURGERY

36 per cent of the 603 patients Urgency of urination affected 28 per cent In 9 per cent gross hematuria was a symptom

Panendoscopy demonstrated pathologic narrowing in 43 per cent of the urethras examined, a diagnosis of stricture was made in every patient in whom the urethra would not permit passage of a #20 F instrument. Periurethritis was marked in 130 cases, and urethral granulations or polyps were found in 215 Urethral bulging (enfolds) were present in 53 instances

Treatment consisted of urethral dilatations, instillations, sulfonamides, and the occasional endoscopic application of silver nitrate Polyyps were treated with gentle superficial fulguration of a segment of the urethra Transurethral resection of the bladder neck was performed when the residual urine was over 3 ounces This consisted of a short quick stroke at 6 o'clock (posteriorly) as an office procedure

Histologically, Brunn's nests were found frequently in the superficial portion of the submucosa close to the epithelial lining of the urethra The authors are of the opinion that cystitis cystica and ureteritis cystica represent vacuolization and cystic degeneration of Brunn's cell nests There was no correlation between the histological picture and the clinical history

DAVID ROSENBLUM, M D

**Morphological and Functional Significance of the Ureteral Sheath and the So-Called Fissure of Waldeyer** (Sul significato morfologico e funzionale della guaina ureterale e della cosiddetta fessura del Waldeyer) ANTONIO RUOTOLO *Urologia*, Treviso, 1949, 4 9

Twenty ureters, in male subjects from 20 to 50 years of age, were sectioned transversely and longitudinally with the object of studying the muscular and fascial relationships of the ureter and mural, and juxtavesical portions of the ureter and urinary bladder It was found that the muscular wall of the bladder everts upward around the lower end of the ureter in the form of a muscular sheath, however, this sheath is only about 2 to 3 cm in length, that is, it is much shorter than is generally thought At the upper end the sheath loses its muscle fibers, becomes fibrous, and goes over continuously into the adventitial tissues of the ureter Between this muscular sheath of longitudinal muscle fibers and the ureteral wall of circular muscular fibers which is filled with a loose mesh of connective fibers which inferiorly passes over into the surrounding submucosa of the bladder It is believed that those who have observed this area as an empty space and designated it as the fissure of Waldeyer were looking at an artefact, produced perhaps by the method of fixing the tissues

From his studies the author believes that the loose connective tissues filling this so-called fissure of Waldeyer serves as a sliding mechanism which guarantees the independent motion of the lower end of the ureter, that it is a factor in the so-called inver-

sions of the ureters into the urinary bladder, that it protects the ureter from involvement in the inflammatory processes of the neighboring bladder mucosa, and that adhesion of the ureteral wall to the sheath, across this loose connective tissue, by means of inflammatory cicatricial processes, may account for certain disturbances of ureteral function

JOHN W BRENNAN, M D

**Experimental Contribution to the Study of Chloridemia in Rabbits with Puncture of the Chloride Center** (Contributo allo studio della cloruremia nei conigli punti nel centro clorurico) PASQUALE FIGARA *Arch ital urol*, 1949, 23 25

The author has determined the amount of plasmatic chloride contained in the renal artery and the renal vein, respectively, of normal rabbits, of rabbits with puncture of the fourth ventricle, and of rabbits given injections of serum from animals of the second group His experiments have confirmed the existence of a saline center in the fourth ventricle, the puncture of which causes hyperchloruria which is passively transmissible through the blood serum of the animal to a normal animal and must be connected with the action of a hormone, as demonstrated by previous investigators The chloride action should not be ascribed to an increase in the rate of the circulating chloride because the concentration of the plasmatic chloride of the peripheral blood in some animals remains practically unchanged This is in agreement with the findings of Jungmann and Meyer who made some interesting observations from which they concluded that the puncture cannot cause a hyperchloruria through simple filtration, but that the two factors of increased chloride concentration in the urine without simultaneous increase of water elimination, and of higher chloride concentration in the urine than in the blood, are reconcilable only by the hypothesis of an excitation induced by puncture or interruption of the nerves

In his own experiments the author has also observed that in rabbits with puncture and in those treated with serum from these animals there is a chloride excretion which is not always accompanied by a corresponding increase in elimination of plasma While in normal rabbits the concentration of plasma shows no significant variations in the blood obtained from the marginal vein and the renal artery and vein, in punctured rabbits or in those injected with serum from punctured rabbits the plasma chloride of the renal artery is invariably lower than that of the renal vein Therefore, the action of the hormonal stimulus can take place only in the tissue interposed between the artery and vein, i.e., in the functioning renal tissue, by direct stimulation of the renal cell which alone is responsible for the abundant discharge of chloride into the urine

A hypothesis to explain the hyperchloruria after puncture of the saline center is that the amount of sodium chloride resorbed is lower than normal, or that the threshold, which is rather high for chloride, is lowered To explain the higher concentration

chloride in the vein than in the artery, when it should be lower in view of the increased elimination in the urine, it must be supposed that the kidney is capable of synthesizing sodium chloride under the hormonal stimulation, as for hippuric acid, but this hypothesis requires further study. RICHARD KEMEL, M D

**Streptomycin in Nontuberculous Urinary Infections** CHARLES A. WELLS and RAPHAEL MARCUS  
*Brit J Urol*, 1949, 21, 68

The authors have analyzed the courses of 12 patients with nontuberculous urinary infection who were treated with streptomycin. All of the patients were followed up carefully from a bacteriological and clinical point of view, all had had previous courses of the following therapy: (1) urinary acidification for days or weeks, (2) urinary alkalinization, (3) mandelic acid for 10 days, (4) sulfonamides for 10 days, and (5) penicillin, 100,000 units every 6 hours for several days.

The urine cultures in the cases treated grew one or more of the following organisms: *Bacillus coli*, *Bacillus pyocyaneus*, *Bacillus proteus*, and *Friedländer's bacillus*. The dosage of streptomycin used was 0.5 gm every 6 hours until 4 gm was given and then, 6 hours later, a final dose of 1 gm. A striking feature was the rapidity (12 to 24 hours) with which the cultures became sterile in many instances.

The results obtained were directly related to the degree of free urinary drainage. The cases in which urinary stasis supervened did not show the response as did those in which no residual urine existed. In general, all the results were considered good, and all of the group of patients in whom the surgical program had been completed but in whom a resistant infection remained showed permanent improvement amounting to a clinical cure. No toxic reactions were manifested. JOSEPH E. MAURER, M D

**Right Inguinal and Iliac Sarcomatoid Myxoma Metastasized from a Previous Remote Epididymal Blastie Phase** (Di un miroma sarcomatode inguinale e iliaco destro, metastatizzato da progressa remota fase blastica epididimaria) GIÒ TARTARINI  
*Arch ital urol*, 1949, 23, 75

A man of 61 had been subjected to orchidectomy on the right side 9 years previously for a tumor of

the epididymis which had been diagnosed histologically as a sarcoma with myxomatous evolution. It had been well until a year ago when a swelling appeared in the right inguinal region and gradually increased in size without causing any disturbance. He had not lost any weight. Examination disclosed an ovoid, irregular swelling, the size of a lemon, with its long diameter in the direction of the inguinal canal, it was covered by normal skin of hard fibrous consistency, and was apparently attached to the deep tissues. Palpation did not cause any pain. A hard mass with an irregular surface was felt in the iliac fossa.

Under spinal anesthesia, the neoplastic mass of the inguinal canal and the metastatic lymph node along the iliac vessels were removed simultaneously with some small portions of the peritoneum which were involved, but some infiltrated tissue which was fused with the iliac vein was left in place. The wound was closed in layers and the patient recovered. The histologic picture of the specimen was that of a sarcomatoid myxoma.

This form of epididymal tumor is rare. It is not difficult to understand how the tumor, which had occurred 9 years previously, reappeared after such a long interval. The tumor had a low potential of malignancy; it was a blastie sarcoma, one of those transition forms which, in the evolution of the normal connective tissue from undifferentiated mesenchyma (completely immature sarcoma) to the various forms of adult connective tissue (benign tumors), occupy an intermediate stage. These neoplastic sarcomatous cells with myxomatous evolutive tendency and scarce anaplasia, having reached the inguinal and iliac lymph nodes undoubtedly by the lymphatic route, have taken root and become stabilized there for a long time, perhaps because of inadequate blood supply and biochemical conditions unfavorable to growth; then, the cells have started to proliferate, perhaps after reduction of the limiting and defensive forces of the organism.

By strange coincidence, the wife of the patient had been operated upon for sarcoma of the uterus a year before he was operated upon. However, although suggestive, this has no significance in the light of modern experimental cancerology.

RICHARD KEMEL, M D

# SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

## CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC

**Osteitis Fibrosa Disseminata** D J MACRAE *Brit M J*, 1949, 1 389

Osteitis fibrosa disseminata is a disease of unknown etiology, involving the integrity of the skeletal system. It predominates in children from 1 to 4 years of age. Many of the patients manifest icterus gravis neonatorum. Enlarged breasts, menstruation, and sexual precocity have been commonly observed in children under 4 years of age.

Deformity and fractures of the lower extremities may be the first symptoms of this disease. Any bone may be affected. The epiphyses are characteristically spared. The diaphyses, on the other hand, are notoriously involved with patchy decalcification which may subsequently undergo cystic degeneration and spontaneous fracture.

While the periosteum does not share in the cystic formation, the cortex and medullary cavity furnish the media for the bony destruction and replacement with dense osteoid fibrous tissue. The cystic cavities are, as a rule, lined with compact fibrous tissue and nests of foam cells.

The skulls of the patients may show osseous defects namely, (1) marked thickening or hyperostosis at the base, (2) obliteration of the mastoid cells and accessory sinuses (with dense bony deposit), (3) Pagetlike architectural defects, and (4) cystic rarefaction of the occipital protuberance.

The author reports a case of osteitis fibrosa disseminata observed in a man of 25 years of age with a typical history of fractures during childhood and fibrocystic bony derangement in the occiput and humerus with hyperostotic changes in the accessory sinuses.

The author further maintains that a dysfunction of the parathyroid, pituitary, and hypothalamus glands may be interrelated to this bizarre clinical entity—a fibrocystic disease of bone characterized by episodes of recrudescence and intermission.

SAMUEL L. GOVERNALE, M D

**Essential Bone Cysts and Giant-Cell Bone Tumors**  
(Cisti essenziali e tumori delle ossa a cellule giganti)  
G CATALANO *Policlinico, sez chir*, 1948, 55 241

One case of solitary bone cyst and 2 cases of giant-cell tumor of the bone are reported. All of the patients had suffered pathologic fractures as a result of minor trauma. The tumors developed, respectively, in the inner third of the clavicle and the upper end of the humerus in boys of 14 and 15 years of age. The clavicular tumor was resected and a tibial implant was inserted in its place. This implant healed in perfectly and 13 months later the functional capacity of the extremity was perfect. The implant had united at both ends to form a new clavicle and

had actually begun to assume a curved aspect in imitation of the normal bone. The humeral tumor was excised and the upper end of the humerus supplanted by an osseous implant composed of the whole thickness of the fibula including its head. The head was fitted into the glenoid cavity and the remnants of the joint capsule sutured around it. The muscles of the shoulder were sutured meticulously to the implant by circular catgut sutures. The lower portion of the fibular implant was wedged into the medullary cavity of the lower humeral fragment and the areas of impaction were frequently drilled through with a fine perforator. Eight months later the fibular implant had developed osseous union with the humerus and the epiphyseal head of the implant had become somewhat flattened to adapt itself to the glenoid cavity. With some aid from the scapula the movements of the arm were limited but satisfactory, even some abduction of the arm was possible.

The solitary bone cyst was found in a woman of 30 years, however, the condition had started 10 years previously as a pathologic fracture of the lower end of the left radius. At this time the cyst was curetted and the cavity packed with plaster of paris and iodoform. The condition had recurred and revealed the typical roentgenologic picture of a loculated bone cyst. The patient refused further surgery.

The author believes that curettage and plugging of the bone cavity may be permissible in the solitary bone cyst, but not in the giant cell bone tumor because of the danger of recurrence and because of the difficulty in distinguishing this tumor from malignant varieties. On the other hand, there seems to be no indication for mutilating resections, amputations, and exarticulations. An excision of the diseased portion of the bone in these cases rarely results in recurrence and the percentage of death from metastasis, even in some of the more malignant types, is not greater than that following the more radical procedures. The possibility of securing a useful limb will win the confidence of the patient and lead to earlier surgical interventions. Even in the malignant types of bone tumor, so long as the growth is still confined within the bone itself, an ample resection followed by the placing of a free autoplasmic osseous implant in the resulting defect will undoubtedly result in a worthwhile prolongation of life and social usefulness.

JOHN W. BRENNAN, M D

**Conservative Therapy of Agenesis of Tibia and Fibula**  
*Report of 5 Clinical Cases (La terapia conservatrice delle agenesie della tibia e del perone)*  
ROSARIO VASSALLO *Sicilia med*, 1949, 6 10

Five cases of agenesis of the tibia and fibula are reported by the author who concludes that conservative treatment is indicated in the majority of cases, no matter whether the agenesis is partial or total.

He obtained good results with conservative surgical procedures, such as resections or synostosis. Amputations of the big toe were performed in only 2 cases, because the organs were useless from the functional point of view. When possible, a prosthesis should be tried before amputation is advised.

Hereditary factors play the greatest role in the pathogenesis of this congenital deformity. Apparently a faulty distribution of the germinal formations leads to the malformation of the lower leg.

JOSEPH K. NARAT, M D

## SURGERY OF THE BONES, JOINTS MUSCLES, TENDONS, ETC

### Surgery in the Treatment of Chronic Arthritis H KELIKIAN *Surg Clin N America*, 1949, 29 87

The author discusses chronic arthritis under the headings of rheumatoid arthritis, osteoarthritis, pigmented villonodular synovitis, and osteochondromatosis. The terms are defined and differentiating characteristics are listed. The surgical treatment requires the utilization of casts to immobilize joints, splints to correct deformity, traction to correct deformity, exercises to maintain motor power and mobility, and manipulation to increase mobility.

In addition to these methods, débridement of synovial adhesions within the suprapatellar pouch of the knee may be done. Joints improve with the aspiration of excess fluid and irrigation with normal saline solution. The suprapatellar pouch may be punctured to allow escape for excess fluid, and bones may be decompressed by drilling their ends. Joints are improved by arthrotomy for removal of loose bodies, removal of fluid, and erosion of incongruities. Synovectomy is frequently of value when the inflammatory stage of the joint involved is slight or quiescent. Osteotomy to correct deformity, and osteotomy to remove the patella or the end of a nonweight-bearing or avascular necrotic bone, have a place in treatment. Arthroplasty, especially in the upper limb, during a quiescent phase of at least 1 year's duration, may be helpful, in the lower limb, the hip lends itself to cup arthroplasty in the presence of good abductors and rotators. Rheumatoid hips do not do as well as osteoarthritic hips. Arthrodesis of joints which are painful is an excellent method when mobility can be sacrificed for stability. Amputation may be used as a last resort in eliminating deformities, facilitating nursing care, and lessening pain.

Rheumatoid arthritis is a systemic disease and any measure which improves the general health of the individual also improves the joints. Osteoarthritis is a local disease and the particular part involved should be treated with the methods discussed.

DANIEL H. LEVINTHAL, M D

### Ruptures of Muscles and Tendons RICHEY L WAUGH, THOMAS A HATHCOCK, and J L ELLIOTT *Surgery*, 1949, 25 370

Among 60,792 hospital admissions, the authors have encountered 50 cases of ruptured biceps brachii

muscles. Acquaviva, in 1898, was the first to describe laceration of the lacertus fibrosus. Other vulnerable muscles are, in order of frequency, calf extensor of the leg, biceps brachii, Achilles tendon, extensors of the thumb and fingers, supraspinatus tendon, rectus abdominis, adductors, etc.

Biancheri maintains that rupture of the long head of the biceps is by far the most common. In his series, 96 per cent of the lacerations were confined to the long head and only 3 per cent involved the short head of the biceps. This percentage distribution likewise was observed in the present communication.

The mechanism of ruptures of tendons is not very lucid. Speculation leads to the conclusion that occupation, osteophytic growths in the floor of the bicipital groove, indirect and direct trauma, and anatomical intrinsic musculotendinous deficiencies are the precursors of ruptured muscles. Muscle fatigue tends to increase the susceptibility of tears. One patient sustained a rupture of the long head of the biceps by lifting his hat from his head. This is not inconceivable because one occasionally encounters elongation of the tendon, fraying, laceration, and edema in the bicipital groove without discernible clinical manifestations.

Rupture of the long head of the biceps occurs at two constant levels, i.e., the high and the low. The former rupture at the supraglenoid region, whereas the latter rupture at or below the level of the bicipital groove.

The symptoms are those of a sudden snap, "bunching" of the muscle in question, with a marked reduction in muscle strength. Ecchymosis may be noted 24 to 48 hours later.

Heuter's, Ludington's and Yergason's signs help to differentiate it from other lesions of the shoulder.

The treatment consists of (1) suturing the long tendon to the short head, (2) suturing the long head to the coracoid process (Perthes), (3) suturing to the humerus (Roloff), (4) suturing to the deltoid (Cotton and Morrison), and (5) suturing to the insertion of the pectoralis major (Hoffman).

SAMUEL L. GOVERNALL, M D

### Spasmodic Torticollis Surgical Treatment TRACY J PUTNAM, ERNST HERZ, and GILBERT H GLASER *Arch Neurol Psychiat*, Chic., 1949, 61 240

The effect of surgical treatment in 18 cases of a total of 43 cases of spasmodic torticollis is discussed. Generally speaking, any procedure which provides emotional relaxation will produce subjective improvement. This improvement, however, may prove to be temporary.

A table "After Dandy" is included, it shows muscles involved in torticollis together with their nerve supply.

The result of surgery primarily depends upon its ability to reduce the activity of the muscles concerned. Three surgical procedures generally have been used: (1) myotomy, used as early as 1641 (this has been abandoned in favor of more effective forms of surgical treatment), (2) section of the peripheral

nerves, and (3) intradural section of the cervical roots and spinal accessory fibers

The author outlines surgical treatment in three steps as contemplated in his series

1 The Foerster-Dandy bilateral intradural section of the first three cervical nerves and of the spinal accessory fibers

2 Unilateral or bilateral section of the spinal accessory nerves in the neck

3 Keen's operation section of the posterior divisions of the cervical nerves

In the case of further progression of the disease with lordotic posture, additional denervation is indicated

The degree of improvement depends upon various factors and a physical evaluation cannot be given. Propagation of dystonic movements, the course of the disease, the part played by the platysma muscle, the psychological attitude of the patient, his emotional situation, and personality factors must all be considered. Bilateral involvement of the neck muscles with painful severe tension and little or no emotional background is considered a definite indication for surgical intervention

KENNETH SHERMAN, M D

**Poliomyelitic Scoliosis** (A propos des scolioses poliomyéliquies) BOPPE and QUENEAU *Rev orthop*, Par, 1949, 35 12

Deformities of the spine resulting from poliomyelitis are attributable to a disturbance of balance not only of the muscles of the trunk but also of those of the pelvic and shoulder girdles. In addition, trophic disturbances are an important factor in the production of deformities in children and adolescents, but not in adults. The author compares the foot and the spine. In children the ligaments of an affected foot are flaccid, while in adults the foot is stiff and the ligaments are firm and resistant. Similar differences can be noticed in the spine: in an adult poliomyelitic scoliosis is limited and comparable with scoliosis caused by neuromyopathies, while in a child extensive scoliosis with considerable gibbus formation is frequently observed.

In the author's material, scoliosis developed in approximately 10 per cent of all cases of poliomyelitis. American writers report a much higher frequency of scoliosis, the discrepancy being due to the fact that these authors have a tendency to consider certain severe, progressive cases to be of paralytic origin, while in France they are classified as essential scoliosis.

Only in 2 cases was the paralysis limited strictly to the muscles of the trunk.

For the purpose of discussion of the treatment, the material is divided into three groups.

A Scoliosis caused by a disturbance of the balance of the muscles of the pelvic girdle and the lower extremities. This type of scoliosis, secondary to pelvic obliquity, is relatively rare. It is usually not difficult to correct the obliquity of the pelvis, after which the scoliosis recedes spontaneously. Only in excep-

tional cases is a lumbosacral bone graft necessary. Transplantation of the insertion of the gluteus maximus muscle or a section of the trochanter may be required to correct the abduction deformity. Tenotomy of the adductors may be necessary in case of contracture of these muscles.

B Scoliosis caused by a disturbance of balance of the muscles of the shoulder girdle and the upper extremities. Orthopedic correction of this condition is very difficult and maintenance of the proper position with a brace is not very efficient. Tendon transplantation or fascioplasic procedures are frequently required. From the cosmetic point of view, thoracic scoliosis is very deforming, but from the functional viewpoint it is less important than lumbodorsal scoliosis.

C Scoliosis caused by a disturbance of balance of the muscles of the trunk. The correction of scoliosis with an oblique pelvis is accomplished either with the "push and pull apparatus" or with a wedge jacket. In many instances abdominal fascioplasic procedures are unavoidable, with or without a vertebral graft or spinal fusion. The author usually employs Hibb's method of fusion.

Of 33 lumbodorsal curves, 22 were on the right side. In 18 of the 27 cases of oblique pelvis, the right side was lower than the left.

JOSEPH K. NARAT, M D

**Attempts at Prosthetic Reconstruction of the Hip after Resection of the Femoral Head** (Essais de reconstruction prothétique de la hanche après résection de la tête fémorale) ROBERT JUDET and JEAN JUDET *J chir*, Par, 1949, 65 17

Resection of the head of the femur is performed for various conditions, the most frequent indications being chronic degenerative arthritis, and pseudarthrosis. Different methods are in use for replacement of the head. The one employed most is transplantation of the great trochanter to the shaft of the femur.

The mechanical results of these operations are not satisfactory. Although the arthritic pains are relieved in most cases, the functional success is not very good. Frequently the joint becomes more or less ankylosed, and the femur is fixed more and more in a position of adduction and flexion. But even when satisfactory mobility is preserved, the tendency toward adduction and flexion impedes walking and produces severe limping.

To reconstruct a well functioning articulation, the authors devised a prosthesis made of methyl methacrylate (acrylic). This substance is harder than bone, can easily be drilled, filed, and fashioned to any desired shape, and can be sterilized in the autoclave. It is tolerated well by the living tissue and does not cause fibrosis or cytotoxicity.

The technique of the operation is as follows:

A vertical incision 15 cm in length is made between the tensor fascia lata and the sartorius muscles. The capsule is exposed laterally to the anterior rectus. After resection of the head the acetabulum should be enlarged (and deepened in most cases) to

provide a proper receptacle for the new head. Then a hole is drilled in the stump of the epiphysis along its axis toward the great trochanter and the prosthesis is inserted. A cast is applied for 25 days.

The author discusses the advantages of this method over the Smith-Petersen operation, in which a vital hum cup is molded over the remodeled femoral head.

The new method has been used in 76 cases during the last 2 years. The results were excellent. From 60 to 90 days after the operation, the patients had a flexion of at least 60 degrees. Seventy per cent of the patients obtained a flexion of 90 degrees.

Although the time interval is too brief to form a definite evaluation of the late results, no case of foreign body reaction or irritation of the surrounding tissues has occurred up to date.

WERNER M. SOLMITZ, M.D.

#### The Substitution of the Musculus Gluteus Maximus. A New Operative Technique. F. SPIRA. *Acta orthop. scand.*, 1948, 18, 19

Ten cases of spastic paralysis with impaired gluteus maximus function were treated by transplantation of the hamstring muscles. Following Silfverskiöld's principle, the transformation of double joint muscles into single joint ones is used to substitute the hamstrings for a paralyzed gluteus maximus muscle. The insertions of the hamstrings are transplanted from the tibia and fibula to the femur, and the origin on the tuberosity of the ischium is shifted to the ilium with the help of the ligamentum sacrotuberosum.

A detailed operative technique is reported although the author states that imperfections in technique still exist. A lateral approach to the tuberosity of the ischium was tried in the first case. It was complicated by the neurovascular bundle of the gluteus maximus muscle and by the sciatic nerve. The medial approach, on the other hand, was simple and gave a clearer view. This approach is to be recommended in future. In the first case reported, the flexors were cut in the hollow of the knee and the proximal ends of the tendons were fixed first to the deep fascia and then, during the revision, to the periosteum of the femur. Genu recurvatum developed. The gluteus maximus has two main functions: it extends the thigh when its point of fixation is the pelvis, and it raises the pelvis when its point of fixation is the thigh. The latter function is exercised, supported by other muscles, such as the hamstring, when the trunk is brought from the flexed to the erect position. Should both points of insertion be points of fixation, the function of the muscles will be that of fixing the pelvis against the femur, as is the case when standing on one leg. In addition to these main functions, the lower part of the gluteus acts as an external rotator and adductor. The loss of this muscle led to severe functional damage. The commonest causes are poliomyelitis and spastic paralysis.

Preoperative examination is conducted in the following manner: the patient stands with flexed

knee and hips; the weight of the body rests on the right leg; the left leg is abducted after standing a few minutes; the patient collapses completely. After 8 weeks of immobilization the patient is able to walk exercises.

It was amazing to see how quickly the author's patient, who had no means of direct communication, learned to extend his right knee and hip joints and walks without assistance long distances and can stand quite firmly on the right leg and move normally.

Lange was the first to attempt a plastic operation and use of the erector spinae. He lengthened the mobilized muscle with silk thread to the insertion of the gluteus maximus. Krauscher's method is similar. Ober and Hely Groves substituted five tendons for the silk thread. Dickson transferred the tendons from the anterior to the posterior third of the ilium. Wagner and Rizzo shift the tensor fasciae latae, and the long head of the rectus femoris as far as possible to the posterior third of the ilium.

C. LEOP. GÖRINGER, M.D.

#### Metallic Osteosynthesis with Medullary Graft for Pseudarthrosis of the Tibia (Osteosynthèse métallique avec greffe médullaire pour pseudarthrose du tibia). CL. VAN DE VOORDE. *Acta orthop. belg.*, 1949, 15, 37

A 22 year old male suffered a fracture of both bones of the left leg. The fracture was compound and was treated by continuous extension by means of external traction. Seven months later the fibula had healed; the tibia exhibited a frank pseudarthrosis. The edges of the pseudarthrosis were freshened and shaped with a hand saw, the medullary cavity was reamed out, and an intramedullary bone graft from the tibia of the opposite limb was inserted. The operation was completed by the application of a metallic plate with 6 screws. No plaster cast was employed. A movie film of the operation was made and this was demonstrated. The patient himself, and recent genograms (taken 7 months later) showing a perfect healing of the pseudarthrosis is also exhibited.

In the subsequent discussion, Sorue of Brussels suggested that the graft might better consist of a section of the tibia of the same leg, which would avoid damage to the other limb. COGNET of Brussels preferred the inlay type of graft. DEBIEUX of Montigny sur Sambre preferred the intramedullary graft but he fixes the fragments of the tibia and pseudarthrosis with screws. He does not use a plate. VERBEECK of Antwerp remarked on the fact that two great surgeons favor diametrically opposed methods of treatment of pseudarthrosis. PHILIPSTADT of Chicago employs the graft but without surgical fixation, he uses a plaster cast. LAMBERTON of the other hand, after freshening the pseudarthrotic surfaces, employs a simple metallic fixation without plaster cast. VERBEECK developed the method used by the author throughout a period of years and would like to add to the technique here described and cinematographically portrayed, the application



of small osteoperiosteal fragments (taken locally) to the freshened fracture site. He has employed this method in even fresh fractures.

In concluding the discussion Van de Voorde contended that the present demonstration was not intended to start a discussion on the methods of treatment of pseudarthrosis but was simply meant to present a case. Nevertheless, he maintains that the intramedullary graft is preferable to the inlay type of graft in that it does not require fixation in a plaster cast.

JOHN W. BRENNAN, M.D.

## FRACTURES AND DISLOCATIONS

**Clinical and Pathologic Anatomy of Fracture, Pseudarthrosis, and Malacia of Navicular Bone** (Zur Klinik und pathologischen Anatomie der Naviculare-Fraktur,—Pseudarthrose und —Malacie") J. R. ROETTNER *Heidel chir acta*, 1949, 16 25

Fracture of the navicular bone is the most frequent fracture of all carpal bones. Two types of fracture may be distinguished: intra-articular and extra-articular. The first type is the most frequent one and, as a rule, it has a transverse direction. The rare extra-articular fracture, such as an avulsion of the tuberosity, is of minor importance.

The observation of 2 cases of fracture of the navicular bone attracted the author's attention to the similarity of the condition to Kienboeck's disease, or the so-called malacia of the lunate bone.

Fractures of the navicular bone show a tendency to pseudarthrosis, attributable to the intra-articular location of the fracture, participation of the cartilage in the fracture, the formation of only myelogenous, enchondral callus, the absence of periosteal callus, the poor blood supply, the inundation of the fracture line with synovial fluid, and insufficient immobilization. The failure to recognize the fracture is usually responsible for improper treatment.

The nearthrosis of the navicular bone may be primary or secondary, the latter type forming in the fibrocartilaginous myelogenous callus.

The pseudarthrosis leads to secondary conditions such as fracture of the callus, development of cysts, fibrosis of the medulla, and aseptic necrosis of bone.

From the anatomicopathologic point of view, the conclusion is justified that the necrosis or malacia of the navicular bone represents the late result of a

pseudarthrosis or nearthrosis. Therefore the term "necrosis or malacia of the navicular bone" should be given up in favor of the more appropriate term "pseudarthrosis."

The condition is the sequel of a single violent trauma or repeated minimal traumas, to which miners, farmers, and other persons engaged in heavy work are frequently exposed.

The differential diagnosis should consider inflammatory processes, such as chronic nonspecific osteomyelitis.

JOSEPH K. NARAT, M.D.

**Wedge Osteotomy for Fresh Intracapsular Fractures of the Neck of the Femur** ANTHONY F. DEPALMA *Ann Surg*, 1949, 129 323

Inadequate immobilization of intracapsular fractures of the neck of the femur remains the all important cause of nonunion. Fifteen and one-half per cent of fractures, in a series of 102 hips, failed to unite when treated by the orthodox method. A statistical survey emanating from the Campbell Clinic disclosed a comparable percentage of failures (13.5%). Other causes of nonunion are inadequate reduction, severe initial trauma, ablation of blood supply to the proximal fragments, death of the head of the femur, and lack of impaction of fragments.

Abduction types of fractures are said to unite in 100 per cent of cases when properly treated. Adduction fractures, however, with the well known shearing mechanism provoked by the contraction of the iliofemoral muscle, may produce absorption of the femoral head in a greater percentage of cases.

To minimize torsion and shearing force at the site of fracture, in the adduction fractures, the author has devised a wedged osteotomy to convert the fracture into an abduction type of trauma. The fragments are held in a valgus position by the internal fixation with a Smith-Petersen nail.

In the postoperative management, the author allows his patients immediate ambulation with the aid of crutches.

To date, 22 patients with adduction type of transcervical fractures of the neck of the femur have been treated with no evidence of aseptic necrosis, no loss of position of fragments, and no sign of nonunion. The youngest patient was 72 and the oldest, 83 years of age. No deaths are reported in this series of cases.

SAMUEL L. GOVERNALL, M.D.



# SURGERY OF THE BLOOD AND LYMPH SYSTEMS

## BLOOD VESSELS

**Arterial Varices A Syndrome** GERALD H PRATT  
*Am J Surg*, 1949, 77 456

It is the purpose of this article to emphasize a syndrome that has not been emphasized before. The author calls attention to a group of patients having arteriovenous anastomosis, but whose condition was diagnosed and treated erroneously for varicose veins. Because of the inaccurate diagnosis, the treatment of arterial varices is inadequate and often delayed. The arteriovenous connections are of a congenital type, the junctions being closed for many years and suddenly opening with rapid enlargement of the veins, which appears not unlike an acute varicose vein condition. Following the classical operation for varicose veins the rapidity with which the condition recurred definitely indicated that there was some other pathologic process besides incompetent valves which needed correction.

The author notes that the first symptom noticed is an increased local heat at the site of the vein, which is registerable with the hand and always with a potentiometer. There is a heaviness and some cyanosis in the part. With the limb elevated, the veins empty incompletely but never as rapidly as do the varicose veins associated with incompetent valves. The vessels fill very rapidly following reduction of the dilation by finger pressure. If the needle on a syringe of saline or sclerosing solution is introduced into one of these vessels, arterial blood will be seen entering the fluid in the syringe barrel with each heart beat.

Accurate diagnosis of this syndrome is required in order to perform the necessary surgical treatment. The author lists some important points to be observed in making the diagnosis. The veins appear suddenly and dilate rapidly. These enlarged vessels occur most often on the lateral aspect of the leg or in the popliteal space. The veins remain partially filled on elevation of the limbs. The blood in these vessels can be reduced on pressure but the veins fill more rapidly than ordinary varicose veins on a valve failure basis. Arterial bleeding is present when such vessels are opened, and this pulsation is synchronous with cardiac systole. There is an increased skin surface temperature at the point of connections.

Of the last 272 patients referred to the Vascular Clinic with a diagnosis of varicose veins of an advanced nature, the author reports that 65, or 24 per cent of the patients, were found to have arteriovenous connections of the type described. In this same group of 272 patients were 61 patients who had been operated upon before, with prompt recurrence of the varicosities. Approximately 50 per cent of the patients with recurrences had arterial connections.

Arterial varices of the type described should be treated by exposing the vein affected and its

branches, and all connections from the arterial or venous side should be dissected free and widely excised. When the saphenous vein is thus treated, a 4 inch section should be removed, and the proximal end divided at the femoral junction. Because of the tendency of these lesions to recur, the patients who have been treated should be examined at intervals of 6 months for a period of several years. If large recurrent areas are observed, resection is required. Small recurrent connections may be obliterated by the injection of a sclerosing solution.

HERBERT F THURSTON, M D

**The Experimental Production of Gradual Occlusion of Large Arteries with Polythene and Tantalum** F W COOPER, JR, R L ROBERTSON, P C SHEA, JR., and E W DENNIS *Surgery*, 1949, 25 184

The authors found that the use of aluminum bands as a method of producing partial occlusion of large vessels was not feasible because the vessel beneath the band becomes atrophic and erodes. The use of cellophane, wrapped about a vessel, does not produce uniformly a complete occlusion of the vessel. The resulting reaction is a profound cellular response, with phagocytic mononuclear cells interspersed among fibrous tissue cells. This fibrocollagenous layer becomes partially hyalinized, with progressive constriction of the vessel.

Experimental procedures were undertaken to utilize a combination of these two methods of occlusion of large vessels, each of which has disadvantages. A method was sought which would lead to a gradual and complete occlusion of the vessel, and produce a moderate amount of perivascular reaction, but which would not involve surrounding structures in a fibroblastic process. To accomplish these results, a combination of the cellophane reaction and an initial partial occlusion by a tantalum band was used.

After partial occlusion of the aorta was produced by the use of a tantalum band, subsequent complete occlusion resulted from the fibroblastic cellular response produced by polythene. A double thickness of 1.5 ml polythene was placed about the aorta as a band 1.5 cm in width. A Matas band, 1 cm in width, made of tantalum was superimposed upon the polythene about the aorta, and tightened. This resulted in approximately a 60 per cent reduction in cross sectional area. The layers of polythene extended a little beyond the edge of the tantalum band, preventing contact between the tantalum and the aorta.

Through the use of the metallic band it was possible to use smaller quantities of polythene to produce a more rapid occlusion of the vessel, and to reduce the extent of the perivascular reaction. The fibrosis produced by the polythene may serve to prevent erosion of the vessel wall by the margin of

the metallic band The vessel beneath the metallic band continues to atrophy, but the entire area is encased in a sheath of fibrous tissue, which acts also as a preventive of aneurysmal formation

By this method, therefore, a partial occlusion of the artery is immediately produced by the metallic band, and the period of time required for complete occlusion of the artery is greatly decreased

SAMUEL KAHN, M D

## BLOOD, TRANSFUSION

**Venous Thrombosis and Anticoagulants** K P BALL and H O HUGHES *Brit M J*, 1949, **1** 560

A study of 100 cases of venous thrombosis in which anticoagulant therapy was required is presented Of these, 42 per cent were on the medical service, 35 per cent on the obstetrical service, and 22 per cent on the surgical service Bauer, in 1946, showed by phlebography that venous thrombosis always arises in the deep veins of the lower leg

It is probable that only the freshly formed thrombosis breaks off If the clotting process can be halted, organization of the clot on to the vein wall will occur

Thrombosis of the leg occurred in 74 of the 100 patients An interesting sidelight relates to the follow-up study conducted by Bauer, also in 100 patients who had deep leg thrombosis 10 or more years previously Of these, 79 patients developed leg ulcers during the subsequent 10 years

Treatment is preventive and curative Preventive treatment consists in active exercises and anticoagulant therapy Curative treatment consists of (1) venous ligation, (2) sympathectomy, and (3) anticoagulants In the case of the fully developed white-leg, lumbar sympathetic block combined with anticoagulants is the treatment of choice

The comparative advantages and disadvantages of heparin and dicumarol are reviewed Dicumarol has the more contraindications to its use possible liver damage, renal failure, subacute bacterial endocarditis, disease with bleeding tendencies, and recent operations on the brain and spinal cord It is well to bear in mind that patients with high fever or debilitating diseases are more sensitive to the drug than others No fatalities from pulmonary embolism occurred among the 74 patients with deep leg thrombosis during treatment

The authors consider that accurate determinations of the prothrombin content are the basis of successful therapy with dicumarol A reliable laboratory technique is described An anticoagulant service for all hospitals is suggested

KENNETH SHERMAN, M D

**Prothrombin A Critique of Methods for Its Determination, Their Clinical Significance** BENJAMIN ALEXANDER, ANDRE DE VRIES, and ROBERT GOLDSTEIN *N England J M*, 1949, **240** 403

The present techniques of prothrombin estimation have their limitations which must be recognized in order to secure effective therapy and prevent disaster

Prothrombin is assayed by the ability of its conversion product, thrombin, to clot fibrinogen Recently, plasma factors affecting the conversion of protbrombin to thrombin have been described They probably act as accelerator or auxiliary agents These factors cannot be controlled at the present time, therefore, the results which are obtained express protbrombin activity rather than amounts of prothrombin

Most of the current analytical techniques are based upon the one-stage procedure of Quick, or the two-stage method of Warner *et al* In Quick's method the clotting time of the plasma is measured after the addition of thromboplastin and calcium This is called prothrombin time and represents the minimal interval before a clot develops In the two-stage procedure protbrombin is allowed to convert to thrombin in defibrinated and diluted plasma, this thrombin is then tested on its ability to clot a standard fibrinogen solution Sometimes the results of the two methods vary as much as 100 per cent, e g, in infants or aged plasma, dicumarolized blood, or hemophilic serum

In the one-stage method the factors which prolong the prothrombin time are (1) fibrinopenia (as in liver disease), (2) stored plasma, due to loss of a "labile factor," (3) antitbrombin, (4) heparin and heparinlike substances, and (5) other inhibitors The factors that shorten the prothrombin time are (1) the accelerator globulin of Seegers, (2) the factor V of Owren, and (3) the prothrombin A of Quick

In view of the accelerators in serum, precaution is necessary against partial blood coagulation in the syringe during difficult venipuncture The thromboplastin reagents are Quick's fresh rabbit-brain extract which with normal plasma gives a prothrombin time of 11 to 12¼ seconds, but the potency of commercial preparations varies from batch to batch Other factors which may influence the prothrombin time are (1) the normal control plasma which shows a marked variation in prothrombin activity from day to day or from person to person, (2) the dilution of plasma and of thromboplastin, and (3) Russell viper venom which gives different results from brain extract

The relation between the "prothrombin time" and the "prothrombin activity," or "concentration per cent," is expressed by a curve The range between 25 and 100 per cent of prothrombin concentration corresponds to only very small increases of the prothrombin time, which results in very inaccurate readings Different dilution methods have been suggested as a means of improving the accuracy in this range

In the two stage method 1 unit of prothrombin is defined as the amount yielding 1 unit of thrombin in the presence of thromboplastin and calcium One unit of thrombin, in turn, will clot 1 c c of a standard fibrinogen solution in 15 seconds at 28°C The test plasma is defibrinated, diluted, and mixed with thromboplastin and calcium until the conversion of prothrombin to thrombin is complete Then a so-

lution of fibrinogen is added and the dilution inducing coagulation in 15 seconds is considered. From the dilution the units of prothrombin are computed.

The factors influencing the two stage procedure are (1) antithrombin, especially in the low prothrombin levels, (2) the lack of accelerator globulin of Seegers, (3) the Factor V of Owren, and (4) the lack of the "labile factor."

The sharp fluctuation of prothrombin time of dicumulated patients is due to the many variable factors discussed, to variations in the rate of absorption and elimination of dicumolol, and to prothrombin regeneration in the liver. The recommended safe range of prothrombin time—up to 40 seconds—may be hazardous in patients with an otherwise disturbed hemostatic mechanism.

Until a simplified two stage procedure can offer the exact definition of prothrombin in units, the authors recommend the one stage procedure of Quick with the following modifications:

- 1 Standardization on a plasma pool of at least 5 normal persons
- 2 The addition of barium sulfate to plasma
- 3 The use of various dilutions
- 4 The determination of the prothrombic activity of undiluted plasma
- 5 The determination of the prothrombic activity of the serum

ARTHUR J. LESSER, M.D.

#### The Use of Replacement Transfusion in Diseases Other than Hemolytic Disease of the Newborn

M. BRSSIS *Blood*, 1949, 4, 324

Exsanguinotransfusion with replacement of from 85 to 90 per cent of the blood volume was performed in 190 adults and children. In many cases the replacement transfusions were repeated at intervals depending on the condition of the patient. With the present technique, the drawing and injection of blood can be done simultaneously. An adult with an average blood volume of 5 liters requires 15 liters of replacement blood of the same ABO and Rh groups, or O group blood with neutralized anti-A and anti-B agglutinins. Fresh citrated or heparinized blood is infused. A plastic catheter is inserted through a superficial vein until its tip is projected into a large vein. By means of an electrical pump which is connected to the plastic catheter, blood can be removed and delivered at the rate of 300 c.c. in 5 minutes. A single exsanguinotransfusion can be completed in 3 hours.

Replacement transfusions are especially indicated in the adult for anuric nephritis. The urea can be withdrawn at frequent intervals to enable survival and provide time for restoration of the kidney function. Replacement transfusions in 38 cases of leukemia induced remissions due to the antileukemic factor present in normal blood.

BENJAMIN G. P. SHAFIROFF, M.D.

# SURGICAL TECHNIQUE

## OPERATIVE SURGERY AND TECHNIQUE, POSTOPERATIVE TREATMENT

Potassium Metabolism in Connection with Operations N. BLIXENKRONE MøLLER *Acta chir scand*, 1949, 97 300

The significance of disturbances of the metabolism of the intracellular ions in various medical and surgical conditions may have prompted this study of potassium metabolism in connection with operations. In "familial periodic paralysis" a fall of the serum potassium concentration has been shown to be the cause of the paralysis. In diarrhea in children, a large potassium loss has been demonstrated, which must be taken into account at the rehydration. In patients who have been aroused from diabetic coma by means of insulin and fluid treatment, fatigue and paralyses caused by a fall of the serum potassium have been observed. In renal disorders, cardiac injury due to retention of potassium and elevation of serum potassium have been demonstrated, in other renal patients there has been increased loss of potassium with reduced serum potassium, fatigue, and paralyses. In adrenal disorders and Cushing's syndrome, too, disturbances in the potassium metabolism develop. An elevation of the serum potassium concentration to more than 10 to 12 mEq/l (39 to 47 mgm per cent) is dangerous. Characteristic changes of the electrocardiogram, irregular action of the heart, and cardiac arrest appear. Excretion of potassium occurs exclusively through the urine, only in diarrhea the body is deprived of essential amounts in the stools. Even highly impaired kidneys can excrete potassium.

A study was made of 24 patients in whom 30 determinations had been carried out of the potassium excretion in the urine before operation. The general condition of all of the patients was good, they had been on an ordinary diet, and had not been dehydrated or had any metabolic disorders. It was recognized that a patient who has undergone operation is exposed to several influences, all of which may be assumed to affect the potassium excretion: the preoperative dose of morphine-scopolamine, the greater anesthesia, blood loss, operation, trauma, and the greater or smaller reduction of the water or food intake following the operation. Blood loss is followed by increased excretion of potassium. In case of tissue damage (caused by a tourniquet) potassium is liberated from the cells.

From this study, it was concluded that no risk is involved in using bank blood for transfusions. Only if many transfusions are to be given in quick succession, or in case of renal insufficiency, is it advisable to prefer fresh blood. Surgical patients to whom no parenteral fluid has been administered have greatly increased potassium excretion during the 24 hours following operation, especially during the afternoon.

This increase is due to cellular dehydration on account of the negative water balance. If adequate amounts of fluid are administered, the potassium excretion does not exceed that which corresponds to the tissue breakdown. Routine administration of K+ after operation is not necessary if only adequate amounts of fluid are given. If, on the other hand, the organism is dehydrated, it is indicated to add K+ to the intravenous fluid.

C. FRED GOERINGER, M.D.

Observations on the Behavior of the Chlorides, Glucose, and the Proteins in Blister Fluids with Regard to Surgical Interventions (Osservazioni sul comportamento dei cloruri, del glucosio e delle proteine del liquido di bolla in rapporto all'intervento chirurgico) GIUSEPPE ZANNINI *Polidinico, sez chir*, 1948, 55 213

The sodium chloride, glucose, and protein content of the blister fluid in 50 surgical patients was determined along with contemporaneous blood values in the same individual. The blisters were induced by the 20-hour applications of 4 sq. cm patches of cantharides plaster applied to the anterior outer surface of the thigh. Of these 50 subjects, 10 underwent gastroduodenal resection, 10 were thyroidectomized, 10 were operated upon for a variety of neoplastic conditions, and the remaining 20 were surgically treated for a variety of other conditions. The chlorides were determined by the method of Bang as modified by Sahli, the glucose, by the method of Hagedorn-Jensen, and the proteins, by the refractometer of Pulfrich.

The data, as visualized in a series of graphs, show that postoperative variations of sodium chloride in the blister fluid and the blood exhibit only insignificant variations from the normal. There was, as a rule, a tendency for the titer to sink with readjustment to the normal within a few days. The thyroidectomized patients, in general, showed a deeper and more lasting fall in the blood chlorides, however, this is ascribed to the hydration disturbances following the loss of thyroid function.

The effects of operation on the glucose values of the blister fluid were not very marked but did show an odd contrast. Following the operation the blood glucose usually underwent a transitory elevation, while that of the blister fluid tended to fall. However, this behavior of the fluid glucose is ascribed as much to the cellular content of the blister fluid and to the postoperative presence of febrile reactions in a number of these patients as to any effect of glucose on the general body metabolism.

The variation in the protein titer following operation was in no case of great significance. The protein of the blood tended to fall while that of the blister fluid tended to rise immediately following operation, however, the blood protein loss is as-

cribed to the shocklike effects of the operative assault on the processes of hydration, and the blister fluid protein increase has been ascribed to an increased capillary permeability

JOHN W BRENNAN, M D

#### A Study of Postoperative Pulmonary Atelectasis

JOHN GOODWIN *Brit J Surg*, 1949, 36 256

The author uses the following classification of postoperative pulmonary atelectases

Type 1 (a) Massive collapse of the lung There were none in his series (b) Segmental collapse

Type 2 Lobular collapse with roentgenological changes

Type 3 Lobular collapse without roentgenological changes

Sixty-three cases of postoperative chest complications were studied Sixty of the patients had some degree of pulmonary collapse, while of the remaining 3, 1 patient had congestive heart failure, 1 a right phrenic nerve palsy following operation for cervical rib, and 1 had a small pulmonary embolus A preoperative roentgenogram was usually taken and a postoperative roentgenogram with a portable apparatus was taken after 12 hours and then at 2 or 3 day intervals

In this series of 60 patients, 34 (57%) showed segmental collapse (Type 1), 8 (13%) showed lobular collapse with roentgenographic changes (Type 2), and 18 (30%) were diagnosed as having lobular collapse without detectable roentgenological changes (Type 3) Altogether 70 per cent, or 42 patients, showed roentgenological evidence of collapse It is important, however, to diagnose the cases without roentgenographic evidence of collapse The diagnosis is made on clinical grounds when from 6 to 24 hours after operation the patient develops a painful cough with scanty mucopurulent sputum, which is occasionally blood stained The temperature, respiration rate, and pulse rate are elevated, but the pyrexia is usually out of proportion to the pulse and respiration rates There may be pain of the pleuritic type over the basal areas of one or both lungs The physical signs may be slight and vary from an impaired percussion note at one or both bases with impaired air entry and basal rales, to basal rales alone, but this last finding is constant

Atelectasis occurred after 42 laparotomies and 10 hernia operations, and of the total number of patients, 58 had received a general anesthetic Twenty-nine (48%) of the patients had previous respiratory tract infection There was a slightly higher incidence of segmental collapse in the infected group The pre-existing situations consisted of previous pulmonary collapse, chronic bronchitis and emphysema, coryza, cough, and sinusitis In all instances collapse was basal, occurring in the right lung in 28 cases (47%), in the left lung in 13 cases (22%), and bilaterally in 19 (32%) The onset of the collapse was insidious in 49 (82%) and sudden in 11 (18%) of the patients Of those with a sudden onset, 72 per cent had segmental collapse

The treatment consisted of the intramuscular injection and inhalation of penicillin, postural drainage, breathing exercises, and inhalation of 5 per cent carbon dioxide With this treatment, the average duration of the segmental collapse was 16 days, of type 2 collapse, 10 days, and of type 3 collapse, 7 days

The author believes that "bronchoscopy is considered to be contraindicated unless treatment has been carried out for at least two weeks without result, or there is a suspicion of an intrabronchial neoplasm or foreign body" This appears to be a departure from the customary procedure which consists of bronchoscopy if the segmental atelectasis does not promptly disappear with intratracheal catheter aspiration LEROY J KLEINSASSER, M D

#### ANTISEPTIC SURGERY, TREATMENT OF WOUNDS AND INFECTIONS

Injuries and Death from Lightning M J G LYNCH and P H SHORTHORSE *Lancet*, Lond, 1949, 1 473

Two individuals who succumbed to lightning shock were subjected to careful autopsy examination Their lungs showed numerous hemorrhages but gave no evidence of edema In both cases necrosis of the tail of the pancreas was marked while the head of the pancreas was unaffected The necrosis was of the coagulative variety and appeared to be due to the intense heat generated by the lightning shock Homogenization of the blood was noted in the small blood vessels of the brain, lung, and pancreas Varying degrees of tigrolysis were found in the cerebellum, olivary bodies, supra-chiasmatic region, caudate nucleus, and orbital cortex Groups of cells showed Nissl's degeneration, vacuolization of the cytoplasm, and rupture of the cell margin without any spatial pattern

There were 2 nonfatal casualties in the same accident One patient noted that he did not see the flash but found himself prostrate on the ground with no feeling in his legs This patient was cold and clammy with a thin rapid pulse and dilated pupils The right arm and both lower extremities were in a state of flaccid paralysis from which he recovered within a few hours Sensation preceded the recovery of motor power Two small burns were found on both feet The other victim, also, did not see the flash and lost consciousness for a period of 2 minutes, following which a natural speech stammer became temporarily accentuated

BENJAMIN G P SHAPIROFF, M D

The Treatment of Burns A B WALLACE *Brit J Plast Surg*, 1949, 1 232

The general principles of systemic and local care of burned patients are restated and emphasized, with a plea for common sense management to restore the individual to normal activity as rapidly as possible

The exposure method of local treatment is discussed, and the experiences and results of its use

during the past year for burns of all regions of the body are presented

The principles of the exposure method are (1) to expose the burn to daylight and cool ward temperature, (2) to keep the raw area dry and so prevent the multiplication of surface-contaminating organisms, (3) to immobilize the part in order to prevent invasion of the tissues by infecting micro-organisms, (4) to administer penicillin systemically to counter any tendency to general or local infection, and (5) to render nursing care as simple as possible

The burns treated have been mainly superficial and moderate in extent, the most extensive burn treated was one involving the left upper extremity, left chest and abdomen, and left lower extremity. In deep burns, pressure dressings are advocated for the first 4 days, then exposure until separation and surgical removal of the slough, thereafter the problem being of a more purely plastic nature

For superficial burns, it is thought that this method gives more rapid and favorable results

LOUIS T. BYARS, M.D.

**The Management of Severe Burns** W. A. COAKLEY,  
R. N. SHAPIRO, and G. W. ROBERTSON *Plast Reconstr Surg*, 1948, 3: 667

A burn is an injury caused by thermal, chemical, or electric heat, or by radiant energy. Various classifications have been devised to indicate the depth of burns as a guide to prognosis and therapy. The simplest and most widely used classification in this country is that which divides burns into three categories: (1) first degree, simple erythema, (2) second degree, partial destruction of the skin, but without destruction of all epithelial cells, (3) third degree, destruction of the full thickness of skin.

It is frequently impossible to estimate the depth of a burn accurately until at least a week or two has passed following the injury. Upon first observing the early lesion we may say that a burned area which is dry, hard, dead white, firm or leathery to the touch, or charred, is probably third degree. The presence of blebs or bullae, oozing of plasma, and visible corium usually indicate a second degree burn, while simple erythema is, of course, indicative of a first degree burn. Variations, however, are great and it is the authors' belief that the immediate diagnosis of depth of the burn is an estimation only.

The estimation of the proportion of skin area which has been burned is an important guide to both prognosis and therapy. Berkow's table has been used very widely for this purpose and is a convenient and simple standard.

Local pathology varies with the depth of the burn. In mild, first degree burns there is some dilatation of capillaries, arterioles, and venules with an increase in the blood flow. In more severe burns, there is capillary wall damage with a leakage of plasma into the tissue spaces. At the surface, this is manifested by blister formation and exudation from broken blisters. At a deeper level the increase in capillary permeability is marked by edema and increased lymph flow.

The processes of repair begin soon after the burn occurs. In mild burns, this consists of a return to normal of blood vessels, and absorption of the fluid in the tissue spaces. In more severe burns in which cells have been killed, the dead cells are removed by lysis and phagocytosis at the junction between living and dead cells. This results in the formation of a slough of dead tissues at the surface. This slough remains attached until the collagen fibers which connect it to living tissue are digested. Epithelization occurs from skin edges, remnants of hair follicles and deep glands, or, if the burn is severe enough, from the skin edges alone. If the dermis has been destroyed and repair occurs by ingrowth from the edges, the result may be quite imperfect because only a thin sheet of epithelium will cover the scar tissue. This scar epithelium is poorly nourished and poorly attached at its base and is subject to breakdown and damage on slight trauma.

Hemoglobinemia may be seen in deep burns of more than 10 per cent of the body area, and hemoglobinuria in deep burns of 30 per cent of the body area. These conditions result from intravascular hemolysis due to the heat of the burns, and disappear in from 24 to 72 hours. There may be a thrombocytopenia in very severe burns for several days following injury. Leucocytosis is seen early and is usually directly proportional to the severity of the burn. Rarely, severe burns show a leucopenia from the first to the sixth day.

Kidney damage is an important complication in the early course of patients with severe burns. Albumin, hemoglobin, and casts may be found in the urine. In more severe cases there may be oliguria, azotemia, and elevation of the blood nonprotein nitrogen. The changes are of the type seen in shock caused by any other mechanism and are probably due to decreased blood flow through the kidney. Intravascular hemolysis and hemoglobinemia may be a contributing factor in causing injury to the kidneys, and the histological picture of the kidneys in severe burns sometimes suggests this possibility. These changes are characterized by the presence of hemoglobin casts, epithelial casts, and necrosis of the tubules.

Liver necrosis in burns has been reported by many workers, but few cases have been reported in which bland ointments, saline solution, or dry dressings have been used. Many competent observers feel that liver damage can be attributed to tannic acid poisoning, but there is a case of liver necrosis following triple dye therapy, and the authors have seen a case of liver necrosis following treatment with sulfadiazine-triethanolamine spray.

In 1842, Curling called attention to the occurrence of intestinal tract ulceration following burns. This lesion is most likely to result in a severe, septic, third degree burn and is usually manifested by epigastric pain, melena, and hematemesis. The stomach or duodenum (or both) may be involved and hemorrhage is twice as apt to cause death as perforation. The condition is usually, but not always, fatal.

Damage of the respiratory tract, due to smoke inhalation, may be seen in burn cases. The resultant lesion is essentially a laryngotracheobronchitis which may go on to mucosal necrosis, pulmonary edema, and pneumonia.

Marked changes in nitrogen metabolism of the burned patient have been noted by a number of workers at various hospitals. Severe burns show a high output of nitrogen in the urine during the first 3 weeks, and sometimes for as long as several months. The resulting negative balance may reach the magnitude of 25 to 30 gm. of nitrogen per day. The causative mechanism is not yet known, but a similar change has been demonstrated in fractures and other types of trauma. In addition to the above described urinary nitrogen loss, there may be a nitrogen loss of comparable magnitude from the surface of the burn and this latter may continue over long periods of time in extensive deep burns. The marked nitrogen losses from these two sources may result in the occurrence, in the burned patient, of severe hypoproteinemia within a few weeks' time, unless proper therapy is instituted. A continuing hypoproteinemia may cause tissue protein loss with weight loss, edema, weakness, and death from malnutrition as the end results.

Sodium chloride may be lost into the burned area as evidenced by a decrease in the plasma chloride and sodium concentration and a rise in the plasma potassium concentration. Hyperglycemia and acidosis are sometimes observed and many workers have noted an apparent depletion in vitamin metabolism.

Shock can be expected in burns which involve more than 15 per cent of the surface area of healthy adults, and more than 10 per cent of the surface of children or aged persons. The most important factor in the causation of burn shock is the loss of plasma from the circulation into the tissues of the burned area. Because of the increased blood concentration and increased peripheral resistance in burn shock, blood pressure values tend to remain close to normal in spite of markedly reduced total blood volume. Because of this, blood pressure is a poor index of the severity of the shock process in burns. Many investigators have tried to demonstrate the role of toxic substances released from burned areas in the production of shock. There may be many substances released from a burn area which can depress the circulatory system but there is no evidence that these toxins are important in causing burn shock in man. The entire picture can be accounted for by the loss of plasma into the burned area and a consequent loss of effective circulating blood volume. More sensitive and practical criteria for therapy can be found in hematocrit, hemoglobin, and serum plasma protein determinations. It has also been said that if the urine output is good, the general circulation is good. After severe shock has persisted in an individual for a long period (4 to 5 hours) it becomes irreversible. The exact mechanism in this change is a controversial point. Nevertheless, it is universally recognized that prolonged shock eventually produces a

condition wherein restoration of blood volume will no longer restore an adequate circulation for life.

The treatment of burns is constantly changing. Upon admission to the hospital the patient has his burned areas covered with a sterile sheet or sterile towels. If the patient is conscious and in pain, morphine or codeine may be used to allay it. If shock is a factor, morphine is given intravenously to insure immediate absorption. A diagram is then made of the burned area on a burn chart. An attempt is made to estimate, as far as possible, both the degree and depth of an injury since such an estimate is necessary both for the prognosis and as a guide to therapy.

If shock is present, or if shock is anticipated from the extent of the burn, intravenous therapy is started. Normal saline or 5 per cent glucose in normal saline is used and plasma may be administered simultaneously or given after the electrolyte infusion has been given, depending upon the requirements of the case. The fluid that is lost from burns is similar in composition to blood plasma so it is logical to replace this fluid loss with plasma. However, there is experimental evidence that sodium ions administered as isotonic sodium chloride are of some value in preventing shock in burn cases. One thousand cubic centimeters of 5 per cent glucose in saline are probably adequate for the average adult in the first 24 hours, and there are definite dangers to overzealous administration of saline.

It should be mentioned that there is evidence to indicate that whole blood may have a rational place in the replacement therapy of burn shock. In general, plasma losses predominate in extensive second degree burns while in third degree burns there may be additional considerable loss of red cell mass.

After shock treatment has been instituted, dressings are applied to the burn. At this point a warning should be voiced against vigorous débridement which compounds shock and definitely increases morbidity. At this hospital no débridement is performed except in very grossly contaminated cases, and in those cases it takes the form of very gentle sponging with warmed saline. Blisters are left intact in all cases. These procedures as well as the dressing of the burns are carried out under sterile conditions with all personnel gowned and gloved.

Since World War II, the most popular local burn treatment has been that of pressure dressings over fine mesh gauze, either dry or impregnated with petrolatum or boric acid ointment.

The ointment dressings are applied to the burn area and are carried well beyond the obvious lesion because the actual burn is usually more extensive than its immediate appearance suggests. Over this initial layer a bulky layer of stuffed sterile gauze or sterile mechanics waste is placed and even compression is produced by the use of a firm, wide bandage or an elastic bandage. On the extremities, pressure dressings must extend distally to cover the remainder of the extremity and prevent the edema that proximal compression would otherwise cause. It is well to



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incorporate splints in the dressings of burns of the extremities. Many authors recommend the application of close fitting plaster of paris casts to achieve pressure and splinting. This technique is fraught with the dangers of circulatory impairment and gangrene.

Pressure dressings are not very practical in the treatment of burns of the face, head, neck, genitalia, and the anal region. These areas are merely covered with a layer of ointment and thin dressings which are changed at frequent intervals on the ward. In severe burns of the buttocks no dressing is applied, but the patient is placed on a soft sterile towel to which the ointment has been applied. Upon turning the patient another towel may be greased and laid upon the lesion.

The initial dressings on burns of the extremities or trunk are usually left unchanged for 10 to 14 days. If there is gross seepage through the dressings or if they slip, they are merely reinforced or extended without being removed. Burns of the hands and fingers present somewhat of an exception to the rule and are dressed rather frequently. Since there is such a great degree of disability as a result of prolonged immobilization of fingers, it is good practice to start a regime of daily warm saline or water baths with active finger and wrist motion at the end of the first week after injury.

The value of chemotherapy as a prophylactic measure against infection has been extensively discussed. It has been the practice at Kings County Hospital, Brooklyn, New York, to administer penicillin by the intramuscular route routinely in all deep burn cases, from the time of the initial dressing until the first redressing. In the majority of cases, this therapy has been continued until the burn was entirely epithelialized, either by natural processes or by skin grafting. Under this regime, infection has not been a serious problem at any time.

Hyperpyrexia is a serious complication which is sometimes manifested by burn cases in the first few days following the injury. It is seen most frequently in infants and children but may occur in adults in whom very large surface areas are involved. Delirium, stupor, or convulsions frequently accompany the hyperpyrexia. If the temperature of the patient remains above 106 degrees F for many hours, death will result, so energetic measures are necessary to treat this complication. Therapy includes intravenous fluids, ice-water sponge baths, and exposure to drafts.

The maintenance of a good nutritional status is a vital element in the care of the burned patient. Large quantities of fluids containing electrolytes and protein should be provided. Fluid intake should be sufficient to maintain a urinary output of between 1,000 and 1,500 c.c. daily, after the first day. When necessary, tube feedings or intravenous administration of carbohydrate protein hydrolysate mixtures may be resorted to. The importance of a high protein intake to balance the large nitrogen losses has been pointed out. It is very difficult to fulfill the

nutritional requirements of severely burned patients because of the anorexia associated with their injuries.

Anemia is a fairly common complication after the second day. It is most marked in deep and extensive burns and in infants and children. Maintenance of normal hemoglobin and plasma protein levels is essential to proper healing and successful grafting.

The primary goal in full thickness burns should be the early and complete coverage with skin, and it is toward this goal that all therapy should be directed. The techniques used to produce local conditions favorable to grafting are varied. At Kings County Hospital, 70 per cent cod liver oil ointment is used until the slough has separated and the granulations are firm and pink. As soon as this highly desirable condition obtains, the cod liver oil ointment is discontinued and a dressing of nitrofurazone is applied to the granulations for a period of from 24 to 48 hours before grafting. This ointment is quite effective in eliminating mild surface infections which sometimes remain after separation of slough, and it also tends to inhibit the development of exuberant granulations. In treating burned children, the authors have found tub baths an effective adjunct in speeding the separating of slough and eliminating wound infections. As a rule, deep burns are ready to be grafted in 18 to 21 days when the technique described above is used.

Patients should not be grafted until their hemoglobin and plasma protein levels are relatively normal, and any considerable blood loss in the operating room should be promptly replaced.

Medium or thick split skin grafts are used to resurface third degree burn areas. The Padgett dermatome has made it possible to cut sheets of skin calibrated to even thickness from almost any part of the body in sections up to 4 inches by 8 inches. The thickness of skin which should be used is a question of surgical judgment, with which a number of factors are concerned. The thinner the split graft is cut, the more likely it is for a successful take. On the other hand, the thicker a graft is cut the less likely it is to contract badly. Again, the thinner the graft is taken, the quicker the donor site will heal. These factors must be considered together with the availability of donor sites and the thickness of those donor sites. There is considerable variation in the thickness of the more commonly used donor sites. The abdomen and inner sides of the thighs are considered rather thin skin, whereas the lateral sides of the thighs, the chest and back are covered with fairly thick skin. Women and children have relatively thinner skin than adult males. In general, at this hospital grafts are cut at 0.12 to 0.13 inch thickness for burn coverage in adults, and 0.08 to 0.10 inch thickness in young children. The area of skin which is grafted at one operation will depend upon the condition of the patient. As a rule, four drums of skin (128 square inches) are considered about the maximum amount which can be safely transferred at one operation, and in most cases it will be found expedient to limit the operation to two drums.



The technical details of the use of the dermatome and the fixation of grafts are not especially pertinent to this discussion. The authors use automobile "feeler" gauges to adjust the level of the dermatome blade and suture the graft to the recipient areas. When the granulation tissue is young and firm it is not disturbed, but when the recipient area is covered with old, exuberant granulation tissue, the granulations are stripped off down to a firm, yellow base. Bleeding is controlled by warm saline packs and the graft is then applied. Basting sutures improve the fixation of large grafts and "pie crust" incisions are sometimes used for stretching skin where large areas are denuded and donor areas are meager. When concave surfaces are grafted, it is convenient to use a gauze roll as a stent, tied firmly over the graft by sutures which have been left long for this purpose. Pressure dressings are always applied over the graft. If the graft is on an extremity or in the axilla or inguinal region, plaster of paris casts are valuable to insure immobilization of the part.

Grafts are usually redressed in 7 to 10 days, unless there is evidence of infection at an earlier date. A graft may be inspected or dressed as early as 3 days postoperatively if care is taken to avoid stripping it from its new bed, and if pressure and immobilization are reinstituted. Barring complications, dressings are left on donor areas for 2 or 3 weeks, by which time the areas have usually healed and need no further dressings.

Burns which involve the skin over or adjacent to joints require careful splinting if late, crippling complications and sequelae are to be prevented or minimized. It is these areas also which most urgently require early grafting. Severe burns of the popliteal or the antecubital regions are best held in extension to prevent flexion contractures. Severe burns of the hands and fingers can be very crippling. The most important factor in salvaging the burned hand is the early institution of a full range of active motion in daily saline baths. The latter measure should be started at the end of the first week. It must be interrupted when the part is grafted, but should be reinstituted as early as possible thereafter. During the convalescent period from burns which involve joint regions, hands, or fingers, the physiotherapy and occupational therapy departments can give valuable assistance in restoring function.

Burns may result in contractures which require corrective surgery despite splinting and early grafting because of the well known tendency of split skin grafts to contract. Surgery must be individualized to meet the needs of each specific case. As a rule pedicle or tubed flaps are the only effective means of treating neck contractures. Contractures on the face and about the eyes are often best treated with free full-thickness grafts. In some other areas, it is expedient to free the contracture surgically and to use a free thick split skin graft to surface the resulting defect.

The inability of the split skin graft to withstand prolonged trauma is another factor which may necessitate corrective measures in burn cases. Thus, it

may eventually be necessary to place full thickness grafts on fingers and over the dorsum of the hand while pressure bearing areas such as the sole of the foot and the palm of the hand may need pedicle flaps.

Contractures are not the only late sequelae of burns. Unstable scars, ulcers, and occasionally malignant lesions are noted. Old burn ulcers are treated by radical excision and grafting, but biopsies should be performed on all such ulcers before definite therapy is instituted. FRANK F. KANTHA, M.D.

**Rapid Elimination of Eschar by the Use of Pyruvic Acid** (A eliminação rápida da escara de queimaduras pelo emprego do ácido pirúvico). ANTONIO DO CARMO RUSSO. *Rev. brasil. cir.*, 1949, 18, 31.

Dissatisfaction with the various methods recommended for the treatment of deep burns led the author to try the pyruvic acid paste technique of Connor and Harvey. In the preparation of the paste, 800 c.c. of 7 per cent pyruvic acid are heated in a sterile vessel and, when boiling begins, 200 c.c. of the same, but unheated, solution, into which 80 gm. of starch have previously been dissolved, are slowly added while the mixture is continuously stirred with a spatula until a paste is formed. The paste has a pH of about 1.0. The burn is dressed with gauze which is impregnated by cold paste and the dressing is covered first with cellophane and then with vaselined gauze, over which a pressure dressing is applied and held in place by strips of adhesive plaster. The object of the use of cellophane and vaselined gauze is to avoid the rapid evaporation of the pyruvic acid solution. The dressing is changed on alternate days.

Application of this dressing does not require general anesthesia, in most cases it is sufficient to give a 0.01 gm. injection of morphine. After complete elimination of the eschar, and according to whether the wound is infected or not, dressings with penicillin (100,000 units in 1,000 c.c. of saline solution) or with saline solution only are applied for 2 or more days. These dressings free the wound of any remnant of pyruvic acid and make it ready to receive the grafts.

This method was used in 14 cases of second and third degree burns involving from 2 to 57 per cent of the body surface, the most extensive involvement by second degree burn being 57 per cent, and by third degree burn, 40 per cent. The intervals between the occurrence of the burn and the first application of pyruvic acid dressing ranged from 3 to 16 days. The number of dressings required to detach the eschar was usually three, and four in 2 cases. The intervals between the beginning of treatment and detachment of the eschar varied from 4 to 14 days, and those between occurrence of the burn and fall of the eschar from 11 to 22 days.

The use of the method offers the following advantages:

It is not traumatizing, does not cause great blood loss, and requires no anesthesia. It is efficient and

eliminates completely the necrotic tissues without damaging the healthy tissues. It is easy to apply and can be used without previous experience.

Delimitation of the eschar seems to be specifically due to the pH of the solution and to the capacity of the solution to furnish a constant supply of hydrogen ions for a sufficient period. The method should be started as soon as possible after the third day because by that time the tissues constituting the eschar can be considered as dead. Rapid preparation of the recipient bed with pyruvic acid avoids the appearance of infections by penicillin and sulfonamide resistant bacteria, and insures a good nutrient base for the grafts by elimination of necrotic tissues. For this reason the author has used large grafts, sometimes of whole-skin thickness, in many cases and thus obtained the best esthetic and functional results.

RICHARD KEMEL, M D

**Pressure Sores in Paraplegic Patients** RICHARD BATTLE *Brit J Plast Surg*, 1949, 1: 268

Most pressure sores in the paraplegic patient occur around the pelvis, the sacrum, ischial tuberosities, and greater trochanters are the bony prominences most frequently involved. The two most important factors in prophylaxis of such sores are the frequent turning of the patient and the maintenance of a good general condition. In the small percentage of sores which do not respond to conservative treatment, surgery must not be done unless the general nutritive state is good and the patient's healing capabilities are at their maximum. The following points are stressed in preparing any patient for this type of surgery: (a) the hemoglobin must be over 80 per cent and the red blood count over 4 million, (b) local infection must be eliminated, (c) a high protein diet must be given, and (d) acute urinary infection or other chronic infections must be controlled.

These lesions differ from raw burned areas in that they do not take a free graft well, and even if they did they are in such areas that a free graft would not stand up satisfactorily. A pedicled flap with a good protective layer of subcutaneous tissue must be shifted from an adjacent area in order to attain adequate healing. The donor site is then covered with a Thiersch graft. This is preceded by complete excision of the ulcer and any surrounding scar tissue, so that the recipient area is clean and vascular. General or local anesthesia may be used, but in most of the author's cases no anesthetic was necessary.

The sacral sores in this series were excised to leave a triangular raw area with its apex pointing down to the coccyx. The base line was then extended laterally with incisions which curved outward and downward on each side. Triangular flaps on each buttock were thus mobilized and the two sides of the triangular area were brought together. The resulting scar had a crossbow configuration. With lesions over the trochanters, there is rarely enough excess tissue present to permit shifting of a flap without a donor area defect. Two stages were necessary for shifting many of these flaps.

Lesions over the ischial tuberosities are frequently characterized by the formation of a bursa, followed by infection and sinus formation. The entire sinus must be dissected out and removed and the prominence of the ischial tuberosity chiselled away. The resultant bleeding may be difficult to control. The author inserts a small rubber tube deep into the wound to serve as a drain and through which he can instill penicillin or thrombin as indicated. The author states that flaps are less often necessary in this location.

Healing is always delayed in these patients and the sutures are usually left in for 2 weeks. After healing is complete, no weight bearing is allowed for at least 3 weeks.

STANLEY W. TUELL, M D

**Streptomycin in Surgical Infections. Nonpulmonary Tuberculosis (Lymph Nodes, Urinary Tract, Bone, and Peritoneum)** EDWIN J POLASKI, JAMES F. CONNELL, JR., ADAM KOWALCZYK, and SAM F. SEELEY *Ann Surg*, 1949, 129: 90

The results of streptomycin treatment of 35 patients with proved tuberculous lymphadenitis were good. In 19 cases there was no sinus formation, but in the remaining 16, sinus formation with the discharge of pus was present. In 4 patients in the group without sinus formation, there was failure—1 had syphilis, 1 had scrofula of 18 years' duration, 1 had disseminated miliary lesions, and the fourth had a minimal pulmonary infection. Surgical treatment was utilized in 6 cases and the wounds healed per primam. Of the patients with sinus formation, 11 were treated without surgery and their sinuses healed. Three patients were operated upon and the wounds healed solidly. There were 2 failures in this group—one patient died during therapy for miliary tuberculosis, and in the other purpura occurred after a brief course of therapy, during which time the sinuses closed but later reopened.

Treatment of tuberculosis of the genitourinary tract with streptomycin is, for the most part, less satisfactory. Forty-six cases were studied. Eleven patients were benefited. Four had involvement of the bladder only, 7 had involvement of the bladder and kidneys, and 1 patient of the 7 also had an epididymitis. Improvement consisted of negativity of the urine cultures, and decrease of the bladder symptoms. The urograms did not change. Surgically treated patients healed well. There were 24 doubtful cases. These were patients with unilateral lesions in which streptomycin was used preoperatively and postoperatively to insure wound healing. There were no complications. Eleven patients were not benefited.

Tuberculosis of bone treated with streptomycin responds slowly. Eleven of the 24 patients had pulmonary tuberculosis as well. In 6 patients there was a definite response by bone healing, in 17 the bony lesions were unchanged, and in 1 patient destruction continued. In 18 patients there was a response in the contiguous soft tissue lesions and in the general condition of the patients.

Seventeen patients with tuberculous peritonitis, who were acutely ill, were treated with streptomycin. Eleven patients were greatly benefited, 3 were not benefited, and 2 patients died—one went progressively downhill in spite of treatment and the other died after many intestinal obstructions.

The criteria for improvement were a fall in temperature, relief of abdominal cramps and pain, decrease in abdominal distention, change in facies, improvement in appetite, and resolution of the doughy consistency of the abdomen and abdominal masses.

ARMAND D. ALBRECHT, M.D.

**Bacitracin in Surgical Wound Infections** EDWIN J. PULASKI and JAMES F. CONNELL, Jr. *Bull. U. S. Army Med. Dep.*, 1949, 9: 141.

The results of parenteral bacitracin therapy in 26 patients with pyogenic surgical infections are presented. They were considered good in 16 patients, questionable in 3, and of no effect in 7. The dosage varied from 10,000 to 20,000 units every 3 hours to 100,000 units in a single daily dose. The best results were obtained in the treatment of cellulitis, and the poor results were attributed to bacitracin-resistant organisms.

All patients complained of pain at the site of injection, and in some a local inflammatory reaction was present. A few patients complained of malaise, nausea, and anorexia. Urinary frequency, nocturia, and pain in the lumbar region were present in 8 patients.

Eight patients had elevations of the nonprotein nitrogen on the sixth day of therapy which persisted from 2 to 14 days. Two of these patients showed a low urea clearance. The phenolsulfonphthalein output was depressed in 20 patients. The liver function and peripheral blood studies were normal. The urine in all cases became turbid after the fourth day of therapy, and albuminuria was present in all cases after the fourteenth injection. Sporadic glycosuria was noted in 12 patients. The urinary sediment con-

tained amorphous material, casts, degenerating renal epithelial cells, and red blood cells.

Since these urinary manifestations of nephrotoxicity were present in 24 of the 26 cases, it is suggested that further clinical evaluation awaits purification of the drug. ROBERT MAYO TENERY, M.D.

## ANESTHESIA

**The Utility of Intravenous Procaine in the Anesthetic Management of Cardiac Disturbances** CHARLES L. BURSTEIN. *Anesthesiology*, 1949, 10: 133.

The efficacious results following the intravenous use of procaine in overcoming cardiac irregularities manifested during general anesthesia have led to the belief that this therapy tends to minimize the state of cardiac hyperirritability produced by general anesthesia. This belief is substantiated by the beneficial results obtained by intravenous procaine therapy used as a prophylactic measure to diminish the incidence and severity of cardiac arrhythmias which are so frequent during clinical surgical anesthesia. As a prophylactic measure, procaine was rapidly injected intravenously into adult patients immediately after the induction of surgical anesthesia with a general anesthetic agent. The dose of procaine given was between 75 and 100 mgm. in a 1 per cent solution. This procedure has been employed in more than 500 cases comprising all types of patients regardless of their preoperative cardiac status.

Case reports are presented to illustrate the intravenous use of procaine in combating cardiac disturbances during general anesthesia. The method is also recommended as a prophylactic measure to minimize cardiac disturbances during general anesthesia. Cases are reported to show that with this technique cyclopropane may be administered to patients with pre-existing cardiac disease without the manifestation of any apparent deleterious cardiovascular effects. MARY FRANCES POE, M.D.

# PHYSICOCHEMICAL METHODS IN SURGERY

## ROENTGENOLOGY

**Primary Hemangioma of the Skull A Rare Cranial Tumor** B D WYKE *Am J Roentg*, 1949, 61 302

The author presents a review of the literature and a summary of all 40 of the cases so far appearing in print To this list of 40 he adds 1 case report of his own, making a total of 41

Primary hemangioma of the skull is most frequently found in the fourth decade of life and is three times as common in females as in males The parietal bones are the most frequent site of its occurrence, and the frontal bones the next most common

According to the author these cranial neoplasms always have a chronic history of a palpable, and often a visible lump Except for the orbital and petrottemporal lesions these tumors tend to expand externally and for this reason neurological findings are unusual

The roentgenologic feature of these tumors is a rounded area of rarefaction which has a peculiar "honeycombed" appearance, and rarely is there a surrounding zone of osteosclerosis or increased vascularity of the adjacent bone A tangential view will often show spicules of bone radiating outward from a common center with expansion and erosion of the outer table of the vault As the tumor grows the inner table may also be expanded but this usually lags behind the changes in the outer table

These hemangiomas may be either the capillary or cavernous type although the majority are cavernous They arise from one or more diploic veins and consist of large blood-filled lacunae embedded in a connective tissue matrix These tumors are always benign

The differential diagnosis of these lesions includes meningiomas, epidermoids, osteomyelitis, xanthomatosis, osteoporosis circumscripta, certain anemias, osteitis fibrosa cystica, benign osteomas, osteogenic sarcomas, and intracranial hemangiomas

Treatment may be either by surgical removal or by radiation therapy Block resection and replacement of the resulting defect with a bone graft is the preferable method of treatment in calvarial tumors Irradiation is the best treatment for lesions involving the petrous bones

The author concludes the article with a case report of a primary hemangioma of the frontal bone

JOHN W HOPE M D

**Plain Roentgenography in Intraspinal Protrusion of the Lumbar Intervertebral Discs A Correlation with Operative Findings** A CHARLES BEGG and MURRAY A FALCONER *Brit J Surg*, 1949, 36 225

Plain roentgenography in the diagnosis of herniated intervertebral disc has usually been considered of negative value, that is, for the purpose of ruling out

other lesions which might simulate the clinical picture of a herniated disc The authors, however, state that they are able to find changes suggestive of a herniated disc in 80 per cent of the cases and to localize the level accurately in approximately 50 per cent of the cases They concur with other authorities in that degenerative changes of the intervertebral disc must occur before herniation takes place

This study was based on 100 consecutive cases of surgically verified prolapse of a lumbar disc Forty-two per cent of the herniations occurred in the midline and 58 per cent occurred laterally Although the number of herniated discs at the fourth and at the fifth lumbar spaces was equal, it is interesting to note that there was a greater number of central discs at the fourth lumbar space, the ratio being 3 to 2, than at the fifth interspace, where the ratio was 1 to 3 in favor of lateral prolapse Twenty per cent of the patients had multiple herniations

The roentgenologic study consists of routine lateral and posteroanterior projections If these films reveal the necessity of further study, oblique, angle, or stereoscopic views are taken Since it is believed that a comparison of the different intervertebral spaces is necessary for the detection of degeneration, the patient must be placed in such a way as to show all of the lumbar intervertebral spaces in each view This can be done by remembering that the rays pass out in a circle from the tube and by positioning the patient to permit the lumbar spines to form the arc of a circle in which the radius is the distance between the anode of the tube and the central point of the lumbar spine In the lateral projection one of two methods may be used The spines should be marked with a pencil and by using a piece of string and centering the tube over the third lumbar vertebra, sand bags may be placed under the hips and thoracic region to form this arc A more convenient method, however, is the use of a cardboard pattern cut to match the appropriate arc of the circle The same principle is applied to the anteroposterior or posteroanterior projection, which depends on whether the patient has a mild lordosis or kyphosis

An additional study started in a late stage of the investigation consisted of roentgenography in different positions and movements This consisted of lateral views of the lumbar spine with the back in acute flexion and in acute extension This study proved of greatest value when the routine examination failed to reveal the probable level of the disc collapse

Roentgenological evidence of degenerative changes were found at multiple levels of the lumbar spines in 42 cases and hence, although they were of no localizing value, it was helpful in that the verification of degeneration in these cases was indicative of the presence of the herniation In a subgroup of 34 patients there was roentgenological evidence of degeneration



will enter into the trachea. The advantage of this method is its great simplicity, but one must scrupulously avoid anesthesia of the upper orifice of the esophagus, in which case some esophageal spill may also occur.

2 Per oral supraglottic instillation. Originally this method was performed by Lian Darbois and Navarre with a soft short cannula. They used no local anesthetic and no laryngeal mirror, and condemned it as haphazard and unreliable.

In a modified form the method later gave very satisfactory results and this is now widely employed.

The detailed technique is as follows: although some authors claim that in about 70 per cent of the cases no local anesthetic is necessary, it is better to apply it routinely. While the patient holds his tongue out the oil is instilled with the aid of a curved cannula, under direct laryngoscopic control, and dropped on the upturned face of the epiglottis. From there it flows into the valleculae, over the glossoepiglottic and aryepiglottic folds, and into the laryngeal inlet. Adequate posture is necessary during the filling of the bronchial tree by the oil.

3 Per oral transglottic cannularization. This method is the same as the previous one, except in one detail, namely, that under indirect laryngoscopy a rigid Rosenthal laryngeal cannula is introduced.

4 Per oral endotracheal catheterization. Forestier, in 1926, used a soft catheter which he passed through the anesthetized larynx under indirect laryngoscopic control. Since then several variations of this method have been described, most of them making use of a single catheter and a few of an ingenious double catheter with an inflatable cuff. In the anesthetized patient this method may be used with great success.

5 Bronchoscopic method. Jackson was first to perform bronchography, in 1918, by insufflating bismuth carbonate powder through a bronchoscope. Since then the bronchoscopic method has found increasing use and is quite popular with a number of thoracic surgeons.

Its advantages are the possibilities of (a) sucking out the mucopurulent material present in the bronchi, (b) performing selective bronchography, and (c) dilating a stricture and instilling the bronchi beyond it.

T. LEUCUTIA, M.D.

**Angiocardiography in Congenital Heart Disease of Cyanotic Type with Pulmonic Stenosis or Atresia. Observations on the Tetralogy of Fallot and "Pseudo-Truncus Arteriosus."** ROBERT N. COOLEY, HENRY T. BARNSON, and C. ROLINS HANLON. *Radiology*, 1949, 52, 329.

The diagnosis of pulmonic stenosis and particularly of the anomaly known as the tetralogy of Fallot has become more important since the surgical treatment of this condition has been established.

The authors employed angiocardiography in 75 patients with congenital heart disease of the cyanotic type. The group included instances of the tetralogy of Fallot, truncus arteriosus, pulmonary stenosis combined with tricuspid stenosis, complete transpor-

tation of the great vessels, the Eisenmenger complex, and other anomalies. The authors used a rapid changing cassette device that permitted six exposures in slightly less than 5 seconds. A 70 per cent solution of diodrast was used as the contrast media. One cubic centimeter per kilogram of body weight was given to young children, and slightly smaller doses to older children and to adults. Over 140 injections have been given by the authors to 75 patients with congenital cardiac anomalies of the cyanotic group. The ages of the subjects ranged from 8 months to 42 years. No serious reactions to the diodrast were observed, however, fatalities have been reported by other workers. Since most of the patients are children, strong sedation or general anesthesia is used. In this manner satisfactory roentgenograms can be obtained.

The authors reported their findings in 7 selected cases of the tetralogy of Fallot and 2 of "pseudo-truncus arteriosus." The advantages and shortcomings of the method in preoperative evaluation are discussed.

The authors feel that angiocardiography is a valuable technique in establishing an accurate diagnosis when employed in conjunction with clinical, laboratory, and physiological studies, such as catheterization of the heart.

RICHARD C. RIFFLE, M.D.

**Angiocardiography in Coarctation of the Aorta.** E. F. SALÉN and TH. WIKLUND. *Acta radiol.*, Stockholm, 1948, 30, 299.

The authors present their findings in 14 patients with coarctation of the aorta, 11 of whom were subsequently operated upon. Six of them were examined postoperatively.

Coarctation of the aorta is a malformation characterized by a constriction of the aorta at the transition between the aortic arch and the descending aorta. Two types have been described: (1) in the adult, the stenosis is situated immediately above the ligament of Botalli, and its craniocaudal extension is very short; (2) in the infant, it is believed that the stenotic portion includes the entire area between the left subclavian artery and the ligament of Botalli. There are many transitions between these two types. A stenosis of the aortic isthmus is often combined with other malformations of the aorta, especially hypoplasia of the aortic arch. Hypertrophy of the left subclavian artery is almost the rule, and a widening of the descending aorta is by no means rare. These alterations can be seen in the angiocardiographs.

In several of the cases in this group, marked hypoplasia of the aortic arch was observed, also, in nearly all of the cases the subclavian artery was considerably widened, sometimes attaining the same caliber as the aortic arch. The lesions of the arch affect chiefly the distal segment. In coarctation of the aorta in the lateral roentgen view, it runs in an almost vertical direction, or may be arched slightly forward. In some cases the stenotic portion is very short, in others the narrowing is gradual toward the maximal stenosis. The technique of the angiocardiog-

raphy employed is the same as that described by Robb and Steinberg. The injection for the examination is given in a sitting position. A rapid cassette changer is used. The anatomical conditions encountered at operation were well borne out in the angiocardigraphic findings.

FRANK L. HUSSEY, M D

**Right Retrosternal Diaphragmatic Hernia (Ernia diaframmatica retrosternale dextra)** ARMANDO TATTONI *Radiol med*, Milano, 1949, 35 1

The case of a right retrosternal diaphragmatic hernia in a 58 year old farmer is reported by the author. There was no trauma recorded in the past history. For several years the patient has been complaining periodically of painful sensations at the base of the right chest, without cough, expectoration, fever, or any digestive disturbances. He came for an examination only because of a slight enlargement of his upper abdomen, of recent origin.

The results of the physical examination were entirely negative but the roentgenologic studies disclosed a right diaphragmatic hernia, through the region corresponding to Morgagni's foramen. The transverse colon formed the contents of the hernia.

Apparently the hernia was of congenital origin because no violent trauma could be found in the past history.

JOSEPH K. NARAT, M D

**Diagnosis of Congenital Obstruction of the Stomach and Small Intestine in the Newborn** ERIC V. BAEYER *Radiology*, 1949, 52 157

The survival of newborn infants with alimentary obstruction depends as much on prompt and accurate preoperative diagnosis as on adequate nutritional measures and expert surgery. Roentgenography provides the most accurate method of demonstrating alimentary obstructive lesions of any type.

Obstructive lesions of the esophagus and rectum are not discussed in this article. The same methods of studying obstructions in the adult are used in the study of obstructions in the infant, namely, roentgenography without the use of contrast media (flat film technique), roentgenography with the use of contrast media, fluoroscopy, fluorography (spot film technique). The methods may be used as desired. The value of flat film is wholly dependent on the presence or absence of swallowed air and its distribution. Films taken in the first 24 hours are usually less informative than those taken later, after distention has reached a marked degree. Fluid levels are of greater significance than the mere presence of gas distended loops.

It is advisable to obtain erect or inverted films in every case of suspected bowel obstruction. Oral administration of barium may become desirable although some hazards are involved. The amount of barium used should be as small as possible. A soft rubber catheter is valuable to administer the barium mixture, to remove secretion and retained food before examination, and to remove the remaining barium from the stomach after completion of the

examination. The urgency of surgical intervention may outweigh the desirability of accurate preoperative diagnosis in the matter of time entailed by barium studies. Painstaking fluoroscopy supported by spot-filming offers a distinct advantage over conventional roentgenographic procedures. Deviation from the normal anatomic position of certain segments, such as malrotation or displacement of mass lesions, and the rate of progress of the contrast meal and abnormal peristaltic phenomena are more apparent fluoroscopically than on films. Spot films are used for the permanent record of fluoroscopic observations. Hypertrophic pyloric stenosis, the most common congenital obstructive lesion of the gastrointestinal tract, is probably the only obstructive condition between the esophagus and rectum in which the clinical history and findings are usually characteristic enough to warrant surgical intervention without roentgenologic study.

The two roentgenologic signs of supportive value are palpation of a pyloric tumor under the fluoroscope, and a delay of more than 5 minutes in the opening of the pylorus. Persistent narrowing and elongation of the pyloric canal are important roentgen findings. Pyloric spasm has to be differentiated from pyloric stenosis. Conditions in the duodenum which produce obstruction are aplasia and atresia, stenosis and diaphragm, annular pancreas, peritoneal band and volvulus, aberrant vessels and duplication. In atresia and aplasia, as well as in severely stenosing annular pancreas, the characteristic hour glass configuration of the stomach and proximal segment of the duodenum may be demonstrated on flat films if these structures happen to be empty of fluid and contain a sufficient amount of air.

Differential diagnosis of congenital obstructive lesions of the jejunum and ileum involves an even greater variety of conditions than are encountered in the duodenum. In addition to lesions that occur at any level of the alimentary tract, such as aplasia, atresia, stenosis, and duplication cyst, consideration must be given to such diverse possibilities as mesenteric and omental cysts, Meckel's diverticulum with obstructing band, volvulus, herniations of various kinds, extrinsic tumors, and the important entity of pancreatic insufficiency (meconium ileus). On a clinical basis, an extrinsic etiology may be assured when a picture of incomplete obstruction is associated with a palpable tumor, a situation likely to be encountered in omental, mesenteric, or duplication cysts and tumors. Incomplete obstruction in the absence of a palpable mass should bring to mind stenosis, volvulus, or hernia. Intrinsic obstruction is usually suggested by the picture of complete occlusion. The recognition of meconium ileus, which is one of these, is facilitated by the concomitant manifestations of pulmonary disease. While thus a differentiation of extrinsic against intrinsic, and of incomplete against complete, obstruction is clinically possible to a certain degree, accurate localization of the lesion is seldom achieved owing to the unreliability of estimating the intestinal level by the

# PHYSICOCHEMICAL METHODS IN SURGERY

amount of distention present. A barium enema in suspected high colonic atresia or stenosis will differentiate these lesions from low ileal obstruction. The accuracy of roentgen diagnosis of gastrointestinal obstruction in the newborn can be greatly enhanced by basing the diagnostic procedure on fluoroscopy and by making considerable use of fluorographs (spot films).

Seven cases of congenital obstruction are presented in which barium studies led to a correct diagnosis: hypertrophic pyloric stenosis, pyloric spasm, duodenal atresia, malrotation in partial duodenal obstruction, aplasia of segment of ileum, incomplete atresia of the proximal jejunum, and duplication cyst of the jejunum.

FRANK L. HUSSEY, M.D.  
Bone Sarcomas (Sui sarcomi delle ossa) MAURO  
PIEMONTE *Radiol med*, Milano, 1949, 35 105

Various tumors may develop from connective tissue, according to its stage of evolution. Immature or ablastic sarcomas derive from nondifferentiated mesenchyma, blastic sarcomas from tissues in an intermediate stage of development, and benign tumors from adult or fully developed connective tissue.

Radiologically ablastic sarcomas greatly resemble metastases.

The author accepts the following classification of bone sarcomas, suggested by Geschickter and Copeland: primary chondromyxosarcoma, secondary chondrosarcoma, osteogenic osteoblastic sarcoma, chondroblastic sarcoma, and osteolytic osteogenic sarcoma.

Various types of bone sarcoma are illustrated by corresponding roentgenograms.

JOSEPH K. NARAT, M.D.  
Arthrograms H. KELIKIAN and ELBERT KENNETH  
LEWIS *Radiology*, 1949, 52 465

Joint motion depends upon the integrity of the articular cavity and the smoothness of its lining. Movement is compromised when the cavity is obliterated or effaced, when it is invaded by the products of inflammation and of wear, when it is encroached upon by growths, when it is partially or completely filled by fibrous, osseous, and osteocartilaginous deposits, and when the surface which lines it are rough and incongruous. Information as to the contour, the content, the capacity, and the communications of the articular cavity would therefore be of value.

The authors evaluate the findings of more than 3,000 arthrograms. Air is injected into the joints with an ordinary glass syringe. The amount of air injected varies according to the joint injected. Radiographs are taken immediately after injection with an attempt to obtain the maximum amount of detail.

The knee is subjected to arthrography far more frequently than any other joint. It is a complex articulation. It contains intra-articular fibrocartilages and ligaments, the articular cavity is lined by

the most extensive investment of synovial membrane and hyaline plates. Besides the vast coat of cartilage which covers the articular ends of the femur and tibia, the joint cavity receives additional lining from the articular facet of the largest sesamoid bone in the body, the patella. The labella, a small sesamoid bone often found in the lateral head of the gastrocnemius, also offers the articular cavity has a knee a hyaline surface. The articular cavity has a large cul-de-sac above the patella, an extensive anterior chamber, and two rear compartments. The study of arthrograms has enriched the knowledge of joint anatomy and pathology. Lesions of the semilunar cartilages of the knee are demonstrated by changes in the outline of the menisci. The medial semilunar cartilage is more frequently torn than the lateral. The medial meniscus splits lengthwise, its circumferential border remaining attached to the tibial collateral ligament while the torn inner slip shifts toward the intercondylar notch. A marginal tear of the medial meniscus is surmised when there is seen an air pocket between the tibial collateral ligament and the shifting wedge of the semilunar cartilage. Tears of the lateral meniscus seldom occur. A loosened lateral meniscus, discoid cartilage, with tears of the posterior cruciate, discoid cartilage, and synovial cysts along its circumferential border can not be visualized in arthrograms.

In the back of the knee a septum divides the articular cavity into two compartments. The so-called Baker's cyst or the gastrocnemio semimembranosus bursa communicates with the inner, and the diverticulum along the popliteus muscle connects with the outer compartment of the posterior knee joint. Joint outpouchings partake in the changes to which synovial lining of the main joint is heir, they contain villi, adhesions, osteocartilaginous bodies, and gain in capacity with the rest of the joint cavity as a result of repeated hydrarthrosis. Their dependent position, their twisted course around tendons and muscles, and the narrow neck which joins them with the main articular cavity, subject these diverticula to localized irritations. They become filled and distended with thick glairy exudate which will not empty and interferes with the flexion of the knee. Loose bodies formed in the main joint may gravitate into the popliteal diverticulum, usually into the one along the popliteus tendon, which connects with the joint through a wide neck. Arthrograms will reveal the size of these outpouchings, their content, and their connection with the main joint.

Arthrograms help to determine the number, location, and sometimes the source of osteocartilaginous bodies in and around the joints. Foreign bodies, such as shrapnel, present in the soft tissues close to the joint must be localized. Arthrograms will reveal whether they are intrasynovial or extrasynovial.

In rheumatoid arthritis, arthrograms give a variable picture. When villi predominate, the joint cavity gains in capacity, it contains fluid. When the intra-articular adhesions hold the upper hand, the



joint cavity will admit less air, its lining will cast a jagged contour. Shadows indicative of adhesions and irregularity of the articular contour are more characteristic of rheumatoid arthritis than those denoting villi or other projections into the articular cavity.

In pigmented villonodular synovitis, arthrograms reveal an enlarged articular cavity containing fluid. The shadow cast by the joint cavity presents a smooth contour and gives a bubbly flocculent effect due to the filling defects produced by villi and nodules.

Lipomas are recognized in arthrograms by their location in front of the knee, more commonly above than below the patella. Prefemoral lipomas may be so large as to obliterate the suprapatellar pouch completely, or they may be small and create a partial filling defect in the arthrogram. Both prefemoral and infrapatellar fat pads may contain calcific deposits simulating osteocartilaginous bodies. Filling defects of the articular cavity may also be caused by hemangioma, synovial ganglia, polyps, fibroma, and enchondroma. In the arthrogram, the shadow cast by hemangioma is dense, it is usually speckled with opacities indicative of sclerotic vessels and phleboliths. Synovial cysts and ganglia occur more often near the circumferential border of the menisci, synovial fibroma and chondroma cast denser shadows than lipomas. Synovioma is an extremely rare tumor.

Intra-articular chip fractures can be differentiated from phleboliths, osteocartilaginous bodies, the sesamoid bone, the separate center of ossification, a piece of bone pinched off by compression, or from an avulsion ossicle, by arthrograms.

FRANK L. HUSSEY, M D

**The Clinical and Roentgen Manifestations of Erythroblastosis Fetalis.** MAX RITVO, IRVING A. SHAUFFER, and GERALD KROSINICK. *Am J Roentg*, 1949, 61: 291.

Erythroblastosis fetalis is characterized by edema, jaundice, anemia, and circulating erythroblasts. Three forms of erythroblastosis fetalis are recognized: (1) hydrops fetalis, (2) icterus gravis, and (3) congenital anemia. The first-born infant is rarely involved, but usually the succeeding children of an Rh-negative mother and an Rh-positive father are found to have this condition. It occurs in about 1 birth of every 250 births.

Prompt recognition of this condition and proper therapy has reduced the fatal outcome in some instances. The authors conducted the study of the fetus in utero by roentgenographic means at the Boston City Hospital.

In hydrops fetalis, fluid is found in the soft tissues and body cavities, with enlargement of the liver and spleen, anemia, immature red cells, and a large placenta. This condition is often fatal in the intra-uterine period. Icterus gravis is usually associated with jaundice at the time of birth or within the first 24 hours, but rarely later. Progressive anemia, pul-

monary hemorrhage, or injury to the brain result in death. Survival may occur with proper therapy in many cases of this variety. Congenital anemia is the mildest and least frequent type. Extreme pallor is the only sign, and blood studies reveal large numbers of immature red cells.

The authors give a brief discussion on the Rh factors and their interaction. Most cases of erythroblastosis fetalis are due to immunization of the mother to Rh<sub>0</sub>. Rh agglutinins are formed by the mother as a result of transfusion with Rh positive blood or transmission of Rh positive fetal red cells into the maternal circulation, the agglutinins then traverse the placenta to produce agglutination and hemolysis of the fetal erythrocytes.

Blood studies in suspected cases should consist of typing of both parents and anti-Rh-titer estimations in the mother. The absence of Rh antibodies usually means that the infant will be normal, while the presence of Rh antibodies in the mother during pregnancy indicates the probable occurrence of erythroblastosis fetalis. During pregnancy, antibody titers should be recorded at frequent intervals after the seventh month of pregnancy. If an Rh-negative mother first presents antibodies less than 10 weeks antepartum, spontaneous labor is probably advisable. If antibodies appear during the tenth to fourteenth week antepartum, early induction should be considered. The presence of antibodies 14 or more weeks antepartum is suggestive of serious injury to the fetus.

Soft tissue changes are seen roentgenographically. They occur with massive edema which causes marked swelling and tissue thickening of the head, face, and chin, and produces a halolike appearance. In many cases the extremities are clearly seen. The splenic and hepatic enlargement is not seen in utero.

A marked increase in the density may be seen in the skull, vertebrae, ribs, and pelvis. In the skull, the sphenoid and occipital bones are principally involved. The pelvis and other flat bones may be diffusely eburnated. The long bones show a uniformly increased density with narrowing or obliteration of the medullary spaces. These abnormalities may be demonstrated in utero.

Fetal death occurs frequently. This results in overlapping of the skull bones. Sharp angulation of the head in relation to the spine, lordosis of the caudal extremity of the spinal column, collapse of the thoracic cage, and generalized decalcification of the fetal skeleton are also signs of fetal death.

The authors point out the difficulty in obtaining such information in utero and have outlined their roentgen technique. Four case reports are presented with the reproductions of 15 roentgenograms.

HORACE G. BUTLER, M D

**Interstitial Calcinosis (Sulla calcinosi interstiziale)**  
G F TESTA and A GRIGNANI. *Radiol med*, Milano, 1949, 35: 163.

Interstitial calcinosis has been variously designated as the syndrome of Thibierge-Weissenbach,

syndrome of Profichet, syndrome of Minkowski, calcium gout, calcareous diathesis, circumscribed petrification of the skin, calcareous rheumatic tendino fascitis, calcareous tendinitis, universal calcinosis universalis, and cutaneous stone

The reported case, that of a man, was studied clinically and roentgenologically for 11 years, from 1937 to 1948. The calcium deposits developed in the subcutaneous tissues and in the deeper intermuscular fascial planes. The process started when the patient was 10 years of age and was first demonstrated as deposits of calcium in the right upper arm and shoulder, and in the left leg about the knee joint. Later, the condition spread to neighboring regions and the deeper fascial planes, and ultimately it began to involve also the right leg and the left upper arm. During all this time the widespread calcification process gave the impression of impermanence and instability, new deposits were constantly appearing and the older foci tended to fragment and resorb or discharge by way of ulceration through the skin. The progress was inconstant, irregularly advancing, and resting or regressing.

Histologic examination showed the true nature of the process to be the deposition of calcareous salts with hyalinization and ultimate destruction of the neighboring connective tissues. There was no evidence of a tendency toward either cartilage or fascial bone development. Nevertheless, chemical examination of the deposits exhibited about the normal proportions for the various calcium salts as have been determined for normal bone, and the metabolism of the calcium salts in the blood never showed any notable variation from the normal.

The diagnosis of interstitial calcinosis seems indicated, however, the characteristic of both the processes known in the literature as universal calcinosis and localized calcinosis seemed inextricably mixed together in this case and therefore no differentiation was attempted.

Since considerable involvement of the blood vessels leading to the involved areas was uncovered, it is thought that, in addition to the basic postulation of a congenital mesenchymal inferiority, a vascular factor should perhaps be included as a factor leading to this condition.

JOHN W. BRENNAN, M.D.

#### Hodgkin's Disease: A Histopathologic and Clinical Classification with Radiotherapeutic Response

PHILIP F. SAYHOUN and STUART J. EISENBERG *Am J Roentol*, 1949, 61: 369

A classification of Hodgkin's disease (exclusive of Hodgkin's sarcoma) based on histopathologic criteria is presented, and a correlation is made of the histologic picture, clinical course, and prognosis of this condition.

The first classification is the compactly cellular type, progressing slowly and with a maximum life expectancy range of 48 to 160 months. Histologically, there is proliferation mostly of the lymphoid and reticuloendothelial cells with the formation of Sternberg-Reed cells, and with few eosinophils and

plasma cells. Fibrosis and necrosis are not marked. Of 11 such cases presented, 7 were adequately followed up, and 5 of these showed a response to irradiation therapy and a clinical course consistent with the histopathologic expectations.

The second classification is the fibrogranulomatous type, progressing moderately and with a maximum life expectancy of 20 to 60 months. The typical histologic picture of Hodgkin's granuloma is found with marked cellular pleomorphism and abundant Sternberg-Reed cells, eosinophils, and plasma cells. There is hyperplasia of the reticuloendothelial cells and a tendency toward fibrosis and necrosis. Six cases were presented, and all were adequately followed up, they showed a response to radiotherapy and a clinical course consistent with their histologic type.

The third classification is the loosely cellular type, progressing rapidly, and with a range of maximum life expectancy of from 12 to 20 months. Histologically, there is complete destruction of the lymph node architecture and replacement by sheets of loose reticuloendothelial cells. Mitotic figures are abundant. The Sternberg-Reed cells are immature and the capsule and blood vessels may be invaded. Of 7 cases of Hodgkin's disease reported, 6 followed the expected course.

A brief review of the literature regarding the various opinions as to the cause and the histologic classification of Hodgkin's disease is presented. There is a general agreement of most authors regarding the classification of the types of cellular changes seen in this disease. The authors' classification, likewise, is comparable to those most generally accepted, and is based on a study of 24 cases which were followed up in an attempt to confirm the impressions of a correlation of the histologic classifications and prognostic criteria, previously gained during a number of years of study and observation.

DOUGLAS B. NAGLE, M.D.

#### MISCELLANEOUS

##### The Hematological Effects of Ionizing Radiations

LEON O. JACOBSON, EDNA K. MARES, and EGON LORENZ *Radiology*, 1949, 52: 371

X-rays, gamma rays, fast neutrons, and slow neutrons are the principal forms of irradiation which affect the body, especially the hemopoietic system.

Acute whole body exposures (physical factors of 200 kilovolts, 15 milliamperes, 0.5 mm copper, plus 1 mm aluminum filter, high value layer 0.98 mm copper) in rabbits, mice, and other animals revealed that with a dose of 25 roentgens there was a reduction in lymphocytes in the peripheral blood, returning to normal within 24 to 48 hours, with a dose above 100 roentgens the reduction of lymphocytes occurs within 3 hours, the maximum reduction within 24 to 48 hours. With a dose of 300 roentgens recovery requires 60 days. Monocytes follow the same pattern as lymphocytes, but return to normal in 4 to 6 days. Heterophil motility is observed following a

dose of 200 roentgens or more. The platelet count is reduced after a dose of 500 to 800 roentgens, recovery taking from 1 to 2 weeks. Anemia is present in doses above 800 roentgens, with recovery within 20 days. The reticulocyte count is reduced from a normal of 3 to 5 per cent to less than 0.1 per cent within 72 hours.

Bleeding time is prolonged due to an increase in heparinlike substance in the circulation. The heparinlike state may be reversed by the administration of toluidine blue, protamines, and some thionin dyes. The hyperheparinemia may also be caused by nitrogen mustard.

Irradiation had no tendency to produce further anemia in animals with artificial anemia nor did it interfere with the recovery. This may have been due to a delayed response to previously stimulated erythropoietic tissue, as the actively dividing cells are less sensitive to irradiation.

The effect of fast neutrons on the peripheral blood in rabbits was similar to that caused by roentgen rays. Animal studies were also made of the hematological effect of chronic whole body exposure. Macrocytic anemia was also present.

The effects of prolonged whole body irradiation in human beings were similar to those found in animal experiments, the hemopoietic system was sensitive, with leukopenia and lymphopenia, and microcytic anemia was present. Spontaneous recovery occurred, but the time factor was a variable one.

Morphological changes in the peripheral blood cells were described. They occurred between the tenth and twenty-fifth day.

Plutonium, an alpha emitter, produced anemia when the dose was above 0.0063 microcurie per gram of weight. The effect of radium was almost like that of plutonium, a dose of 0.02 to 0.03 micrograms being necessary to produce anemia. Yttrium, a beta emitter, produced a temporary leukopenia with doses of 0.1 to 0.3 microcuries. Sodium, a beta and gamma emitter, produced severe anemia in all animals receiving more than 12 microcuries. Barium and lanthanum, a beta and gamma emitter, produced anemia when given in 1.9 microcurie dosage, and death occurred when a dose of 17 microcuries was given. The minimal dose of strontium (a beta emitter) necessary to produce anemia has not been determined. Small doses of radiation do not stimulate cellular activity and multiplication.

A study of the personnel working on the plutonium project showed only a few instances in which peripheral blood changes could be attributed to irradiation. Inaccuracy of methods and individual variation made it difficult to interpret the findings. All groups received less than 0.1 roentgen per day. Further studies will have to be carried out on the biological action of ionizing radiation before definite conclusions can be drawn as to the possible damage that may occur with the use of such agents.

MATRICE D. SACHS, M.D.

## MISCELLANEOUS

### CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

**Metabolic Studies on Protein-Depleted Patients Receiving a Large Part of Their Nitrogen Intake from Human Serum Albumin Administered Intravenously** CHRISTINE WATERHOUSE, SAMUEL H BASSETT, and JACOB W HOLLER. *J Clin Invest*, 1949, 28 245

The problem of protein depletion is urgent in the chronically ill patient who is unable to ingest adequate caloric or protein intake. Furthermore, the retention of nitrogen can be expected only when a certain critical caloric intake supplement has been made available in the form of carbohydrate and fat.

Protein hydrolysates and synthetic amino acid preparations may be poor sources of nitrogen because they are rapidly deaminated and excreted in urine. Also, they may give rise to vomiting and other reactions. Whipple and his co-workers believe that parenteral plasma protein can supply maintenance requirements. Plasma, especially when derived from large pools, may carry serum jaundice and its relatively high content of sodium is also a source of difficulty to the patient who has a tendency to collect edema.

Purified human serum albumin such as has become available through the Red Cross has the following advantages: a low content of sodium, general freedom from reactions, and freedom from viral jaundice. Its disadvantage is that it is deficient in both tryptophane and isoleucine.

Eckhardt and others concluded that albumin could maintain nitrogen equilibrium in man orally or intravenously and that supplements of tryptophane or isoleucine were unnecessary.

In order to further test the current theories, a series of experiments were set up. Subjects were chosen who were in need of protein but who were not acutely ill. The caloric intake was kept at as high a level as the patient would tolerate. None of the diets were protein-free, but (except in one instance) the amount of diet protein was too low to maintain nitrogen balance. Four subjects were studied. Each received a daily dose of 60 gm of concentrated sodium-free albumin for 10 or more days, preceded by a control period.

Results are discussed under headings of nitrogen balance, proteinuria, body weight, plasma protein and plasma volume, and calcium and phosphorus balances. Wherever possible, the data is exhibited in the form of graphs. The clinical course of each of the patients, and individual variations, are noted. In one instance a patient convalescent from rheumatic fever developed massive proteinuria but without evidence of impaired renal function. All 4 patients gained weight. The major factor was thought to be an expansion of the extracellular fluid. The

portion of albumin nitrogen apparently retained as protoplasm was inadequate to account for the weight gain. One patient, a woman with probable generalized vascular disease, retained water with resultant peripheral edema, hydrothorax, and pericardial effusion.

The variations in clinical results are discussed at length and an excellent bibliography of a related subject matter is appended.

KENNETH SHERMAN, M D

**The Value of Implantation of Hypophyseal Tissue in the Treatment of Hypophyseal Insufficiency** AXEL WESTMAN. *Acta med scand*, 1949, 133 171

The author discusses the value of implantation of pituitary tissue in the treatment of diseases which are more or less attributable to hypophyseal insufficiency.

The pituitary glands of recently slaughtered (not too young) calves were used. A small incision was made through the skin and a small pocket was subcutaneously prepared by blunt dissection, the glandular tissue was minced to a semisolid mass and instilled through the artificial hole into this pocket. In women, the labia majora forms a suitable bed for the implant because of the rich vascularization and favorable conditions in this area for resorption. In men, an area within the pectoral or gluteal regions was selected for implantation of the glandular tissue. In some cases suppuration and expulsion of the tissue occurred a few days after it had been implanted. It was found that this had no practical importance.

In menstrual disturbances it was found that previous treatments with estrone and thyroid had been unsuccessful in all of the cases observed. In addition, a large number of the patients were treated with serum or chorion gonadotropic hormone (antex, physex) which was also ineffective. Hence, the patients of this group were, from a therapeutic point of view, a selection of difficult cases. There were 36 cases of primary amenorrhea, in 3 of which the treatment was effective. There were 111 cases of secondary amenorrhea, in 32 of which the patients benefited from the treatment, and 5 patients became pregnant. There were 80 cases of hypo-oligomenorrhea, in 22 of which the treatment brought relief, 7 patients became pregnant.

In the 2 cases of adiposogenital dystrophy associated with cryptorchidism here presented, the treatment was effective.

Ten cases of alopecia totalis were studied, in 2 of them good results were obtained.

Five patients with alopecia areata were treated, in 1 of them treatment was successful.

Two cases of diabetes insipidus were studied, in these the treatment produced only a temporary effect.

In several cases of ovarian disorders the patients manifested also symptoms of other endocrine disorders, viz, adiposity, marasmus, and delay in stature growth. In a fairly large number the condition improved in connection with the establishment of the menstrual cycle. (The establishment of a normal cycle was verified by endometrial biopsies.)

With the implantation of pituitary tissue several hypophyseal hormones are administered to the patient. This is most important therapeutically, because in a large number of cases in which this treatment is indicated, the existing abnormality is attributable to pluriglandular insufficiency. This might explain why treatment by implantation of pituitary tissue is often more effective than the common hormone therapies.

The theory that the cells of the hypophyseal implant survive is not tenable. "Transplantation" of the pituitary body, therefore, is a misnomer and the procedure should be termed "implantation" of pituitary tissue.

**Structure of the Liver in Fatal Burns.** JOSEPH GILLMAN and THEODORE GILLMAN. *South Afr J M Sc*, 1948, 13, 169.

Examination of the livers of 38 patients dying from burns within from 1 hour up to 36 days after the accident disclosed three main types of reaction, namely, loss of stainability of the liver cells, fatty changes, and atrophy of cells in the central zone of the lobule. Patients dying within 13 hours of receiving the burn did not show very marked hepatic changes. In early deaths, the most striking changes in some livers were round cell and eosinophil and neutrophil accumulations in the portal tracts. Loss of stainability was seen mainly in the livers of patients dying within 9 hours and between 36 and 48 hours. This reaction was confined mainly to the region around the central vein. The granular cytoplasm occasionally contained a fat-free vacuole. Fat, in the form of small and medium sized droplets, could appear as early as 18 hours but was more consistently observed between 36 and 72 hours after

injury. The distribution was at first mainly around the central vein. At 96 hours fat was inconstantly present, but at 120 hours the fat was distributed also around the portal tracts, which is a feature of the livers of patients dying after the tenth day. From an analysis of the time sequence of the fatty changes it was suggested that the development of a very fatty liver requires at least 8 days. Atrophy of the liver cells around the central vein becomes manifest first in a liver at 36 hours after burns. Frank necrosis, such as has been described by others, was not observed in this series of cases. The authors suggest that extensive necrosis may have been intensified by tannic acid treatment, which was not used in any of their cases.

The highest death rate occurred within the first 24 hours, the next highest between 24 and 72 hours. Since there is scarcely any morphologic reaction in the liver under 18 to 36 hours, it is clear that no gross morphologic change in the liver can be correlated with the deaths within this period of time. Judging from the extent of the visible changes in the liver, it appears that at least within the first 120 hours death occurs mainly as a consequence of profound metabolic disorders and not because of any visible disorganization of liver structure.

JOHN L. LINDQUIST, M.D.

**Basal Cell Carcinoma.** SIR CECIL WAKELEY and PETER CHILDS. *Brit M J*, 1949, 1, 737.

A brief summary is presented of 27 cases of basal cell carcinoma (rodent ulcers) occurring in sites other than the face and scalp where, during the same period, 210 of such lesions were observed. All occurred in the older age group. The youngest patient was 47 years of age. Males predominated by the ratio of 25 to 2. The lesions in these cases were single, mobile, and presented no regional involvement of the lymph nodes.

The authors recommend surgical excision of all rodent ulcers in preference to irradiation because of its specificity, curability, lower incidence of post-operative complications, and economic practicability.

DAVID H. LYNN, M.D.

# SURGERY

## GYNECOLOGY AND OBSTETRICS

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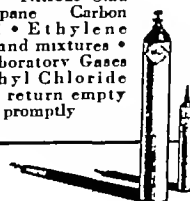
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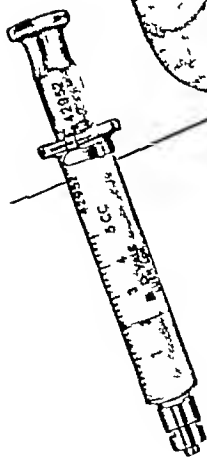
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# SURGERY

## GYNECOLOGY AND OBSTETRICS

VOLUME 89

DECEMBER, 1949

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### THE EFFICACY AND THE SAFETY OF THE INTRAMUSCULAR ADMINISTRATION OF BACITRACIN IN VARIOUS TYPES OF SURGICAL AND CERTAIN MEDICAL INFECTIONS

With an Analysis of 270 Cases

FRANK L. MELENEY, M.D., F.A.C.S., New York, New York, ALFRED B. LONGACRE, M.D., F.A.C.S., New Orleans, Louisiana, WILLIAM A. ALTEMEIER, M.D., F.A.C.S., Cincinnati, Ohio, EDWARD H. REISNER, Jr., M.D., New York, New York, Major EDWIN J. PULASKI, M.C., U.S.A., F.A.C.S., Fort Sam Houston, Texas, and HAROLD A. ZINTEL, M.D., F.A.C.S., Philadelphia, Pennsylvania

THE first report on the systemic administration of bacitracin was presented to the American Surgical Association at Quebec in May of 1948 and appeared in October of 1948 in *Annals of Surgery*. The report covered 105 cases of various types of infection, chiefly surgical (5). These patients for the most part received the commercial product manufactured by the company herein referred to as company A, and it was produced by the *surface growth* of the organism.

The number has now reached 270 cases and another report seems to be in order, because

Part of the work was done under a grant from the Research and Development Board of the Office of the Surgeon General of the Army and part under a grant from the United States Public Health Service.

Dr. Meloney from Laboratory for Bacteriological Research, Department of Surgery, College of Physicians and Surgeons and the Presbyterian Hospital, New York; Dr. Longacre from Department of Surgery, Louisiana State University and the Charity Hospital, New Orleans; Dr. Altemeier from the Department of Surgery, University of Cincinnati and the Cincinnati General Hospital, Cincinnati; Dr. Reisner Jr. from the Department of Medicine, New York University Post Graduate Medical School and Bellevue Hospital, New York; Major Pulaski from Surgical Research Unit, Brooke General Hospital, Fort Sam Houston; and Dr. Zintel from Department of Surgery, University of Pennsylvania and the University Hospital, Philadelphia.

we have had further experience with this potent antibiotic produced by a different method, namely by the *deep tank* growth of the organism, manufactured by the company herein referred to as Company B. This experience has covered the period since January of 1948, when temporary specifications were set up by the Food and Drug Administration for the purpose of insuring the efficacy and safety of the antibiotic. The data herewith reported were obtained by means of a co-ordinated study of cases treated by several observers in different parts of the country, planned in such a way as to minimize the personal equation in the appraisal of this drug. The uniformity of the study was insured by the careful preparation and adoption of a summary sheet, which was designed to bring out all of the essential features of the individual cases, particularly with regard to the diagnosis, the duration of the illness, the previous antibacterial agents used to control the infection, the status of the blood, the function of the kidneys before, during, and after treatment, the daily dosage, the interval and the



of manufacture. But the manufacturers gradually eliminated many of these impurities and finally gave us a highly soluble, faintly yellowish powder in lyophilized form, which could be dissolved in water or saline and then injected subcutaneously, intramuscularly, or intravenously into animals. These preparations permitted certain pharmacologic studies, which were carried out and reported by Dr John Scudi and his associates (11, 12, 13). These studies clearly demonstrated that the drug could be well tolerated by laboratory animals in doses which were effective in the control of infection produced experimentally by susceptible organisms, such as the hemolytic streptococcus and the clostridia of gas gangrene. The only evidence of injury to the body tissues (and this was obtained only by large doses) was in the lower nephron of the kidneys of mice. There was no evidence of injury even in these areas in any other animal in the doses which were employed, except slight changes in the kidneys of monkeys. Dogs, rabbits, rats, and cats seemed to be entirely free from even this evidence of toxicity. It was also found that the drug could be tolerated in very much larger doses, if given intramuscularly and subcutaneously than if it were given intraperitoneally or intravenously. Total doses, divided and administered every 4, 6, or 8 hours over a period of one or more days, gave very much less evidence of kidney irritation than if given as a single dose.

On the basis of this experience we began cautiously to administer bacitracin to human beings, first to members of the laboratory staff, and then to patients who were the victims of infection. These patients were studied carefully to demonstrate any evidence of injury to the kidneys or other organs. It was soon demonstrated that albumin appeared in the urine of the majority of these patients on the third, fourth or fifth day of treatment, but that it disappeared with the continuation of treatment. Along with the albumin, but less frequently, granular casts would appear and an increase in the white cells and the epithelial cells. However, these evidences of kidney irritation were always transient and disappeared from the urine either during the course of treatment or as soon as treatment was

stopped. In only one case did it interfere with the administration of the drug. During this period, those who were using bacitracin systemically did so with increasing confidence in its safety and freedom from significant toxicity.

At this time Dr Harry Eagle, finding the spirochetes of syphilis particularly susceptible to bacitracin, began his study of human syphilis with various doses of intramuscularly administered bacitracin. He found that there was remarkable synergistic action between bacitracin and penicillin both *in vitro* and *in vivo* in the cure of experimental rabbit syphilis (2). He therefore treated two series of patients, one with bacitracin alone and the other with bacitracin and penicillin together. He observed albumin in the urine of treated cases, but it did not seem to be of clinical significance (1).

After using several lots of the Company A (surface growth process) product with steadily increasing confidence, it was found that with a certain new lot one patient became upset with persistent nausea and vomiting. This occurred at a time when the Company A laboratories were trying to step up their production, and it was thought that something had crept into the manufacture, carrying with it some toxic factor. No further patients were treated with this lot and with subsequent lots these toxic manifestations were absent. We became bold enough, thereafter, to increase the dosage gradually to 30,000 to 50,000 units every 6 hours in order to have a wider therapeutic margin.

A patient with malignant endocarditis, which had not come under control with 20 million units of penicillin or 8 grams of streptomycin a day, was given 50,000 units of bacitracin every 6 hours and later the same dose every 4 hours without evidence of toxicity. There was improvement, but our supply of bacitracin became exhausted and treatment was stopped. The patient then became much worse and several days later when more bacitracin became available, he was moribund. He was given 100,000 units every 4 hours, but it did not save him. At autopsy there was some evidence of tubular injury, possibly due in part to bacitracin, but Professor H. P. Smith of the Department of Pathology gave his opinion that no pathological changes were found which could not be accounted for by the disease itself.

In the meanwhile 13 other pharmaceutical houses undertook the preparation of bacitracin

and all ran into difficulties. Some of these firms were determined to find a way to produce the antibiotic by deep growth in large tanks. Company B was in the van in this race, but ran into a number of difficulties before solving the problem of deep tank production. When the Company A laboratories realized that if a deep tank method were found, surface growth could not compete with it economically, they arranged with the Company B to turn over to them all of their experience and their whole stock of bacitracin and agreed to discontinue production. Thereafter the only material made by the surface growth process was distributed to the study units under the Company B label, although the original Company A lot numbers were retained.

The units which had been set up early in the program had on their hands a stock of the Company A material, which they continued to use on their patients. These included the units in Presbyterian Hospital, New York, in Bellevue Hospital, New York, in Charity Hospital in New Orleans, and in the Cincinnati General Hospital. Using the Company A product, these units generally started with 20,000 units every 6 hours for an adult. If there was no response in 24 to 48 hours, the dose was not infrequently increased to 30,000, 40,000, or 50,000 units. Therefore, when the deep tank product became available, the same doses were employed.

The two new units set up in the University Hospital at the University of Pennsylvania in Philadelphia and in the Brooke General Hospital at Fort Sam Houston had little experience with the Company A product and their first clinical trials were carried out with the early deep tank product of Company B. In the Brooke General Hospital the daily doses were generally limited to 80,000 units. Over a period of 6 months about 20 patients were treated. About half of the patients received 10,000 units and the other half, 20,000 units every 6 hours. In the Philadelphia unit their first experience was with cases of endocarditis, which had failed to respond to penicillin and therefore it seemed wise to give as large a dose as could be tolerated. Most of their patients therefore received 50,000 units every 6 hours for a total of 200,000 units daily.

It was soon evident that the reports from these two units were disturbing, because not only did albumin appear in the urine 2 to 3 days after bacitracin treatment was started, but there was frequently a shower of cellular elements from the kidney. Furthermore, the patients developed a lethargy which persisted for some time and along with it a rise in the retained nitrogen, as indicated either by the tests for the serum urea nitrogen or nonprotein nitrogen. At the same time there was frequently a fall in the filtration rate of phenol sulfonphthalein and a lowering of specific gravity. Such findings could not always be correlated with the dosage. The difference often seemed to be due to individual idiosyncrasy rather than to the amount of the material administered.

A month or so later the other units gradually used up their supply of Company A material and began to treat patients with the early product of Company B. One by one all of the units found that they were running into similar difficulties, which they had not experienced with the Company A material.

With his knowledge of renal physiology as a background, a study was carried out at the University Hospital in Philadelphia by Dr Alexander Michie, to determine the effect on renal function of the big doses used by the Philadelphia unit. Figures were obtained in the cases of 6 patients treated with two different lots of the early Company B product in doses of 50,000 units every 6 hours for a period of from 3 to 15 days. It was found that there was an appreciable diminution of glomerular and tubular filtration as well as renal blood flow. These results were not uniform. There was wide variation in different individuals, but there was a definite average decrease in all of these functions. At the same time albumin and an increase in the cellular elements appeared in the urine (7).

These clinical and laboratory experiences made it obvious that it would be necessary to study the problem of toxicity with renewed zeal. All of the records were therefore gathered together and the case histories were studied from the point of view of the lot numbers used and the dosage. These data were correlated with the laboratory and clinical

TABLE I —DEGREE OF TOXICITY ACCORDING TO LOT NUMBERS USED IN THE INTRAMUSCULAR ADMINISTRATION OF BACITRACIN PREPARED BY THE SURFACE GROWTH METHOD

PARALLEL PREPARED BY THE SURFACE						
Lot Number	Number of cases*	Daily dosage	Some evidence of kidney damage before Rx	Toxicity with treatment		
				None or slight transient†	Moderate transient†	Disturbing‡
August, 1946 to March 1948						
Co A 100	3	12-300 000	2	3	0	0
Co A 110	2	60-600 000	1	1	1	0
Co A 113	8	30- 80 000	4	4	4	0
Co A 114	8	60-120 000	6	5	3	0
Co A 115	6	40-120 000	4	3	3	0
Co A 116	1	80 000	1	0	0	1
Co A 116S	2	67-120 000	0	1	1	0
Co A 130	5	48-100 000	3	2	3	0
Co A 131	3	40- 90 000	1	2	1	0
Co A 140	6	10-160 000	2	3	3	0
Co A 141	14	40-125 000	1	11	3	0
Co A 142	26	30-240 000	7	14	12	0
Co A 143	13	22-264 000	8	5	8	0
Co A 144	11	47-132 000	6	2	9	0
Co A 145	6	40-106 000	3	2	4	0

... were treated with more than one lot and are included with

... granular cast a few white cel

\*A few cases were treated with more than one lot and are included with each lot used  
 †Albumin 0 or 1 plus 0 or occasional granular cast a few white cells and epithelial cells  
 ‡Albumin 2-3 plus or albumin 4 plus one day only, few to moderate granular casts white cells epithelial cells rare red cells Treatment not interrupted  
 §Albumin 4 plus moderate to many granular casts, white cells epithelial cells and few to moderate red cells or nausea and vomiting or significant rise in retained nitrogen, or considered advisable to stop treatment for any other reason

Longacre and Dr Reisner had been working with lots of low toxicity

It was then agreed that further systemic use of the antibiotic by all of the units should be limited to material which could meet the specification of LD<sub>50</sub> of 500 for a 20 gram mouse Company B had demonstrated that it could meet this specification It was further agreed that for the time being the initial dose should be approximately 200 units per kilogram of body weight This dose might be doubled or tripled if occasion warranted it in the judgment of the observer This plan has been followed since July of 1948, and the favorable results in the last hundred cases have amply justified this program

evidence of kidney irritation The results of this study are shown in Tables I and II At the same time a series of experiments were carried out in the laboratory in order to compare the Company A material produced by surface growth with the product of Company B grown in the deep tanks Six lots from each firm, which had been used clinically, were selected and saline solutions of the antibiotic were injected subcutaneously into mice in doses ranging from 250 to 1,000 units Four hundred and eighty-four mice were used in this study With each lot the death rate was noted and after a period of several days the surviving mice were subjected to autopsy and notes were made with regard to the evidence of gross renal pathology

When all of the clinical and laboratory data were gathered together, it was obvious that the early product of Company B was definitely more toxic than the Company A material Furthermore, these data indicated that different lots of Company B material varied considerably from one another in their toxicity This variation between different lots was confirmed by the results of the toxicity tests carried out in the laboratory of Dr Henry Welch of the Food and Drug Administration

No LD<sub>50</sub> tests were carried out by the Food and Drug Administration with the Company A surface growth product, because specifications were not set up until January of 1948, after Company A had ceased its production and had turned over all of its supply to Company B At that time it was felt that an LD<sub>50</sub> of 200 units for a 20 gram mouse would provide an adequate margin of safety The early product made by the deep tank method met this specification, but the Food and Drug Administration tests revealed that different lots varied all the way from 224 to 500 units, while the assay of potency per milligram of material remained fairly constant (see Table II) Furthermore, it was found that the Food and Drug Administration tests could be correlated with the laboratory and clinical data mentioned above It was then clear that Major Pulaski, Dr Zintel, and Dr Michie had been making their observations for the most part with relatively toxic lots, while Dr



TABLE II—DEGREE OF TOXICITY ACCORDING TO LOT NUMBERS USED IN THE INTRAMUSCULAR ADMINISTRATION OF BACITRACIN PREPARED BY THE DLEP TANK METHOD

Lot Number	F D A LD 50 20 gm mouse	Number of cases <sup>1</sup>	Daily dosage	Some evidence of kidney damage before Rx	Toxicity with treatment		
					None or slight transient <sup>2</sup>	Moderate transient <sup>3</sup>	Death <sup>4</sup>
January 1948 to June 1948							
Co B 471212S	287±18	20	40-260 000	10	2	8	1 <sup>5</sup>
Co B 471217S	255±70	5	98-260 000	3	0	4	1
Co B 471231S	210±21	5	40-250 000	3	1	5	1
Co B 480114S	93±18	10	40-392 000	8	6	10	3
Co B 480120S	361±23	2	14-400 000	9	11	8	3
Co B 480105S	62±17.7	14	16-160 000	3	5	3	6
Co B 480212S	224±15.2	10	42-200 000	10	1	4	5
Co B 480185S	500 or less	13	40-200 000	6	6	6	1
July 1948 to June 1 1949							
Co B 480108	500	13	20-80 000	8	8	5	0
Co B 480120	<500	42	2-120 000	16	22	10	1
Co B 480512	322±26.8	4	40-80 000	0	0	1	3
Co B 480520	435±80.9	2	10-40 000	0	0	1	1
Co B 480616	about 500	37	2-180 000	12	26	10	15
Co B 480613	>500	13	2-80 000	0	0	1	1 <sup>6</sup>

<sup>1</sup> A few cases were treated with more than one lot and are included with each lot used

<sup>2</sup> Patient in extremis when bacitracin was started.

<sup>3</sup> Bacitracin was given every 4 hours by mistake

<sup>4</sup> Albumin 0 or 1 plus 0 or occasional granular casts a few white cells and epithelial cells

<sup>5</sup> Albumin 2-3 plus or albumin 4 plus 1 day only few to moderate granular casts white cells epithelial cells rare red cells Treatment interrupted

<sup>6</sup> Albumin 4 plus moderate to many granular casts white cells epithelial cells and few to moderate red cells or nausea and vomiting or all of these in retained nitrogen or considered advisable to stop treatment for any other reason

In order to be certain that the low incidence of nephrotoxic responses in the patients receiving the bacitracin with the LD<sub>50</sub> of 500 was not simply a question of low dosage, 6 patients during this period were given material from two lots which fell short of this specification. Table II reveals that 3 of 4 patients receiving lot No 480512 in the same dosage gave disturbing symptoms and signs of toxicity. One of these (Case 5) had received the Company A material the year before for over a month in a daily dose 50 per cent larger without evidence of toxicity. The toxic symptoms and signs all disappeared in the others when the treatment was changed to the lots meeting the specification. Virtually the same results were obtained in the 2 patients treated with lot No 480520. These observations with regard to dosage are amply confirmed by the fact that the toxic effects observed by Major Pulaski were all obtained with doses of the

antibiotic not exceeding 80,000 units per day with lots of relatively high toxicity.

This rather long dissertation on the problem of toxicity seems necessary in order to help the reader of this report to understand the difficulties which have been met and largely overcome during the course of this study. The first phase was a period of calm, the second a storm of uncertainty, and the third phase a period of increasing confidence in the efficacy and safety of this new antibiotic.

Further efforts are being made to reduce the toxic factor still more or to eliminate it entirely from the active principle. If by the present methods of production the manufacturers can meet this specification of LD<sub>50</sub>/500 we believe that bacitracin should be made available for more extended use in hospital. Only those patients should be treated who can be watched carefully and in whom urinalysis can be performed daily and tests for retained

# MELENEY ET AL ADMINISTRATION OF BACITRACIN IN INFECTIONS

nitrogen made once or twice a week. The first clinical sign of toxicity is lack of appetite and if this increases, nausea may occur and in still more toxic cases, vomiting. The more subtle changes can be determined by the microscopic examination of the urine and the test for the nonprotein nitrogen retained in the blood. If any patient needs bacitracin treatment, an albuminuria of 1 plus to 3 plus or an increase of 50 to 100 per cent in the non protein nitrogen do not constitute a contraindication to continued use of the drug, and it should not be stopped unless the symptoms become really alarming, because the toxic factor is far outweighed by the therapeutic value of bacitracin and one can be sure that these changes are reversible and that the kidney function will be restored to normal sooner or later after cessation of treatment. This fact was repeatedly demonstrated in every case which was brought back for checkup. Many patients with infection show some evidence of kidney irritation before bacitracin is started, either albumin in the urine, casts, an increased number of cells, or a high non-protein nitrogen. This is not a contraindication to the use of bacitracin, because an analysis of our data shows no correlation between toxic manifestations and previous evidence of kidney damage. These signs do not usually increase during treatment, a fact suggesting that the toxic reaction is more a question of individual idiosyncrasy rather than the result of damage already present in the kidney.

## ANALYSIS OF RESULTS

Completed summary sheets for 270 cases from the different units have been turned in to the central office. These include 25 cases of pneumonia which Dr. Reisner has carefully studied and has reported (10). Suffice it to say here that his experience clearly indicates that bacitracin is effective in curing pneumococcus pneumonia, that most of the organisms producing this disease are susceptible to bacitracin, and that the clinical symptoms disappear promptly following its use. Favorable results have been obtained by doses as low as 10,000 or 15,000 units every 6 hours, but doses of 30,000 units every 6 to 8 hours for a period of 5 to 7 days are advocated in cases with pneu-

mococcus bacteremia. Reisner recommends the determination of the sensitivity of the invading organism and giving doses large enough to produce blood levels ten times this sensitivity. In some of his cases he gave as high as 99,000 units every 6 hours, and with the lots which he employed, the evidence of nephrotoxicity was minimal. He considers that bacitracin is only slightly more toxic than streptomycin (3). None of his patients showed any permanent or serious damage to the kidneys. He recommends the use of bacitracin in cases of pneumonia where there is a sensitive organism which does not respond to penicillin. He found a high level of bacitracin in the pleural exudate and recommends its intrapleural local instillation in cases in which organisms are present in the pleural fluid.

Of the remaining cases, 7 patients have received the drug prophylactically. In none of these did infection develop, but little can be said of its prophylactic use at this time. The other 238 cases represent 76 different clinical groups. They are listed in Table IIIa and the results obtained are shown in adjacent columns. Forty-five of these are called miscellaneous because there was only 1 case in each diagnostic classification. Thirty-two had 2 cases under each of 16 different diagnoses. All the other clinical entities had 3 or more, the largest group being classified as cellulitis, which is a diffuse inflammation of the skin and subcutaneous tissues with very little evidence of localization of the process in the early stages of the lesion.

If we consider the "excellent" and "good" results as favorable and the "questionable" and "no effect" as unfavorable, we find that in this whole group about two-thirds gave a favorable response to bacitracin. There are about twice as many cases in the "good" category as in the "excellent."

Certain of the groups are worthy of special note. For example, it is seen that in the cases of cellulitis, there are more excellent responses than good. This is also true of synergistic gangrene and staphylococcal meningitis. Furthermore, in infected accidental wounds and in carbuncles there was a better than average percentage of favorable results. Particularly poor results were obtained in endocarditis, all

TABLE IIIa — OVERALL RESULTS OF INTRAMUSCULAR BACITRACIN TREATMENT IN 270 CASES ACCORDING TO DIAGNOSIS

Diagnosis	Total cases	Results of treatment			
		Ex cellent	Good	Questionable	No effect
Cellulitis	31	16	10	2	3
Pneumonia	27	16	2	0	9
Infected accidental wound	20	6	12	1	1
Deep abscess	19	5	10	2	2
Infected operation wound	14	2	5	2	5
Chronic osteomyelitis	12	0	4	4	4
Carbuncle(s)	8	1	6	0	1
Endocarditis	8	0	0	1	7
Prophylactic	7	1	6	0	0
Ulcer(s) of leg(s)	7	0	4	2	1
Undermining burrowing ulcer	6	2	2	0	2
Staphylococcal meningitis	4	4	0	0	0
Synergistic gangrene	5	4	1	0	0
Acute osteomyelitis	4	0	3	0	1
Superficial abscess	4	0	2	1	1
Multiple furuncles	4	0	1	1	2
Ulcerative colitis	4	0	0	2	2
Human bite infection	3	2	0	0	1
Furuncle	3	0	3	0	0
Actinomycosis	3	0	1	2	0
Miscellaneous (2 each)†	32	5	13	3	11
Miscellaneous (1 each)*	45	6	22	9	8
Totals	270	70	107	32	61

Favorable results in 65.6 per cent of cases

†Both favorable Staphylococcus septicemia infected compound fracture infectious eczematoid dermatitis, recurrent erysipelas, epidural abscess, sinus of back acute mediastinitis

One favorable one unfavorable pyelonephritis regional ileitis brain abscess bronchiectasis

Both unfavorable thrombophlebitis peritoneal abscess multiple liver abscesses ulcers of perineum pemphigus

\*Favorable septic abortion gangrenous ulcer of back sacrococcygeal abscess infected mosquito bite chronic vaginitis chronic bronchitis, suppurative arthritis pansinusitis superficial sinus of thigh, infected tumor subdural abscess ulcer of groin cervical adenitis calcified abscess decubitus ulcer tuberculosis of glands of neck felon left thumb, gangrene (symblotic), paronychia infected sebaceous cyst, ulcer of vulva and foreskin ulcer of gluteal fold chronic paranasal sinusitis, edema of face and neck, choroiditis cystitis chronic osteomyelitis of bones of face with pansinusitis Septic (mixed) meningitis

Unfavorable ulcers of perineum wrist and neck cholangitis influenza meningitis gangrene of foot, peritonitis chronic bronchopneumonia, strangulated hernia Harada's disease gas gangrene, ulcer of arm gangrene of foot with tetanus basal skull fracture sinus of chest wall meningitis panophthalmitis Hodgkin's disease tetanus

of which were unfavorable This is probably a reflection of the present limitation of dosage The wide variety of diagnoses makes it clearly apparent that an opportunity has been given to bacitracin to try its strength against all

TABLE IIIb — RESULTS OF TREATMENT WITH INTRAMUSCULAR BACITRACIN ONLY

Diagnosis	Total cases	Results of treatment			
		Ex cellent	Good	Questionable	No effect
Pneumonia	27	16	2	0	9
Cellulitis	18	11	3	2	2
Deep abscess	11	3	6	1	1
Infected accidental wound	10	3	6	1	0
Endocarditis	7	0	0	1	6
Chronic osteomyelitis	5	0	0	3	2
Infected operation wound	5	0	0	1	4
Human bite infection	3	2	0	0	1
Prophylactic	3	0	3	0	0
Recurrent erysipelas	2	1	1	0	0
Furuncle	2	0	2	0	0
Superficial abscess	2	0	2	0	0
Pyelonephritis	2	0	1	1	0
Ulcer of leg	2	0	1	1	0
Carbuncle(s)	2	0	1	0	1
Acute osteomyelitis	2	0	1	0	1
Thrombophlebitis	2	0	0	2	0
Peritoneal abscess	2	0	0	0	2
Undermining burrowing ulcer	2	0	0	0	2
Miscellaneous (1 each)	24	3	7	6	8
Totals	133	30	36	10	30

Favorable results in 56.4 per cent of cases

kinds and conditions of infections, including those in which the organism is not known or cannot be determined It has also been tried in many cases which are probably not infections at all and which have been included in the "no effect" column Furthermore, no patient was refused treatment when the call was made for bacitracin Even though he was moribund, it was given to the patient in the hope that it might turn the tide Some of the patients with infections thought to be hopeless nevertheless surprised everyone and recovered

Tables IIIb and IIIc show that about one half of the patients were treated solely with systemic bacitracin, while the other half received the drug both locally and systemically The results in the latter (75.6 per cent) seem to be much better than in the former (56.4 per cent), but it is obvious that these two

TABLE III—RESULTS OF TREATMENT WITH INTRAMUSCULAR AND LOCAL BACITRACIN

Diagnosis	Total cases	Results of treatment			
		Excellent	Good	Questionable	No effect
Cellulitis	11	4	7	0	0
Infected accidental wound	9	2	6	0	1
Infected operation wound	9	2	5	1	2
Deep abscess	8	2	4	1	1
Chronic osteomyelitis	6	0	4	1	1
Staphylococcus meningitis	4	4	0	0	0
Synergistic gangrene	5	4	1	0	0
Carbuncle(s)	5	1	4	0	0
Ulcer(s) of leg	5	0	3	1	1
Undermining burrowing ulcer	4	2	2	0	0
Prophylactic	4	1	3	0	0
Actinomycosis	3	0	1	2	0
Multiple furuncles	3	0	1	0	2
Infected compound fracture	2	1	1	0	0
Infectious eczematoid dermatitis	2	1	1	0	0
Epidural abscess	2	0	2	0	0
Acute osteomyelitis	2	0	2	0	0
Mediastinitis	2	0	2	0	0
Sinus of back	2	0	2	0	0
Regional ileitis	2	0	1	0	1
Brain abscess	2	0	1	0	1
Superficial abscess	2	0	0	1	1
Ulcers of perineum	2	0	0	0	2
Ulcerative colitis	2	0	0	0	2
Miscellaneous (1 each)	33	5	17	4	7
Totals	131	20	70	11	21

Favorable results in 75.6 per cent of cases

Use of local bacitracin					
Uncertain	6	2	1	2	1

TABLE IV—RESULTS OF INTRAMUSCULAR TREATMENT WITH BACITRACIN AFTER FAILURE WITH OTHER FORMS OF SYSTEMIC TREATMENT

Systemic treatment	Total cases	Results of bacitracin treatment			
		Excellent	Good	Questionable	No effect
Penicillin only	37	7	14	5	11
Penicillin and streptomycin	13	0	5	2	6
Penicillin and sulfonamide	31	7	11	4	9
Penicillin and aureomycin	2	0	2	0	0
Penicillin and other	1	0	1	0	0
Penicillin streptomycin and sulfonamide	28	9	7	3	9
Penicillin aureomycin and sulfonamide	1	0	1	0	0
Penicillin sulfonamide and other	5	0	3	0	2
Penicillin streptomycin sulfonamide and aureomycin	2	1	1	0	0
Penicillin streptomycin sulfonamide and other	5	0	1	2	2
Penicillin aureomycin sulfonamide and other	1	0	0	0	1
Sulfonamide only	7	2	3	2	0
Sulfonamide and streptomycin	1	0	0	1	0
Sulfonamide and other	1	0	0	0	1
Sulfonamide streptomycin and other	1	0	0	1	0
Aureomycin only	1	0	0	1	0
Other systemic treatment	3	1	2	0	0
Other systemic treatment unknown	11	3	3	4	1
Totals	151	30	54	25	42

Favorable results in 55.6 per cent of cases

No other previous systemic treatment	110	40	53	7	10
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Favorable results in 78.1 per cent of cases

series are not comparable because in the former group the infections were more serious, the inflammation was more diffuse and often was not sufficiently localized to permit local treatment. Many of the latter group had the benefit of surgical drainage and the removal of dead tissue or slough and the drug could be applied to the area of infection in a concentration far above that which could be reached by systemic injection alone. Nevertheless, the favorable response in cases of cellulitis, syner-

gistic gangrene, and acute osteomyelitis clearly demonstrates the value of a drug coming through the blood stream to the area of infection and limiting its spread by infiltration into the periphery of the lesion. A study of these two subsidiary tables clearly reveals, however, that many of the patients treated with systemic bacitracin alone could have had the advantage of combined local treatment, and the figures suggest that the results for this group might have been improved thereby.

TABLE V — RESULTS OF SYSTEMIC TREATMENT WITH BACITRACIN ACCORDING TO THE DURATION OF ILLNESS BEFORE THE INITIATION OF BACITRACIN TREATMENT

Duration of symptoms	Total cases	Results of bacitracin treatment			
		Excellent	Good	Questionable	No effect
Previous systemic treatment					
1 day	4	2	2	0	0
2 days	4	2	1	1	0
3 days	6	2	2	1	1
4 to 7 days	18	5	5	4	4
8 to 15 days	23	5	11	1	5
16 to 30 days	24	6	7	4	7
1 to 6 months	22	3	7	3	9
7 to 12 months	8	0	0	3	5
1 to 5 years	25	2	12	3	8
Over 5 years	5	0	3	0	2
Totals	139	27	51	20	41
No previous systemic treatment					
1 day	10	5	5	0	0
2 days	13	5	7	1	0
3 days	8	3	4	0	1
4 to 7 days	27	7	11	5	4
8 to 15 days	13	1	11	1	0
16 to 30 days	4	1	2	0	1
1 to 6 months	5	1	2	0	2
7 to 12 months	1	0	0	0	1
1 to 5 years	4	0	3	0	1
Over 5 years	1	0	1	0	0
Totals	86	23	46	7	10
Pneumonia cases omitted	27	16	2	0	9
Previous treatment unknown	11	3	3	4	1

About three-fifths of the 270 patients had had previous treatment and were sent for bacitracin treatment because these methods had failed. The authors recognize fully that the percentage (56 per cent) of these failures is far higher than for all patients with infections coming to a doctor's office or to an out-patient clinic. These were all seriously ill patients requiring hospitalization and many of them had been ill for a long time. The units set up for the appraisal of bacitracin were known to have a new method of treatment

available. Therefore patients not responding to other forms of treatment naturally gravitated toward these centers or were referred there by their local doctors. They had been given the best treatment that their doctors knew how to give for their particular trouble and yet they had failed to respond to the initial treatment or to a combination of treatments. Nevertheless there was a favorable response to bacitracin in 55.6 per cent. This breakdown of the cases is shown in Table IV. The great majority of these patients would almost certainly have gone on with their infection to prolonged, temporary, or permanent disability or death. Therefore it seems fair to call these "salvaged cases" for whose recovery bacitracin should be given full credit. With regard to previous treatment, 126 had received either penicillin alone or penicillin in combination with other drugs. The three largest groups were "penicillin only," in which there were 37, "penicillin and some sulfonamide," 31, "penicillin, streptomycin and some sulfonamide," 28. Of the 96 cases in these three main categories of previous penicillin treatment, there were 23 which gave a brilliant response to bacitracin, and in 32 it was called "good," a total favorable response of 57 per cent.

Of the 119 cases that had had no previous systemic treatment the favorable results were 78.1 per cent. This difference can be explained largely on the basis of earlier treatment in the latter group.

This would seem to indicate that if the primary treatment had been bacitracin, the results in the first group would have been better. It is obvious that the cases of patients who had had previous treatment were of longer standing than of those who had none. The infection had gained a deeper foothold and the organisms were often resistant to penicillin and the other antibacterial agents which had been employed. Thus the chances of success with bacitracin in the first group were greatly prejudiced. When these cases are studied from the point of view of the duration of the illness before treatment, it is seen in Table V that in the patients who had failed to respond to previous treatments, almost one-half of them (43 per cent) had chronic infections,

TABLE VIA —RESULTS OF BACITRACIN THERAPY ACCORDING TO THE BACTERIA CULTURED FROM THE LESIONS

Bacteriology	Total cases	Results of treatment			
		Excellent	Good	Questionable	No effect
Hemolytic streptococcus pure	4	0	2	0	2
Hemolytic streptococcus mixed	45	11	21	5	8
Nonhemolytic streptococcus pure	3	0	2	0	1
Nonhemolytic streptococcus mixed	30	5	9	5	11
Coagulase positive staphylococcus pure	31	7	19	0	5
Coagulase positive staphylococcus mixed	40	8	22	3	7
Coagulase negative staphylococcus pure	4	1	2	0	1
Coagulase negative staphylococcus mixed	20	3	12	0	5
Coagulase unknown staphylococcus, pure	34	10	13	7	4
Coagulase unknown staphylococcus mixed	28	10	7	4	7
Other aerobic cocci, pure	3	1	0	0	2
Other aerobic cocci mixed	7	2	1	0	4
Gram positive aerobic bacilli pure	0	0	0	0	0
Gram positive aerobic bacilli mixed	35	8	11	3	13
Culture not taken	43	13	11	10	9

TABLE VIIb —RESULTS OF BACITRACIN THERAPY ACCORDING TO THE BACTERIA CULTURED FROM THE LESIONS

Bacteriology	Total cases	Results of treatment			
		Excellent	Good	Questionable	No effect
Escherichia coli pure	3	0	1	0	2
Escherichia coli mixed	19	2	11	4	2
Proteus pure	1	0	1	0	0
Proteus mixed	19	2	8	2	7
Other gram negative aerobic bacteria pure	5	1	1	2	1
Other gram negative aerobic bacteria mixed	25	6	11	3	5
Anaerobic and microaerophilic cocci, pure	0	0	0	0	0
Anaerobic and microaerophilic cocci mixed	22	4	10	0	8
Clostridia pure	0	0	0	0	0
Clostridia mixed	10	0	4	3	3
Gram positive anaerobic bacteria pure	0	0	0	0	0
Gram positive anaerobic bacteria mixed	2	2	0	0	0
Gram negative anaerobic bacteria pure	0	0	0	0	0
Gram negative anaerobic bacteria mixed	6	1	0	2	3

that is, their symptoms had lasted for over a month, whereas in the "no previous treatment" group the percentage of chronic cases was only 13 per cent. Thus by the time the first group received treatment, the organisms had not only become more firmly entrenched, but there were unquestionably factors of malnutrition and anemia with necrosis of tissue, all of which interfered with a successful outcome. In both of these groups the table clearly indicates that in general the earlier that treatment was administered, the better were the results obtained. All of those in both groups with symptoms lasting for only 24 hours responded favorably, but unfavorable responses began to appear as the duration of illness increased. In patients with symptoms lasting for 7 days or less in whom previous treatment had failed, bacitracin was successful

in 66 per cent. In the cases of 7 days' duration or less with no previous treatment, the favorable response to bacitracin was 81 per cent. Nevertheless, it is seen that in 5 patients with chronic conditions that had been going on for over a month and which had failed to respond to other agents, the responses to the treatment with bacitracin were brilliant.

In the majority of cases a careful and complete bacteriological analysis of the purulent exudate was made, but in a certain number of this was impossible. The largest group of those in which no culture was taken were cases of cellulitis, usually caused either by the hemolytic streptococcus or the Staphylococcus aureus. It is always difficult to obtain a culture, if there is no breakdown of tissue. Where there was an exudate, however, analysis was made and all of the organisms which were recovered were subjected to tests for susceptibility to bacitracin and penicillin and in many instances to streptomycin as well (see Tables VIa and b).

TABLE VIIA — SUSCEPTIBILITY AND RESISTANCE TO BACITRACIN AND PENICILLIN OF CERTAIN OF THE BACTERIA CULTURED FROM THE LESIONS

Bacteriology	Bacitracin S Penicillin S	Bacitracin S Penicillin R	Bacitracin R Penicillin S	Bacitracin R Penicillin R
Hemolytic streptococcus	22	13	1	3
Nonhemolytic streptococcus	12	12	0	3
Coagulase positive staphylococcus	26	34	2	3
Coagulase negative staphylococcus	11	8	1	1
Coagulase unknown staphylococcus	19	18	6	0
Other aerobic cocci	4	3	0	2
Anaerobic cocci	15	3	0	4
Gram negative bacilli	0	4	0	66
Gram positive bacilli	7	6	1	9
Clostridia	6	3	0	1
Totals	122	104	11	92

S—Susceptible R—Resistant

Very often a bacteriological laboratory will report the *predominant* organism in a given culture rather than give a complete list of all species present. Many laboratories make no anaerobic cultures. Thus many *significant* organisms are missed. In this series an effort was made to find all of the representative organisms and in doing so it was found that the majority of cases were infected with a mixture of organisms. This is particularly true of chronic cases. Only 88 of the 238 cases had organisms in pure culture, and unless the 43 cases from which no cultures were taken were in fact pure infections, which is unlikely, the remainder had mixed cultures, which totaled 107. The results clearly indicate that even with mixed cultures bacitracin is effective in controlling the infection. This is due to the fact that bacitracin has a very wide antibacterial spectrum and is not inhibited as is penicillin by the penicillinase producers, which are so frequently present in mixed infections. These include not only a large number of species of aerobic gram negative rods, but even among the staphylococci which are resistant, we find many which produce penicillinase. It is of interest to note that the coagulase positive staphylococci are the only

ones in which pure cultures approach closely in number the mixed cultures. Probably the strains of staphylococci for which the coagulase test was not done were for the most part pathogenic.

The low incidence of the hemolytic streptococci is a reflection of the secondary role which they play since the advent of the sulfonamides. It is not surprising that the aerobic gram negative rods are seldom present in pure cultures, as they are essentially saprophytes, but that this was true of the anaerobic and microaerophilic cocci was somewhat unexpected.

Of particular interest is a comparison of the cultures in their susceptibility to bacitracin and penicillin. Table VIIa shows that 122 species were susceptible to both, 104 were susceptible to bacitracin and resistant to penicillin, while only 11 were resistant to bacitracin and susceptible to penicillin. Thus it is seen that when there was a difference in susceptibility to these two antibiotics, the ratio was about 10 to 1 in favor of bacitracin. This ratio is twice as great in favor of bacitracin as appeared in a similar study 2 years ago (6). This would seem to indicate that as time goes on an increasing number of organisms are found to be resistant to penicillin and still be susceptible to bacitracin. Again it must be remembered that this is not the ratio one would meet with in cultures from a doctor's office practice or an ordinary clinic. It applies solely to this series, which contains a majority of cases which had failed to respond to previous treatment. In this series 92 strains were resistant to both bacitracin and penicillin, the great majority of these being aerobic gram negative bacilli. It is seen that the balance in favor of bacitracin is most striking with the coagulase positive staphylococci and the streptococci, both hemolytic and nonhemolytic, but it is true of every bacterial group. It must be remembered, of course, that a large portion of these patients had had penicillin. It is not known whether the organisms were originally susceptible and developed a resistance to penicillin or were originally resistant.

If this table showing bacterial susceptibility to bacitracin and penicillin is broken down so as to reveal the difference between the group

TABLE VIIB —SUSCEPTIBILITY AND RESISTANCE TO BACITRACIN AND PENICILLIN OF CERTAIN OF THE BACTERIA CULTURED FROM THE LESIONS OF PATIENTS WITH PREVIOUS PENICILLIN TREATMENT

Bacteriology	Bacitra cin S Peni cillin S	Bacitra cin S Peni cillin R	Bacitra cin R Peni cillin S	Bacitra cin R Peni cillin R
Hemolytic streptococcus	13	9	0	3
Nonhemolytic streptococcus	6	9	0	1
Coagulase positive staphylo- coccus	12	27	0	2
Coagulase negative staphylo- coccus	6	3	1	1
Coagulase unknown staphylo- coccus	1	13	1	0
Other aerobic cocci	3	2	0	1
Anaerobic cocci	8	3	0	3
Gram negative bacilli	0	2	0	52
Gram positive bacilli	2	3	0	5
Clostridia	3	0	0	0
Totals	54	71	2	68

S—Susceptible R—Resistant

Note—Cases in which previous treatment is unknown are not included

TABLE VIIC —SUSCEPTIBILITY AND RESISTANCE TO BACITRACIN AND PENICILLIN OF CERTAIN OF THE BACTERIA CULTURED FROM THE LESIONS OF PATIENTS WITH NO PREVIOUS PENICILLIN TREATMENT

Bacteriology	Bacitra cin S Peni cillin S	Bacitra cin S Peni cillin R	Bacitra cin R Peni cillin S	Bacitra cin R Peni cillin R
Hemolytic streptococcus	9	4	1	0
Nonhemolytic streptococcus	4	3	0	1
Coagulase positive staphylo- coccus	13	7	2	1
Coagulase negative staphylo- coccus	4	4	0	0
Coagulase unknown staphylo- coccus	12	5	5	0
Other aerobic cocci	1	1	0	1
Anaerobic cocci	6	0	0	1
Gram negative bacilli	0	2	0	11
Gram positive bacilli	3	2	0	4
Clostridia	3	2	0	1
Totals	55	30	8	20

S—Susceptible R—Resistant

Note—Cases in which previous treatment is unknown are not included

which had been previously treated with systemic penicillin and the group which had not, the ratio of bacitracin to penicillin in the first group is 35 to 1 (see Table VIIB), while in the latter group the ratio is less than 4 to 1 (see Table VIIC). This would seem to indicate clearly that many organisms had built up a resistance to penicillin in response to treatment with it. A comparison of the acute and chronic groups in this regard shows that there is no essential difference, so it is not a feature of the passage of time alone.

In the appraisal of any antibiotic, of greatest interest are the cases which respond promptly, dramatically, "brilliantly," "miraculously" and in which there is no doubt in anyone's mind that the drug has been a potent factor in the control of the infection. But perhaps from a scientific point of view of equal importance are those cases in which the effect of the drug is nil. Among the questionable cases there is room for argument as to whether the drug helped or not, but not among those in the column in which there was obviously no effect. There were 61 of these cases and an attempt has been made to analyze the reasons

for failure. In 8 of them the patient was moribund and perhaps they should not be included in the series, but the authors wish to point out that treatment with bacitracin was never refused in order to bolster statistics. It was sometimes given when it was obvious that any treatment was utterly hopeless. There were 11 cases in which the causative organism proved to be resistant to bacitracin. The 7 cases of endocarditis had all had prolonged and unsuccessful treatment with large doses of other antibacterial agents. Successful treatment of such cases will have to await the further purification of bacitracin. In 8 cases treatment with bacitracin was discontinued because of some evidence of nephrotoxicity, and in one it was stopped because the patient complained of the pain of injection. In some of the remaining cases it was obvious that the nature of the illness, the extent of the lesion, the degree of tissue necrosis and the inaccessibility of the infection to the drug seemed to explain the failure, while in the remainder the cause of failure was not apparent.

The following brief outlines of case histories will illustrate the results which were obtained



during the three phases of this study and will serve to emphasize what has been mentioned above, that during the first phase while we were using the surface growth material the evidences of nephrotoxicity were inconsequential. In the second phase, when we were using the earlier product made in the deep tanks, the nephrotoxicity was disturbing. In the last phase, while we were using the material which meets a Food and Drug Administration toxicity test of LD<sub>50</sub>/500 units for a 20 gram mouse, our confidence in its efficacy and safety has been largely restored.

#### CASES ILLUSTRATING THE RESULTS OBTAINED WITH "SURFACE GROWTH" BACITRACIN DURING THE FIRST PHASE OF THE STUDY

CASE 1. J. B., male, aged 43 years. Deep abscess of thigh. Series No. 1007.

Three weeks before admission this patient was taken ill with chills and fever and generalized aches and pains. Two days later a tender mass appeared in the upper inner area of the left thigh. He was given penicillin with temporary subsidence of the mass but then it recurred and did not respond to further treatment with penicillin. On admission to the hospital he was given 15,000 units of bacitracin every 6 hours with prompt improvement, subsidence of the mass, and freedom of movement without pain. However, the mass did not completely disappear. Improvement came to a standstill and temperature and blood count remained high. The mass was explored and found to be a deep abscess around the femoral vessels which yielded on culture a hemolytic streptococcus. The dose was increased to 30,000 units and the abscess cavity was irrigated daily with bacitracin solution containing 1,000 units per cubic centimeter. Exudation in the cavity decreased rapidly and on the fifth day of local treatment the wound was closed with sutures and it healed by primary union. The stitches were removed on the sixth day after suturing. Systemic bacitracin was stopped on the following day and he was allowed to walk around. Two days later he was on schedule to leave the hospital, but his temperature rose slightly and pain recurred in the thigh. He was put back to bed and systemic bacitracin again administered, 30,000 units every 6 hours with immediate improvement. Residual induration in the thigh, however, indicated aspiration, which yielded 25 cubic centimeters of pus. This was replaced by 2,500 units of bacitracin. Daily aspiration of pus and instillation of bacitracin caused a rapid subsidence of the process, and no treatment was needed after the fourth day. The patient has been followed over a period of 28 months, and there has been no evidence of recurrence of the process nor symptoms or signs of nephrotoxicity.

CASE 2. O. C., female, aged 46 years. Cellulitis of arm. Series No. 1005.

Four months before admission a hemorrhage in the right arm was followed by infection which was not controlled by incision. The cellulitis eventually spread to involve the whole arm. A second incision on the inner surface also failed. The circumference of the arm from elbow to chest was red and markedly swollen. Beside the incisions which had never healed spontaneous abscesses had developed. Culture revealed a hemolytic streptococcus susceptible to penicillin and bacitracin and a hemolytic *Staphylococcus aureus* resistant to penicillin but susceptible to bacitracin. With intramuscular 15,000 units of bacitracin every 6 hours the sinuses began to close after 48 hours. In 14 days healing had occurred and surgical treatment was obviated.

CASE 3. A. W., female, aged 32 years. Postoperative bacterial synergistic gangrene. Series No. 1013.

This was a typical case of this disease of 4 months' duration following a hysterectomy, which did not respond to penicillin, streptomycin, sulfadiazine and many forms of local treatment, including a total operation. The infection jumped over the incision and spread out into the flanks and down both thighs. Cultures showed a mixture of organisms, *pyococcus proteus* and a hemolytic *Staphylococcus aureus* susceptible to bacitracin but resistant to penicillin. The microaerophilic nonhemolytic streptococcus was not found, probably being masked by the *proteus* and *pyococcus*, which may have been responsible for the failure of penicillin to control the infection. In 48 hours, after receiving intramuscular bacitracin in a dosage of 20,000 units every 6 hours, the spread of the infection ceased and the gangrenous areas had begun to separate spontaneously. The wound was completed in 72 hours and epithelium very rapidly spread over all the surface from remnants of the hair follicles and sweat glands. The *proteus* and *pyococcus* factors of the infection were controlled by the local application of 0.25 per cent parachlorophenol solution combined with bacitracin in a concentration of 500 units per cubic centimeter. Final epithelialization was favored by a 2 per cent oxyquinoline and 5 per cent serratol red ointment. Healing was completed in 8 weeks without the necessity for excision or skin grafting.

CASE 4. N. A., male, aged 22 years. Infected operation wound with cellulitis of back. Series No. 1024.

A sebaceous cyst was removed from the lower posterior chest and within 12 hours a red hot infection developed which spread over all the back and left flank. He was very toxic and the infection did not respond to three doses of 500,000 units of penicillin in oil at 12 hour intervals with 50,000 units of bacitracin every 2 hours. The culture yielded a group A hemolytic streptococcus and a coagulase positive *Staphylococcus aureus* both sensitive to both penicillin and bacitracin. It has been observed before that the

combination may resist penicillin treatment even though the individual organisms in pure culture are susceptible. He was given 20,000 units of bacitracin every 6 hours. The toxicity promptly disappeared and within 12 hours his temperature fell to normal, the cellulitis melted away and the wound went on to rapid healing.

CASE 5 V H, male, aged 24 years. War wound with suppurative osteomyelitis of the stump of the femur. Series No 1023.

A Marine lieutenant had received a compound fracture of the femur, produced by a dum dum bullet at Iwo Jima. He was given penicillin and sulfadiazine, but developed an infection which failed to respond to surgical drainage and the further administration of antibacterial agents. He was transported to Pearl Harbor, then to San Francisco, and to Chelsea, Massachusetts. In each place there was a flare-up of infection, treated by multiple incisions for drainage. Finally, at Chelsea amputation was done to save the patient's life, but the stump became infected. A transfer to Philadelphia and further incisions and more drugs failed to control the infection. After 3 years, draining sinuses were still present at the end and on the lateral surface of the stump. Cultures revealed a *Staphylococcus aureus* susceptible to bacitracin but resistant to penicillin, and *Bacillus proteus*.

On admission the x-ray films showed residual foreign bodies and osteomyelitis of the stump. He was given intramuscular bacitracin in a dosage of 18,000 units every 6 hours. After 2 days the dose was increased to 33,000 units. On the third day he was operated upon. Most of the metal and all of the diseased bone were removed. Bacitracin was instilled locally into the bone cavity by means of plastic catheters. There were also two separate abscess cavities on the inner side of the thigh, which were drained through separate small counter-incisions and bacitracin was instilled into these cavities. The catheters were removed on the fourth day. The lateral wound granulated rapidly and on the seventeenth day the granulations were covered with pinch grafts. Healing was complete in a month. During this time the patient gave no evidence of renal toxicity from a daily dose of 120,000 units a day, except for a little albumin and a few casts lasting 3 days in the early days of the treatment (See Table VIII. This table is typical of cases treated in the "first phase" of the study.) A year after the above treatment the pebbly area of skin was excised and a primary closure of the wound was successful with the aid of systemic bacitracin for 10 days.

CASE 6 J L, male, aged 27 years. Osteomyelitis of the radius following bone graft operation. Series No 1027.

This was an American infantry officer wounded in Germany by a rifle bullet through the left forearm, both thighs, and the scrotum. He was captured by the Germans and recaptured by the Russians. He was finally evacuated through Odessa. By that time

TABLE VIII — URINE CHART FOR CASE 5

Date 1948	C.C. Urine 24 hrs.	Dosage units	pH	NPN mgm %	Alb	Casts
1-29	2050		7	25	o	o
1-31	2300	132 000	6.5		st	o
2-1		99 000	6		ht	few
2-2			7		t	few
2-3			7		o	rare
2-4	1900	132 000	7		o	o
2-5	2100	132 000	7		spt	o
2-6	1500		6.5		o	o
2-7	1800	120 000	6.5		o	o
2-8	1500	120 000	6.5		o	o
2-9	1500	120 000	7		o	o
2-10	1650	120 000	7		o	o
2-11	1900	120 000	7.5		o	o
2-12	2750	120 000	7.5		o	o
2-13	2400	120 000	6		o	o
2-14	2000	120 000	6.5		o	o
2-15	1900	120 000	7		o	o
2-16	2200	120 000	6		o	o
2-17	1800	120 000	7.5		o	o
2-18	1500	120 000	6.5		o	o
2-19	2100	120 000	7.5		o	o
2-20	2400	120 000	7.5		o	o
2-21	2630	120 000	6		spt	o
2-22	980	120 000	7.5		o	o
2-24	2150	120 000	7.5		o	o
2-25	2050	120 000	7.5		o	o
2-26	1400	120 000	7		st	o
2-27	2300	120 000	7.5		o	o
2-28	2000	120 000	7.5		o	o
2-29	1800	120 000	7.5		o	o
3-3				23		

This table shows that a daily dose of 120,000 units of the surface growth bacitracin for over a month was well tolerated and resulted in minimal and only transient evidence of kidney irritation. This was typical of all but 1 or 2 cases during the first phase of the study.

spt Smallest possible trace st slight trace t, trace ht heavy trace.

all wounds had healed. He was sent to an American army hospital where because of the shortening of the radius, a bone graft was introduced. The wound healed without apparent infection, but a month later an abscess formed and came to the surface. It was surgically drained and a number of small sequestra were found and others came out later. The wound then healed slowly, but flared up again a week before admission to the hospital. X-ray films revealed osteomyelitis around the lower screws (see Fig 1). These screws and the infected bone around them

were removed. The cultures showed a *Staphylococcus aureus* susceptible to bacitracin but resistant to penicillin. He was given 20,000 units of bacitracin every 6 hours for 11 days and it was also instilled locally into the wound. This gradually filled with granulations and healed. During the course of treatment the patient had nausea and vomiting, but this did not interfere with treatment. There was albumin in the urine and a moderate transient rise in non-protein nitrogen.

**CASE 7** E W, male, aged 24 years. Actinomycosis of hand. Series No. 1016.

This patient developed an actinomycosis of the hand in a wound from a tooth injury. This steadily increased in size over a period of 11 months. *Actinomyces bovis* was cultured from the wound as well as *Staphylococcus aureus* susceptible to bacitracin but resistant to penicillin. He was put on intramuscular bacitracin in a dosage of 20,000 units every 6 hours for 3 days. On the third day the swelling began to subside. The dose was doubled, but because of some nausea and vomiting after 3 days it was reduced to the original dosage. After 10 days the patient insisted upon leaving the hospital because of certain home responsibilities and he did not come back for a month, at which time it was found that the swelling had increased. An x-ray examination revealed that the third metacarpal bone was involved in the process (see Fig. 2). It was decided that the best chance for recovery would be an excision of the local lesion and a continuation of drug treatment. He was therefore given 22,000 units of bacitracin every 6 hours. The diseased tissue was removed. This included the third and fourth fingers and their corresponding metacarpal bones and a portion of the os magnum. The wound was closed primarily with a small plastic catheter placed in the web, through which bacitracin was instilled locally for 3 or 4 days. The catheter was then removed. The wound healed by primary intention and excellent function of the hand was restored. There has been no recurrence of the infection during 18 months.

**CASE 8** M F, female, aged 32 years. Postabortal sepsis. Series No. 1030.

Five days before admission to the study, this patient had been relieved of a threatened abortion by a dilatation and curettage. Her temperature rapidly rose to 106 degrees, where it stayed for 3 days in spite of sulfadiazine, penicillin, and streptomycin. There was a prompt response to bacitracin in a dosage of 20,000 units every 6 hours. Within 4 hours the patient began to have a sense of well being. All attending doctors believed that bacitracin saved her life. Aerobic cultures which were made of the cervical discharge showed no growth, but the infecting organism was believed to be an anaerobic streptococcus.

**CASE 9** L S, male, aged 58 years. Bronchiectasis. Series No. 6010.

This patient had an 8 year history of bronchiectasis and emphysema which had failed to respond to penicillin and sulfadiazine. The penicillin caused a

severe reaction and it had to be discontinued. Cultures from the sputum yielded a group A hemolytic streptococcus and a nonhemolytic streptococcus which were susceptible to both penicillin and bacitracin. He was given 22,000 units of bacitracin every 6 hours for a period of 2 weeks. During this period of treatment the sputum decreased from 1 cubic centimeters to 20 cubic centimeters per day. A month later he had no purulent sputum and was able to return to work.

**CASE 10** W D, male, aged 20 years. Cellulitis following human bite. Series No. 5010.

A 2 day history of human bite, involving lacerated wounds in the soft tissues of the chest wall and the distal phalanx of the index finger, yielding on culture a mixture of organisms, with swelling, redness, pain, tenderness and fever, responding dramatically to systemic bacitracin therapy in a dosage of 9,000 units every 6 hours for 4 days. Within 24 hours practically all of the tenderness and pain disappeared and the cellulitis had subsided.

**CASE 11** E R, male, aged 6 years. Cellulitis of leg. Series No. 5029.

This patient had an extensive cellulitis of the leg with inguinal lymphadenitis and a high fever, as well as redness, pain, tenderness, and a blistering of the skin. The response to treatment with bacitracin with 19,000 units every 6 hours was dramatic with complete clearing of the lesion in 3 days. The cultures yielded a highly sensitive gram negative bacillus which was resistant to penicillin but susceptible to bacitracin. The patient left the hospital after a period of 6 days.

**CASE 12** G S, male, aged 4 years. Cellulitis of leg. Series No. 5032.

This patient came into the hospital with a history of very rapidly developing cellulitis of the leg all the way up from the ankle to the knee with a severe toxemia and inguinal adenitis. There was swelling, redness, pain, and a fever of 105.6 degrees, all of which subsided dramatically within 48 hours following the administration of 20,000 units of bacitracin every 6 hours.

**CASE 13** A G, female, aged 67 years. Post radiation cellulitis of chest wall. Series No. 5030.

This patient had had a radical mastectomy months previously and had received a full course of postoperative irradiation, following which she developed an extensive cellulitis of the entire left half of the chest wall, front and back. The swelling extended down on to the abdominal wall and down the arm to the elbow. She was very toxic, running a high fever. She was given 40,000 units of bacitracin every 6 hours. Toxic symptoms disappeared in 48 hours and the temperature reached normal on the third day. Before treatment began the blood urea was 30.8 milligrams per cent and during the treatment it went up to 38.4 milligrams per cent. The urine showed hyaline and granular casts before bacitracin and 1+ plus albumin with an occasional granular cast appearing during treatment, but the casts promptly disappeared.

CASES ILLUSTRATING THE RESULTS OBTAINED  
WITH "EARLY DEEP TANK BACITRACIN"  
DURING THE SECOND PHASE OF THE STUDY

CASE 14 H B, male, aged 35 years Cellulitis  
of neck Series No 1043

Two days before admission this patient developed an infection on the front of the neck over the larynx. He was given 500,000 units of penicillin, but the infection continued to spread during the night until there was a zone of cellulitis all around the front of the neck extending down to the anterior chest with a small opening through the skin over the larynx where some necrotic tissue was seen. Penicillin treatment was continued and 40,000 units of penicillin were injected in the local area without improvement. Because of the rapid spread of the infection, it was thought advisable to start him off with a large dose of bacitracin and 38,000 units from lot No 480210 were given and repeated twice at 4 hour intervals. His temperature began to come down after the third dose, so the interval was increased to 5 hours for the fourth dose and to 6 hours for the fifth dose. Thereafter it was continued every 6 hours. On the third day the cellulitis in the neck had almost entirely subsided, indicating a favorable response to bacitracin. No cultures were taken, but the condition behaved like a hemolytic streptococcal cellulitis. However, on the third day he became nauseated and vomited several times, so bacitracin was stopped after 9 doses with a total of 342,000 units. On the third day his urine showed 2 plus albumin and a few red and white blood cells. On the fourth day this had increased to 3 plus albumin, but he felt well enough to go home. However, after his return home he complained of nausea, vomiting, and lethargy. He then reported that he had voided only a few ounces of urine. When these symptoms continued for 2 days, it was thought best that he should return to the hospital. However, with expectant treatment his urinary output gradually increased until on the eighth day he was voiding over 1 liter and on the tenth day it reached 2,340 cubic centimeters. The nonprotein nitrogen reached a peak of 117 milligrams per cent on the day after his readmission to the hospital, but on the ninth day it was down to 43 milligrams per cent and he left the hospital on the twentieth day with all of his renal function restored to normal. Later examinations have shown no residual evidences of kidney damage. (Table IX illustrates the study of his renal function.)

CASE 15 W D, male, aged 18 years Cellulitis  
of neck Series No 1047

Four days before admission to the clinic the patient developed two furuncles on the chin. Penicillin was injected locally in a dosage of 2,000 units per cubic centimeter and on the following day some necrotic tissue was extruded from each lesion. This local treatment was continued and the redness and swelling subsided slightly but on the ninth day of the infection, swelling, redness and induration recurred and rapidly increased. Penicillin was then given

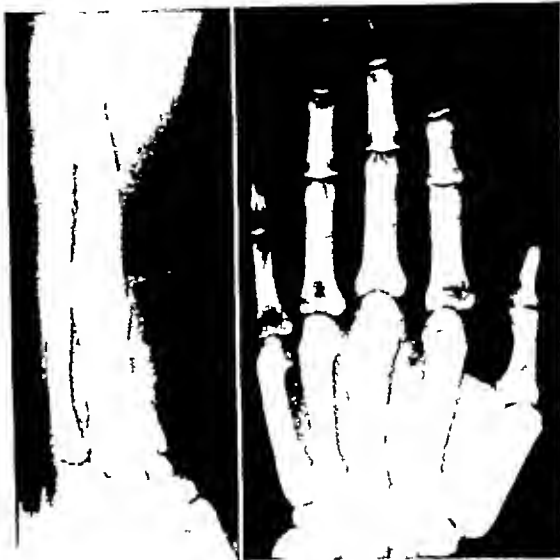


Fig 1, left Roentgenogram of Case 6 showing osteomyelitis around the lower screw holes in the bone graft

Fig 2 Roentgenogram of Case 7 showing osteomyelitis of the third metacarpal bone in actinomycosis of the hand

intramuscularly, but this was followed by an itching rash over the neck and the upper part of the trunk, and the local lesions showed no evidence of improvement. The patient then stated that 6 months before he had had two injections of penicillin without any reaction and this was thought to be a sensitivity response. Cultures of the wounds showed a coagulase positive hemolytic *Staphylococcus aureus*, which was susceptible to both penicillin and bacitracin. He was given bacitracin in a dosage of 20,000 units from lot No 480212 every 6 hours and the local wounds were irrigated with bacitracin solution containing 500 units per cubic centimeter. The next day he was definitely better. The swelling had decreased. The improvement during the next day was dramatic indeed and on the following day he was so much better that he was allowed to go home. During his hospitalization the urine did not show any albumin and the blood urea nitrogen remained at the low level of 12 milligrams per cent. The phenolsulfonphthalein was 65 per cent on the second day and 80 per cent on the fourth day. When he came to the clinic on the day after his discharge from the hospital the inflammation had further subsided, but he reported that he felt nauseated and had vomited. The urine then showed a 3 plus albumin, 4 plus glucose with clumped white cells and 5 to 6 red cells per high power field. He was admitted to the overnight ward and on the following day his blood urea nitrogen was 21 milligrams per cent, but the albumin, glucose, and cellular elements began to decline. During the following day he continued to improve, his appetite returned and his urine was in good

TABLE IX.—URINE CHART FOR CASE 14

Date 1918	cc Urine 24 hrs	pH	Sp gr	Alb	Microscopic examination of centrifuged specimen				BUN or NPN mgm %	PSP	Dosage units
					WBC	RBC	Fpith	Casts			
4-22				0	0	0	0	0			38 000
4-1		ac	1020	0	0	0	0	0			100 000
4-1	1350	6	1016	2+	6-8	1-2	occ	0			101,000
4-5			1010	3+	5-6	1-2		2-3			stopped
4-26	100	7		3+	5-6	0	3-4	5-6	NPN		
4-27	<100	ac		2+	many	6-8		8-0	69		
4-8	<100	ac	1008	4+	5-10	1-3		25	117		
4-29	110	ac	1010	3+	15	15-0	5-6		BUN		
4-30	180	5	1010	3+	15	4-5		1-3	124		
5-1	220	5.5	1008	7	3-5	3-4		1-2	127		
5-	345	5.5	1010	2	3-5	occ		occ			
5-1	550	6	1010	2-	3-5	occ		occ	100		
5-4	375	5.5	1010	2	10-15	10-12		10	77		
5-5	1115	5.5	1010	2--	3-5	occ		2-3	100		
5-6		5.5	1008	1--	3-5	3-5		3	43		
5-7	110	6	1010	1--	3-5	1-2		0	110		
5-10	100	6	1010	1--	many	occ		4-5			
5-13	2300	6	1008	1--	5-10	1-2		0	60	30	
5-15	1500		1010								
5-17									30		
5-6				0					NPN		
5-25									30		
6-15			1028	0	rare	0	0	0		40	

The table shows the changes in the albumin and microscopic picture, the high blood urea nitrogen and low specific gravity following the administration of one of the most toxic lots. Restoration, however, was complete in a month.

volume. The albumin fell to 1 plus, glucose was negative, and the red blood cells were rare. Four days after discharge the blood urea nitrogen had returned to normal.

CASE 16 J. R., male, aged 21 years. Paronychia of toe, cellulitis of foot and inguinal lymphadenitis. Series No. 7004.

Four days before admission this patient developed a paronychia of the large toe with a rapid spread of redness, swelling, pain and tenderness on the dorsum of the foot and with tender inguinal lymph glands. Cultures showed a hemolytic streptococcus sensitive to both penicillin and bacitracin and a coagulase positive *Staphylococcus aureus* sensitive to bacitracin but resistant to penicillin. He was put on 20,000 units of bacitracin from lot No. 471212, and the nail was removed. There was a prompt clinical response within 72 hours. On the fifth day the nonprotein nitrogen rose from an initial level of 32 milligrams per cent to 42 milligrams per cent and the phenolsulfonphthalein fell from 70 per cent to 54 per cent. Renal cells were still present on the thirteenth day, but thereafter signs of nephrotoxicity cleared.

CASE 17 M. C., male, aged 17 years. Cellulitis of the hand and arm with axillary lymphadenitis. Series No. 7011.

Six days before admission this patient had an accidental avulsion of the skin over the dorsum of the right hand and the wound promptly became red, swollen, tender, and obviously infected. Two days before admission a painful lump developed in the axilla with red streaks coursing up from the area of infection on the hand. He was given bacitracin in a dosage of 11,800 units from lot No. 471231 every 6 hours. The cultures showed hemolytic streptococcus, susceptible to both penicillin and bacitracin, and coagulase negative *Staphylococcus aureus* susceptible to bacitracin and resistant to penicillin. The infection promptly subsided and resolved completely after 96 hours. On the fourth day of treatment, casts and renal cells appeared in the urine, but there were no red cells. The nonprotein nitrogen, starting with 39.9 milligrams per cent before bacitracin, rose quickly to 61.5 milligrams per cent on the fourth day. The phenolsulfonphthalein fell slightly during this time. The patient left the hospital on the fourth

day with no complaints except slight anorexia and malaise. After leaving the hospital he steadily improved and soon went back to active duty in the Army without any evidence of any kidney damage.

CASES ILLUSTRATING THE RESULTS OBTAINED DURING THE THIRD PHASE OF THE STUDY WITH "LATER DEEP TANK" BACITRACIN MEETING THE FOOD AND DRUG ADMINISTRATION TOXICITY TEST OF LD 50/500

CASE 18 S L, female, aged 79 years. Suppurative arthritis of hip after arthroplasty. Series No 1070

Three years before admission this patient had fallen and broken her hip. She was taken to a local hospital and the fracture was pinned, but this treatment was not successful and an arthrotomy was performed. The wound became infected and continued to drain for a long time through the operative site and a spontaneous sinus developed on the inner surface of the thigh. This sinus drained profusely over a period of 3 years. Culture then yielded a *Staphylococcus aureus* susceptible to bacitracin but resistant to penicillin. An x-ray plate taken after lipiodol injection revealed that there was an abscess cavity extending upward from the sinus opening into the hip joint where there was a large fragment of the femoral head (see Fig 3). Bacitracin was instilled through the sinus for several days and then through an anterior approach the head of the femur was removed from the hip joint. She was treated intramuscularly with 10,000 units of bacitracin every 6 hours and the sinus was irrigated daily with a solution of bacitracin containing 500 units per cubic centimeter, without any evidence of toxicity except light nausea. The anterior wound healed rapidly and after 5 weeks the sinus in the groin closed and has remained healed. There has been a steady increase in the function of walking, with the infection apparently completely arrested.

CASE 19 P W, male, aged 13 years. *Staphylococcus septicemia* with acute osteomyelitis of the femur. Series No 1066

This boy had been playing soccer on the day before admission and had fallen down a number of times. He awoke early the next morning complaining of pain in the region of the left hip. He felt nauseated and vomited and 3 hours later had a short chill. His temperature during the day gradually rose to 103.6 degrees and he appeared very toxic and in great pain. There was tenderness well localized to the posterior region of the hip joint, but the joint itself was free, although extremes of flexion and extension caused pain. He was brought into the hospital and a blood culture was taken. He was given 100,000 units of penicillin and 50,000 units every 3 hours during the night. The next morning his temperature was 104 degrees. Tenderness was still present, so the dosage of penicillin was increased to 100,000 units every 3 hours. On the third day he seemed a little better. There was less tenderness



Fig 3. Lipiodol injection of a suppurative arthritis of the hip in Case 18 following arthroplasty for a comminuted fracture. Part of the head of the femur is seen acting as a sequestrum.

and muscle spasm, but with the diagnosis and the organism still in doubt, he was given sulfadiazine along with the penicillin, but together they failed to control the infection. On the fourth day his pain, tenderness, and Kernig's sign reappeared, indicating a reactivity of the process. The blood cultures taken on admission and on the first day after admission both grew out on the fourth day revealing a coagulase positive hemolytic *Staphylococcus aureus*. It was then obvious that he had a *Staphylococcus septicemia* with an osteomyelitis probably of the neck of the femur. On the fourth day when the nature of the organism was known, sulfadiazine was stopped and he was given bacitracin in a dosage of 200 units per kilogram of body weight (5,250 units) every 6 hours. Blood culture taken on that day showed no growth. On the fifth day the bacitracin dosage was doubled. That day the sensitivity test revealed that the organism was resistant to penicillin but susceptible to bacitracin, explaining the failure of penicillin to bring about the expected prompt response. However, it was demonstrated that there was a synergism between bacitracin and penicillin, which permitted 1/10 of the growth inhibiting dose of one, plus 1/32 of the growth inhibiting dose of the other to prevent

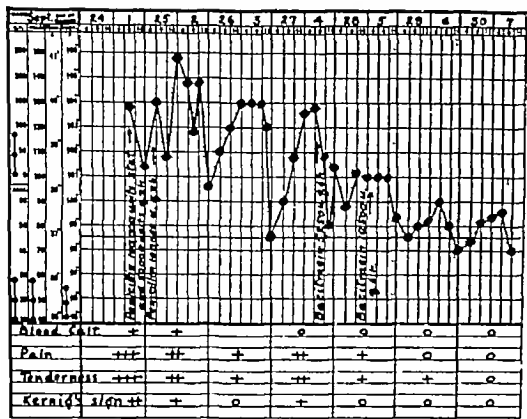


Fig 4 Temperature curve of Case 19 showing failure of penicillin to control the infection and resolution when bacitracin was added to the therapy

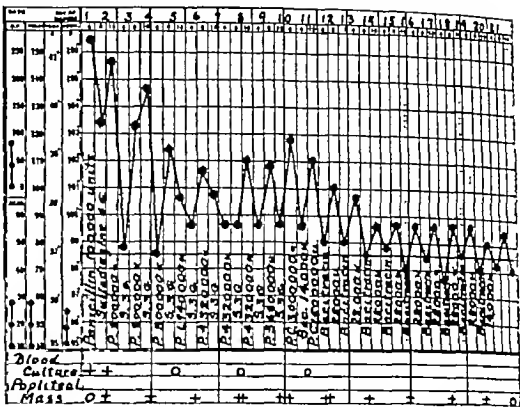


Fig 5 Temperature curve of Case 21 showing rising temperature and increasing mass in popliteal space not controlled by penicillin but responding to bacitracin

the growth of the organism in vitro. Thereafter all symptoms and signs rapidly subsided (Fig 4). During this treatment the nonprotein nitrogen rose from 30 to 49 milligrams per cent, but with continued treatment it came down again to 32 milligrams per cent at the end of treatment and thereafter dropped back to normal (see Table X for a résumé of his toxicity studies). There were no clinical symptoms of toxicity and this rise in nonprotein nitrogen was not sufficiently alarming to warrant cessation of treatment. It is likely that in this case the favorable response was due to a synergistic action between the two antibiotics. On the tenth day the x-ray film revealed a suggestive area of beginning rarefaction in

the neck of the femur, but on subsequent x ray films this disappeared. However, the clinical diagnosis was unmistakable. CASE 20 S T, female, aged 62 years. Post craniotomy wound infection with subdural abscess. Series No 1100. Three weeks before treatment began, a cortical ablation had been done of the right frontal lobe through an osteoplastic craniotomy for a depressive type of schizophrenic psychosis. Postoperatively she received 50,000 units of penicillin every 3 hours for 8 days and 300,000 units of duracillin a day for 7 days. Two days after stopping this treatment the patient became drowsy and fluctuation of the scalp

TABLE X—URINE CHART FOR CASE 19

Date 1948	cc Urine 24 hrs	pH	Sp gr	Alb	Microscopic examination of centrifuged specimen				NPN mgm %	PSP	Dosage units
					WBC	RBC	Epith	Casts			
9-26			1010	0							
9-27									32	45	5 250
9-28		7	1022	0	0	0	0	0			31 500
9-29	950	7	1028	0	1-3	0	0	0	36	85	42 000
9-30	1300	7.5	1026	tr	3-5	0	3-5	occ	40		42 000
10-1	1800	7.5	1025	3+	5-6	0	4-6	occ	49	55	42 000
10-2	1400	7	1020	3+	5-6	occ	6-8	1-2	43		42 000
10-3		6	1016	3+	5-6	0	5-6	1-3			42 000
10-4		6.5	1017	3+	2-4	0	5-6	occ		75	42 000
10-5	1960	6.5	1019	3+	3-4	0	6-8	2-4	42		42 000
10-6	1500	6.5	1022	1+	5-6	0	3-5	2-4		60	42 000
10-7	1400	7	1020	1+	2-3	0	1-3	1-3	32		31 500
10-8		7.5	1027	1+	2-3	0	1-3	rare		60	stopped
11-17		6	1025	0	rare	0	0	0	29		

This table shows the moderate but transient evidence of kidney irritation with rise and fall of nonprotein nitrogen during treatment

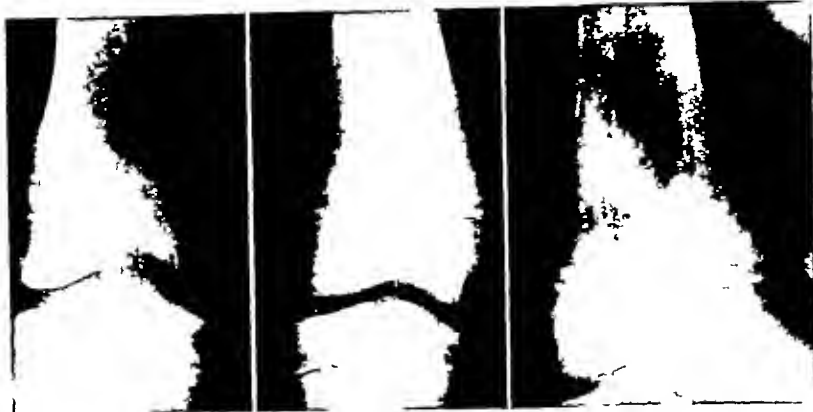


Fig 6

Fig 6 Roentgenogram of Case 21 showing progressive breakdown of the bone



Fig 7

Fig 7 Later films of Case 21 showing progressive regeneration of the bone with no clinical signs or symptoms

revealed an underlying abscess. Penicillin was increased to 150,000 units every 3 hours, but this failed to control the infection. The wound was opened and a large quantity of pus was released yielding a staphylococcus susceptible to bacitracin but resistant to penicillin. The wound was opened further and the bone flap removed. A subdural abscess was found. She was given 10,000 units of bacitracin in 10 cubic centimeters of saline instilled into the wound through a sterile catheter every 3 hours. Bacitracin was also given intramuscularly in a dosage of 10,000 units every 6 hours for a period of 10 days. The local instillation was continued for a month, the sinus at the catheter site remaining open. During this treatment the blood urea nitrogen tests remained essentially unchanged. The sinus persisted until it was re-explored and a small piece of necrotic tissue which was acting as a foreign body was removed. With a continuation of local bacitracin the sinus promptly closed.

**CASE 21** W R, male, aged 10 years. Staphylococcus aureus septicemia with acute osteomyelitis of the femur. Series No 1039.

This boy had a sudden onset of pain in the popliteal space of the left leg followed by inability to walk and high fever. On admission to the hospital the next day his temperature was 106 degrees. He had diffuse pain and tenderness in the region of the lower end of the left femur. He was immediately put on penicillin in a dosage of 100,000 units every 3 hours and sulfadiazine 0.5 grams every 4 hours. His temperature stayed up for 24 hours and then came down toward normal, but then rose again and reached 104.4 degrees on the fourth day. During this time there was a slow but steady development of a mass in the popliteal space. Blood culture on admission showed a hemolytic Staphylococcus aureus resistant to penicillin but susceptible to bacitracin. Therefore all other treatment was stopped and he was given bacitracin in a dosage of 400 units per kilogram of body weight. It was thought that the

popliteal mass was an abscess which would require drainage, but following bacitracin treatment the mass steadily decreased in size, the function of the leg rapidly improved and he was soon able to return home, having shown no evidence of renal toxicity. A series of x-ray films showed an area of osteomyelitis in the lower end of the femur with a progressive breakdown of bony tissue, then a standstill and a gradual restoration (see Fig 5). In this case the penicillin plus the sulfadiazine controlled the septicemia, but they could not control the local process. Nevertheless bacitracin stopped its progress and caused its steady resolution. He has been perfectly well for 6 months so far. Figure 6 shows progressive breakdown and Figure 7 regeneration of bone.

**CASE 22** M B, female, aged 6 weeks. Staphylococcus septicemia and meningitis with metastases in lungs and subcutaneous tissues. Series No 1080.

This baby was born prematurely but left the hospital after 3 weeks weighing 5 pounds. Four days after discharge the right side of the face began to swell and there was a bloody nasal discharge. She was taken to a suburban hospital where she was given penicillin and streptomycin without any appreciable effect. She was therefore brought to the Babies Hospital in New York, where the penicillin dosage was increased and where blood culture revealed the hemolytic Staphylococcus aureus septicemia and a lumbar tap revealed meningitis. The dosage of penicillin was increased and this was also given intrathecally but without effect. Streptomycin was also given intrathecally and then aureomycin was started, but all of these treatments failed to control the infection. Metastatic abscesses appeared in the back and on one hand and one foot. Several areas in the right lung field suggested a pneumonitis with early abscess formation. The baby's neck was stiff and she was semicomatose when bacitracin was called for. She was started on 400 units per kilogram of body weight every 6 hours intramuscularly. It



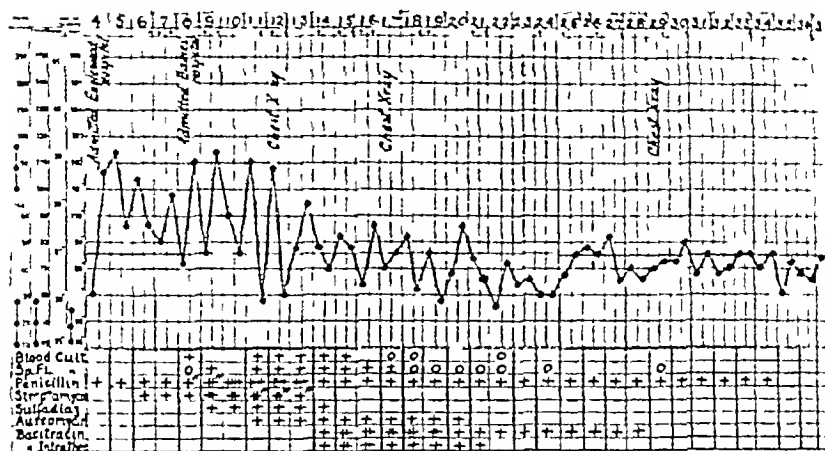


Fig 8 Temperature curve of Case 22 showing failure of septicemia and meningitis to respond to penicillin, sulfadiazine, streptomycin, and aureomycin with prompt response when intramuscular and intrathecal bacitracin was added

was also given intrathecally twice a day in a dosage of 500 units and it was instilled into the abscess of the face through a plastic catheter in a dosage of 500 units per cubic centimeter. Two days after beginning treatment the patient came out of her coma. The blood and spinal fluid cultures became normal on the fourth day of bacitracin treatment and thereafter she went on to a complete recovery (see Fig 8). The incipient abscesses of the lungs resolved completely (see Figs 9, 10). There was a moderate rise of the nonprotein nitrogen from 30 to 38 milligrams per cent, but it returned promptly to 31 milligrams per cent.

It was generally agreed that bacitracin had saved this patient's life.

**CASE 23.** I. R., female, aged 30 years. Pansinusitis with undermining burrowing ulcer of face and orbits. Series No. 1072.

This patient had had an infection of the bones of the face starting 5 years before as a pansinusitis which spread from the antrum up into the right orbit, requiring the removal of the eye. Gradually the process then spread to the left orbit. All of the small bones of the face were involved in the destruction. She was given several series of penicillin treatments without any effect and also a long period of aureomycin. This case had many of the features of undermining burrowing ulcer. However the characteristic microaerophilic hemolytic streptococcus was not found. The only organism constantly present was a *Staphylococcus aureus*, susceptible to bacitracin but resistant to penicillin (Fig 11 shows the lesion at this time). Bacitracin was then started in a dosage of 10,000 units every 6 hours. It was also used locally in the form of an ointment and a solution which was applied on gauze packing. It was obvious within a few days that the spread of the

infection had stopped. After a month of treatment with only partial improvement because the infection was still active in the left orbit and beneath the eyelids, it was decided after 50 days of bacitracin treatment to remove all of the diseased tissue and to cut back the undermined margins so as to permit a more complete contact of the medication with the infected tissue. At the same time the systemic dosage of bacitracin was increased to 20,000 units every 6 hours. Hereafter the whole wound cleaned up with remarkable rapidity, new skin grew in from the margins and on the twenty-first day the entire area was covered with pinch grafts. These took everywhere except in several small areas where there was residual nasal mucosa (see Fig 12). The areas were then curetted and the defects covered with similar grafts. These also took satisfactorily and the area was soon completely covered.

This patient has the record for prolonged treatment with bacitracin. For 50 days she received 40,000 units a day and for 85 days 80,000 units a day. The total systemic bacitracin was 9,360,000 units. About 800,000 units were used locally during the course of treatment. The nonprotein nitrogen stayed at a remarkably constant level, being 23 milligrams per cent before beginning bacitracin and 28 milligrams per cent at the end of treatment. This is unquestionably a case in which the life of the patient was saved and the infection brought under control by bacitracin. Standard doses of bacitracin were continued for almost 5 months with little or no evidence of kidney damage.



Fig 9 Roentgenogram of Case 22 showing metastatic abscesses of the lungs before bacitracin therapy



Fig 10 Roentgenogram of Case 22 showing clearing of lung lesions after bacitracin

CASE 24 D M, male, aged 60 Gangrenous ulcer of back, flank, and buttock Series No 1092

Five weeks before admission this patient developed a pleuritic pain in his left chest, which was strapped with broad adhesive to which his skin was sensitive. The skin became blistered like a second degree burn and the whole area then became infected with a very peculiar type of gangrene. This spread rapidly all over the back, into the left flank and down on the buttock. The infection failed to respond to penicillin, sulfadiazine, and streptomycin (Fig 13 shows the lesion when it was first seen by FLM). He was given bacitracin in a dosage of 10,000 units every 6 hours and in 48 hours it was obvious that the spread of the infection had come to a standstill. He was brought to Presbyterian Hospital in New York from a suburban hospital and the dosage of bacitracin was doubled. There was moderate but transient evidence of kidney irritation, but no significant rise in nonprotein nitrogen. The gangrenous tissue was excised and on the tenth day two-thirds of the area was covered with skin grafts, and 10 days later the remainder. There was an almost complete take of these grafts and soon they grew out epithelium from the margins and rapidly fused together (see Figs 14 and 15). His recovery, however, was complicated by the development of two pressure sores, which occurred during the immobilization period after the grafting. The cultures yielded not only a hemolytic *Staphylococcus aureus* and non-hemolytic streptococcus, which were resistant to penicillin but susceptible to bacitracin, but also an *Acrobacter aerogenes* and later both proteus and pyocyanus were recovered from the large area. The staphylococcus and streptococcus were brought under control by bacitracin, the proteus by parachlorophenol and the pyocyanus by sulfamylon.

Everyone was impressed by the rapid control of the infection with bacitracin and believes that this saved the patient's life.

CASE 25 M B, female, aged 34 years Progressive postoperative bacterial synergistic gangrene Series No 1101

This patient was admitted to a suburban hospital in the early stages of labor, but after 16 hours there was no progress and a cesarean section was performed. The patient was given 60,000 units of penicillin prophylactically and 2 grams of sulfanilamide crystals were sprinkled throughout the wound, which was then closed with silk stay sutures protected by rubber tubing. Forty thousand units of penicillin were given every 3 hours for 6 days and 1 gram of sulfadiazine was given every 4 hours for 3 days. On the eighth day, in spite of these antibacterial agents, the wound revealed an infection with redness, swelling, and small vesicles which gradually developed into bullae, evidently starting around the retention sutures.

At this time the whole wound became inflamed with areas of dusky skin somewhat raised from the surface, indicative of the early stages of bacterial synergistic gangrene. Cultures were taken which revealed the microaerophilic nonhemolytic streptococcus, *Staphylococcus aureus*, and *Escherichia coli*. The stay sutures were removed. The patient was put on bacitracin in a dosage of 10,000 units every 6 hours and it was also applied locally on wet com-



Fig 11



Fig 12

Fig 11 Progressive destruction of the eyes and small bones of the face in Case 23 up to the time of bacitracin treatment

Fig 12 Relatively prompt control of the infection in Case 23 by excision of undermined margins followed by systemic and local bacitracin permitting successful skin grafting on the 21st day



Fig. 13 The extent and nature of the infection in Case 24 before treatment with bacitracin

presses in a concentration of 500 units per cubic centimeter. Within 48 hours the spread of the infection ceased and the whole process came under control. Thereafter resolution was rapid without any necrosis of tissue.

It was generally recognized that the early diagnosis and the early administration of bacitracin completely controlled the infection and saved the patient from the development of extensive gangrene, after prophylactic penicillin, sulfadiazine, and streptomycin failed to do so.

**CASE 26** G B, male, aged 39 years. Cellulitis of the scalp. Series No. 2022.

Four days before admission this patient was hit on the head with a brick. Three days later he noted swelling of the scalp and of the tissues around his

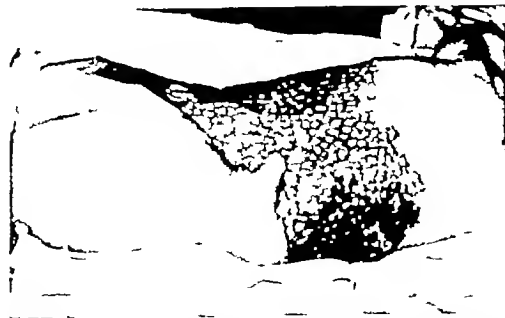


Fig. 14 Control of infection in Case 24 and successful postage stamp grafts on two thirds of denuded surface

left eye. On admission to the hospital his temperature was 102 degrees and there were numerous lacerations in the left frontal region of the head which were surrounded by a zone of cellulitis and edema extending down to the ear posteriorly and the zygoma in front. The eye was almost closed and the lids were light purplish in color. The patient was given 10,000 units of bacitracin every 3 hours for 3 days. During this time the cellulitis and edema rapidly subsided and the patient was discharged 4 days later. Although albumin appeared in the urine the phenolsulfonephthalein filtration was normal throughout. There was a mixture of organisms including hemolytic streptococcus, *Staphylococcus aureus*, *Bacillus melaninogenicum*, and several other organisms not fully identified.

This was considered a brilliant response of the infection to bacitracin.

**CASE 27** S D, male, aged 51 years. Cellulitis of face, diabetes. Series No. 2019.

Seven days previously this patient had squeezed a furuncle on his left cheek. Following this the area became greatly swollen and indurated. Mild diabetes had been present for about 15 years. On admission the left side of the face was involved in a severe cellulitis of the entire parotid region, the left maxillary and submental area, and an extension ran down along the sternocleidomastoid muscle, with an area of fluctuation at the site of the furuncle. This area was incised and drained. Bacitracin was given in a dosage of 10,000 units every 6 hours. The patient had a 3 plus albumin before treatment, but this decreased during therapy and the red cell white cells, and sugar disappeared. Bacitracin was stopped after 5 days, when the temperature was normal.

This was considered an excellent response to bacitracin.

**CASE 28** C H, female, aged 13 months. Cellulitis of thigh. Series No. 5040.

Three days before admission this patient was bitten by a mosquito and the area very rapidly developed



Fig. 15 The successful completion of the graft in Case 24



Fig 16



Fig 17



Fig 18

Fig 16 The extent and nature of the undermining burrowing ulceration in Case 29 before treatment with bacitracin

stage in the healing process following the administration of bacitracin therapy

Fig 18 The final healing in Case 29 following partially successful secondary closure

Fig 17 The control of the infection in Case 29 and a an extensive cellulitis involving all of the anterior portion of the thigh. The patient's temperature was 104 degrees on admission to the hospital and there was swelling, redness, pain, and tenderness throughout the thigh

She was put on 5,000 units of bacitracin every 6 hours and the temperature fell abruptly. It was almost normal on the afternoon of the first day of treatment and on the following day reached normal and remained there with complete resolution of the



Fig 19



Fig 20

Fig 19 The extent and nature of the undermining burrowing ulcer of the thigh in Case 30

Fig 20 The final healing in Case 30 following bacitracin therapy

inflammatory process. No opportunity was given for cultures. A few red and white cells appeared in the urine but there was no albumin and no rise in the nonprotein nitrogen.

**CASE 29.** I. W. male, aged 70 years. Chronic undermining burrowing ulcer of abdominal wall. Series No. 5253.

Three weeks before this patient had had an appendiceal abscess drained through a stab wound in the right flank. Immediately thereafter he developed a severe infection of the abdominal wall which spread through the subcutaneous fat down into both groins and over into the left flank with undermined skin flaps measuring 2 or 3 inches in various places. The muscle was not involved and the infection had all of the characteristics of the undermining burrowing ulcers (see Fig. 16). The microaerophilic hemolytic streptococcus was found along with several secondary contaminating organisms. The streptococcus was susceptible to bacitracin but resistant to penicillin. He was put on bacitracin in a dosage of 20,000 units every 6 hours systemically and it was used in the form of an ointment locally containing 1,000 units per gram. Improvement was rapid and remarkable. Further extension of the infection was immediately halted and healing began almost immediately. After 10 days the wound was clean and a secondary closure was attempted but this was only partially successful because of the secondary contaminants (see Fig. 17). However thereafter the wound healed by secondary intention (Fig. 18) and it was the general opinion that bacitracin had saved this patient's life.

**CASE 30.** M. P. female, aged 41 years. Undermining burrowing ulcer of thigh. Series No. 5051.

Two weeks before admission to the hospital this patient developed a pimple on the anterior surface of the left thigh. She picked it and it began to enlarge. On admission there was a large ulcer about 4 inches in diameter on the anteromedial aspect of the left thigh in the upper third (see Fig. 19). The ulcer was excised and warm compresses were applied. Penicillin and sulfadiazine were given systemically, but there was complete failure of the ulcer to heal. Thereafter the margins of the ulcer became undermined almost up to the inguinal ligament above and to a lesser degree all around the other margins, giving the characteristic features of the chronic undermining burrowing ulcer. Intramuscular bacitracin was started in a dosage of 20,000 units every 6 hours and continued for 10 days. Bacitracin ointment was applied on fine meshed gauze. Within 24 hours improvement was obvious and in 72 hours the whole ulcer was covered with clean granulation tissue. The flaps thereafter rapidly became adherent and partial secondary closure and a skin graft was then done. The portion which could be sutured healed primarily and there was about an 85 per cent take of the skin graft (see Fig. 20). The urine remained normal throughout treatment and the nonprotein nitrogen fell from 17 to 12 milligrams per cent.

This was considered a most dramatic cure.

## SUMMARY

1. Two hundred and seventy cases representing a wide variety of surgical infections and certain medical infections have been treated with intramuscular bacitracin over a period of 22 months by 6 different observers in different geographical areas of the country.

2. These cases have been studied in a uniform manner with careful consideration of all of the factors involved, and the results of treatment have been divided into 4 categories: "excellent," "good," "questionable," and "no effect." The first 2 are considered "favorable" and the last 2 "unfavorable."

3. Records of these cases have been transferred to summary sheets which have been carefully reviewed in a central office and the data have been subjected to critical analysis.

4. About three-fifths of these cases had failed to respond to other antibacterial agents, yet 55.6 per cent then responded favorably to bacitracin. These are called "salvaged cases."

5. About two fifths of these cases had had no previous treatment and 78.1 per cent have responded favorably to bacitracin.

6. These two groups are not comparable because the patients without previous treatment in general had been ill for a shorter period of time when bacitracin treatment was started than the patients previously treated by other methods.

7. The bacteriological studies indicate that the majority of these infections were due to a mixture of organisms.

8. The favorable results with bacitracin were obtained in these mixed infections almost as readily as in the pure infections, owing to its wide antibacterial spectrum and the absence of any inactivating substance such as penicillin has to face in penicillinase.

9. Tests for susceptibility of the organisms associated with these infections to bacitracin and penicillin, showed that the majority were susceptible to both drugs but where there was a difference, the ratio was 10 to 1 in favor of bacitracin. The evidence seems to indicate that this is due to the fact that many of the patients had built up a resistance to penicillin during previous treatment with that drug.

10. The bacitracin used in this study was manufactured by Company A by the surface

growth method and by Company B by the deep tank method

11 Circumstances have divided this study into 3 phases. First, the period when the patients were treated by the "surface growth bacitracin" and evidences of nephrotoxicity were minimal and inconsequential. Second, the period when patients were treated by the "early deep tank bacitracin" and evidences of nephrotoxicity were disturbing. Third, the period when patients were treated by bacitracin meeting the Food and Drug Administration toxicity test of an LD<sub>50</sub> of 500 units for a 20 gram mouse, during which phase confidence in the efficacy and, in large measure, the safety of bacitracin has been restored.

12 Brief outlines and photographs have been presented which illustrate some of the cases of patients who have been successfully treated during these 3 phases of the study.

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# THE MECHANICAL HEART-LUNG SYSTEM

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EARLY in 1948 I published the reports of the results obtained from experiments in dogs, performed by myself and staff and dealing with the use of an artificial heart with artificial lungs

In our opinion an artificial heart must replace the organic heart temporarily, in other words it must maintain circulation throughout the body. From the interesting work of Bjork it appears that with the Crafoord method only the brains of dogs are perfused. As other parts of the organism can be left without circulation for some 15 minutes, the venae cavae may then be clamped during such an interval of time so that the heart cavities become free of blood, intracardial operations are then possible.

The question arises, however, whether or not parts such as the spine, the heart muscle, or other organs can really withstand a lapse in circulation without harm. Even if that were possible, with the Crafoord method, which may be very useful for some special purposes, one is always handicapped by the time element. Our method, on the other hand, permits the maintenance of complete circulation (to the brain, to the spine, to the heart muscle, the bronchial circulation to the lungs, to the endocrine organs, to the liver, to the kidneys, etc.). Only venous blood does not enter the heart and the pulmonary circulation. The cavities of the heart are empty of blood, or nearly so.

We realize that with our broader conception of the artificial heart additional difficulties must be met. First about five times as much blood per unit of time must be oxygenated as in brain perfusion. Second, the persistence of the coronary circulation might make intracardiac operations more difficult, we have no choice, however. A prolonged lapse in coronary circulation undoubtedly will cause damage to the heart muscle (fibrillation), especially in the presence of heart weak-

ness. If absolutely necessary the heart surgeon may interrupt the coronary circulation for a short time or he may aspirate the venous coronary blood when the right heart cavities are opened. We have accepted these difficulties readily since the great advantage of our method is that in principle we are not limited for time, we are not restricted to minutes, we may go on for hours and we hope eventually for days. The use of our heart-lung system therefore will not be restricted to operations upon the heart and perhaps some other operations, but the apparatus may possibly be used also as an artificial heart to relieve the organic heart in its task of overcoming an acute process (diphtheria) and as well to replace the lungs temporarily in cases in which a few days will suffice for our modern drugs to overcome infection (for example, in cases of severe pneumonia in the remaining lung after pneumonectomy).

*Early experiments in dogs* In preliminary experiments we studied the behavior of the heart and the lung during and after the use of the mechanical device. In these experiments the thorax was widely opened. Cannulas were inserted in both venae cavae and in the aorta. After the venae cavae were clamped near the heart the venous blood was pumped to an oxygenator and from here into the aorta via the side branches of the cannulas.

From these experiments we learned that the electrocardiogram of the heart empty of blood was almost unchanged, and that the heart and the lungs resumed their normal functions immediately when the mechanical device was stopped and the clamps were removed, even when they had been empty of blood (except for the coronary and the bronchial circulation) for more than an hour.

In the second series of experiments we studied methods of applying the artificial heart lung with as little damage to the animal as possible. The following method was adopted

From the Physiological Institute of the University of Utrecht

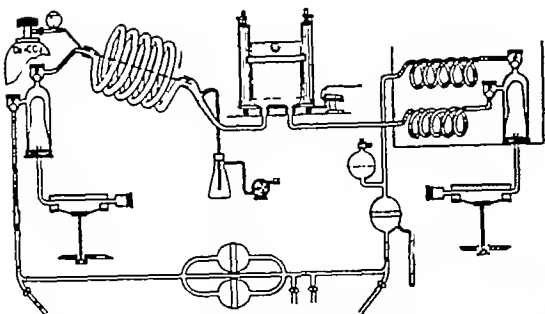


Fig 1 Schematic diagram of the apparatus Shunt in use, venous tube coming from the subject (under, left) and arterial tube leading to the subject (under, right) both clamped In the shunt are 2 filters, a filling and an outlet tube Further from left to right rotameter (volume per minute indicator), one venous pump with membrane pump, one spiral oxygenator, assembling tube with bubble aspirator, regulating reservoir, waterbath with one arterial pump, arterial leading with buffer vessel, filter, and pressure meter

A catheter was introduced through the external jugular vein into the vena cava superior close to the heart A second catheter was brought up high in the vena cava inferior through the femoral vein Both catheters were connected with a pump (type Dale-Schuster), which sucks the blood from the venae cavae Careful adjustment of this pump made it possible to aspirate all the blood from the venae cavae just before it enters the heart The same pump drove the blood to an oxygenator By a second pump the collected oxygenated blood was forced into the femoral arteries in which T cannulas were inserted This blood proceeded in the normal direction to the distal parts of the hindlegs and in the abnormal direction in the aorta toward the heart However, as there was no blood in the left ventricle, the artificial aortic pressure was higher than the pressure in the right ventricle and the aortic valves remained closed From the aorta the blood flowed normally into the different arterial branches, including the coronary arteries Thus in performing only the simple operations on the vessels necessary in order to insert the catheters and the cannulas, it proved to be possible to maintain artificial circulation and respiration If treated aseptically the animal survived without any sign of distress We have a dog on which the artificial heart-lung system

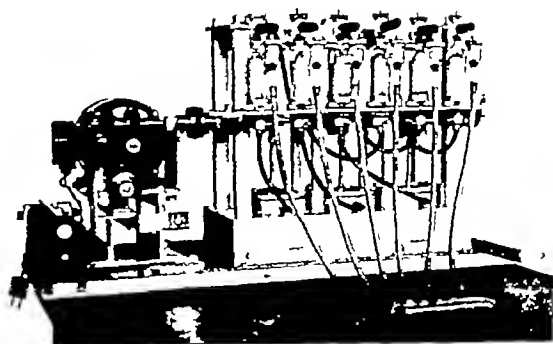


Fig 2 The 6 venous pumps with their inlet tubes, membrane pumps and motor, which also drives the spiral oxygenators

was applied 1 year ago, and the animal behaves still as normal as any dog This probably is the first dog in the world who has lived an interval of 2 hours without using his own heart and lungs

Our results were so convincing and the method and apparatus so simple, that I decided to construct a bigger apparatus for future use in man

*General construction of the apparatus* A system of pumps (right heart) sucks the venous blood from the subject and drives it to the oxygenators The oxygenated blood is collected in a reservoir A second system of pumps (left heart) forces the oxygenated blood through a heating device back into the subject (see schematic diagram, Fig 1, from left to right)

*The right heart pump system* A modification of the Dale-Schuster pump is used (Fig 2) The unit consists of 6 single pumps driven by a central 6-fold crankshaft The movements of the membranes are transported by air to the finger stalls The glass housings of these finger stalls have inlet and outlet valves, consisting of amber or glass balls in a ground glass fitting Thus the blood comes in contact only with rubber and glass, there are no metal and no frictionizing parts The frequency of the pumps can be regulated by changing the speed of the electric motor driving the shaft, the volume per stroke of each pump by a divided tap, which provides a smaller or greater leak in the air-transport system, a method also used by Gibbon The



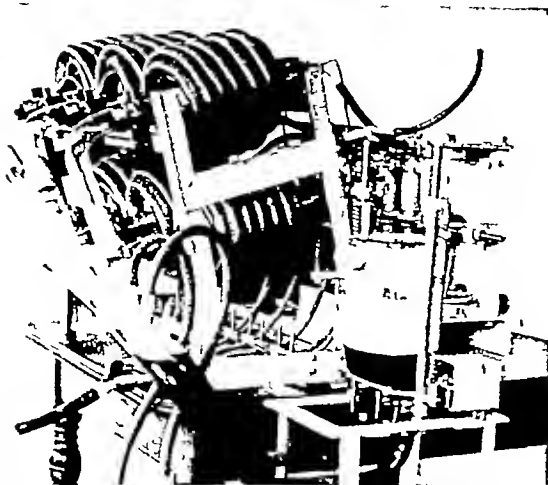


Fig 3 The 6 oxygenators with the 2 assembling tubes leading to the reservoir Under left, the main venous tube, on the table, the handles to clamp the 6 venous tubes

six pumps work alternately, so that constant suction from the caval vein ensues. The volume per minute can be constantly read on a rotameter. At a frequency of 70 per minute, and a volume per stroke of 10 cubic centimeters per pump, the volume per minute is  $7 \times 6 \times 10$  cubic centimeters = 42 liters. The pumps are mounted on a detachable metal strip and can easily be sterilized together with their tubing.

*The spiral oxygenator* As it is practically impossible to insert the organic lungs in an artificial heart circuit, the use of a mechanical heart calls for the use of artificial lungs. Our artificial lung consists of 6 equal parts, one for each right-heart pump (Fig 3). To avoid the disadvantages of the usual oxygenators we developed a new type of relatively small size and without rapid moving parts, which may cause hemolysis and foaming. Each oxygenator consists of a rigid tube of some suitable plastic material with an internal diameter of 18 millimeters and about 10 meters long. This tube is bent into the shape of a spiral, or to be exact, it forms 3 layers of spirals one in the other, to save space. Both the beginning and end of the tube lie in the central axis of the spiral. The six spirals are mounted in a frame, with their axis pointing slightly downward. They turn about this axis, synchronously with the pumps. Now if a quantity of blood is in the

first winding of a spiral it will move all through the spiral and at last come out at the other end. (A similar principle is used by Kolff for diffusion purposes in his artificial kidney (6).) As the blood passes through the spiral tube it will adhere to the wall and form a thin layer. Oxygen (with carbon dioxide) streams constantly through the tube and the blood is readily oxygenated. The volume per stroke of each pump proceeds during one revolution from the first coil of its spiral to the second coil, while simultaneously a new volume of blood is pumped into the first coil and so on. So the stroke volumes of blood pass through the spiral, one after the other, becoming gradually oxygenated.

The oxygen intake in one passage through the spiral on the average is very good, the saturation with oxygen rises for example from 60 to 90 per cent at a volume per minute of 700 cubic centimeters per spiral. This means that with a total minute volume of  $6 \times 700 \text{ c.c.} = 42$  liters, the oxygen intake is  $42 \times 60 \text{ c.c.} = 252 \text{ c.c.}$  per minute, which may be considered sufficient for a man in basal condition.

It is clear that the oxygen-intake will be greater the lower the saturation of the venous

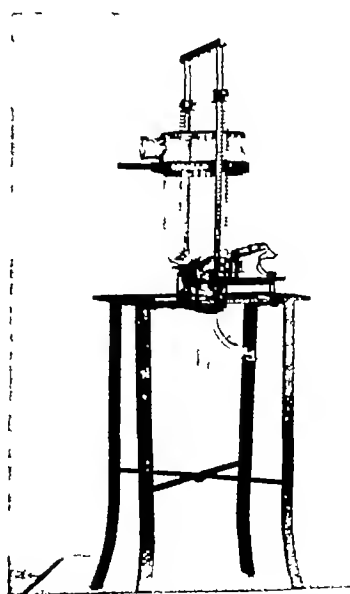


Fig 4 The regulating reservoir, which prevents air from coming in the arterial system. Two (curved) inlet tubes and one outlet tube

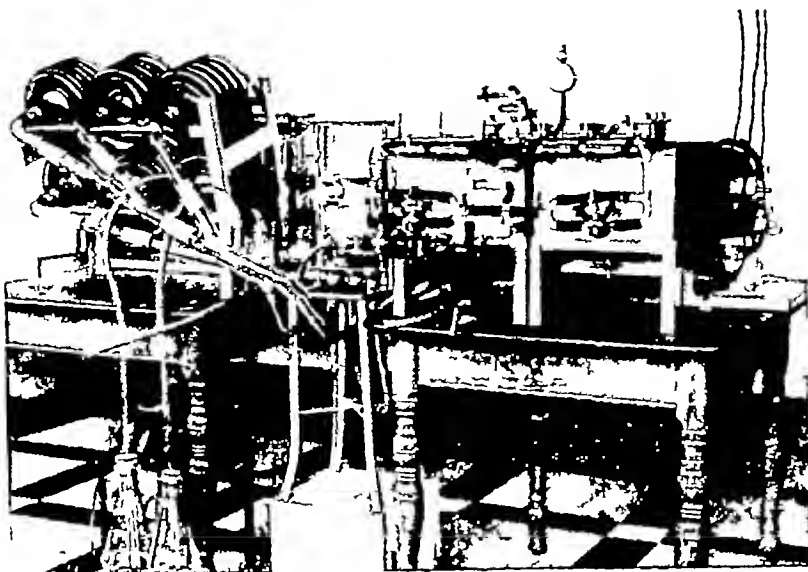


Fig 5 Overall view of the mechanical heart-lung device The tables are 80 cm wide.

blood With a venous saturation of about 20 per cent we found an oxygen intake of between 90 and 100 cubic centimeters per liter of blood The accompanying table presents some of our experimental figures in the range from 80 per cent to 50 per cent saturation of the venous blood

VENOUS SATURATION IN 80 TO 50 PER CENT RANGE

Venous saturation per cent	Arterial saturation per cent	Oxygen intake per liter c. c.
80	96	32
74	94	40
66	90	48
61	88	54
51	85	68

Even after the same quantity of blood had constantly passed the oxygenators for 2 hours and more, we could detect no appreciable hemolysis There was no foaming in the spirals

It is our opinion based on our observations that this new type of artificial lung offers much that is promising

*The regulating reservoir* The arterial blood from the oxygenators is collected in a glass reservoir (Fig 4), from which it is sucked away by the left-heart pumps To prevent the pumps from sucking air, which would cause air embolism in the subject, they stop auto-

matically when the blood in the reservoir has reached the lowest tolerable level After about 2 seconds the steady flow from the oxygenators has raised the level and the arterial pumps start their work again This automatic system to prevent air from coming into the arterial system is very simple the reservoir hangs in spiral springs and moves by its weight (which depends on the quantity of blood inside), a mercury contact It is practically not possible to make two sets of pumps which return absolutely the same volume per minute, and even if it were, both the venous return in the subject, as well as the arterial pressure may change a bit from time to time, which would make continuous regulation of the pumps still necessary It would of course be wrong if the volume per minute of the venous pumps were greater than that of the arterial pumps, because then the blood of the subject would gradually be accumulated in the reservoir For these reasons the arterial pumps are regulated in such a way that their minute-capacity is just a little greater than that of the venous pumps, then the apparatus functions automatically the arterial pumps will stop for a few seconds now and then, say once in some minutes, this time interval depending on the degree of exactitude with which the arterial pumps are adjusted

*The left-heart pump system:* The left-heart pump (shown at the right in Fig. 5) system consists of 6 pumps similar to those of the right-heart system. They work in two groups of 3 alternately, so that a real pulse results. A pulse seems to be necessary for good perfusion of the organism. The pumps with their inlet and outlet tubes are immersed in a waterbath kept at such a temperature (about  $30^{\circ}\text{C}$ ) that the outcoming blood registers  $37^{\circ}$  degrees. The cooling of the blood in the oxygenators is, however, not more than  $\frac{1}{2}$  to 1 degree at normal room temperature. The outlet tubes of the pumps join 3 by 3 to a larger tube. Parallel to each of these two tubes runs a tube with a fine filter so that the blood can be driven at will through or beyond the filters. The two tubes are connected with the two horizontal arms of a cross shaped glass tubing. The upper arm of the cross leads to a buffer-vessel, the upper opening of which is connected with a blood-pressure meter. The tube which leads to the two cannulas in the femoral arteries is connected to the lower arm of the cross. Of course the pressure to be exerted by the arterial pumps depends foremost on the circulatory resistance of the subject. By altering the leak of the membrane pumps it is easy to adjust the blood pumps so that the wanted volume of blood per minute is driven out against the prevalent pressure.

*The arteriovenous shunt:* From the main arterial tube a shunt tube leads to the suction-side of the venous pumps (Fig. 5). Parallel to this tube we mounted two filter-houses with fine filters. If the tubes leading from and to the subject are closed and the shunt tube is opened the blood circulates in the apparatus from the venous pumps through the oxygenators and the reservoir to the arterial pumps in the waterbaths and then through the shunt back to the venous pumps. Thus the apparatus is filled with oxygenated warm blood before it is applied to the subject. During this shunt circulation the blood is passed through the filters so that clots if there might be any in the blood are filtered out beforehand. So when the patient is prepared for operation that is when the catheters are inserted into the venae cavae superior and inferior (through a jugular and a femoral vein, respectively) and

the T cannulas are placed in the femoral arteries and when the connecting tubes having been filled with blood or saline are attached to the catheters and the cannulas has simply to open the connecting tubes to close the shunt and artificial circulation started.

As circulation is maintained with the filters in the main circuit may also be used during circulation through the shunt. These filters are of use only in so far as they may withhold clots which originate in the apparatus.

*Adjacent apparatus:* Each of the tubes leading to the venous pumps and also the inlet and outlet tubes of the arterial pumps are provided with handles so arranged that the tubes can be closed rapidly with one simple movement in case something might go wrong with the relative pump. We have had however, no trouble whatsoever during the hundreds of hours in which the system has been in use.

As already stated the blood does not foam in the apparatus but at the blood level in the assembling tubes, leading from the oxygenators to the reservoir some bubbles may appear. If they do the bubbles are easily sucked away to a vacuum vessel (Fig. 4 and 5).

*The handling of the apparatus:* As the apparatus is semiautomatic the handling is very simple and can easily be done by a man. Before use the dead space of the apparatus must be filled with blood (of course in future use in man it must be filled with blood of the same group as that of the patient). Otherwise the blood taken to fill the dead space would lessen the volume of blood of the subject. It takes about 2½ liters of blood to fill the dead space. This may seem like a rather large quantity. Strictly speaking it could be less as the blood normally present in the lungs (in man about 1 liter) could be taken from the patient. However as blood especially human blood is easily obtained I think that the use of 2½ liters will not present a great difficulty. Except for the artificial lungs which hold about 1 liter, the dead space consists of the various tubes, the reservoir, the pumps and the heating system.

# JONGBLOED MECHANICAL HEART-LUNG SYSTEM

fill the apparatus we use separate inlet and outlet tubes (Figs 1 and 5) The blood is sucked by the venous pumps into the apparatus directly from the blood-container The air, or if the system is previously filled with saline, the saline, can escape through the outlet tube In order not to spoil blood the last quantity of saline can be left in the system to mix with the blood, air bubbles if present can escape via the shunt to the venous pump of the apparatus where they mix with the oxygen in the oxygenators and do no harm When the apparatus is full of blood, the shunt in function, and no air bubbles are present in the arterial part, the apparatus is ready for use As soon as the connections with the subject are completed and the shunt is closed, the operator adjusts the venous pumps in such a way that a maximum of blood (to read from the rotameter) is sucked from the subject If suction is too weak only a part of the blood is sucked from the venae cavae On the other hand if suction is too strong the wall of the veins may be sucked into the openings of the catheters and thus close them To reduce this difficulty to a minimum we used catheters which have 3 or 4 openings When optimal suction is established the operator adjusts the arterial pumps, so that the automatic regulator comes into function only now and then Once this is done the operator has only to give general supervision to the workings of the apparatus, to watch the temperature of the outcoming blood in order to adjust the heat of the waterbath and to keep under control the flow of oxygen (preferably with 5 per cent carbon dioxide) Other than this the apparatus works automatically and reliably, in the hundreds of hours it has been in use we have had not the slightest trouble with it

*Testing the capacity of the apparatus* As the apparatus is meant for use in man, we had to find a way to test its real capacity *in vivo* For this purpose we used two dogs with a body weight respectively of 30 and 32 kilograms, that is about half the weight of a man Therefore we used only half of the apparatus, i.e. 3 venous pumps, 3 oxygenators, and 3 arterial pumps Under these conditions both dogs lived for 2 hours on the mechanical system The elec-

trocardiograms showed no, or very small, alterations, and when shutting off the apparatus after 2 hours, the organic heart and lungs resumed their functions immediately To determine whether the mechanical system was sufficient to maintain the life processes, a closed leather mask was tightly fitted over the mouth and nose of the animal, so that it had no chance to breathe (In our earlier experiments we sometimes clamped the trachea for the same reason) The animals showed no sign of distress during this procedure and it was obvious that it was just the same whether the mask was present or not Thus we may take it for granted that oxygenation by the mechanical system was sufficient in these experiments

Once more I would point to the fact that while in our method the complete circulation is maintained, there is no reason to believe that the functions of the organs (kidney, liver, glands of internal secretion, etc.) are impaired We may assume therefore that all life processes go on materially unaltered

In these experiments the volume per minute varied between  $1\frac{3}{4}$  and  $2\frac{1}{4}$  liters, thus if the whole apparatus were used the volume per minute under similar conditions would reach about 4 liters, this indeed being approximately the quantity which is necessary to maintain life in man

As the experiments proved that half of the apparatus was sufficient to maintain life in dogs of 32 kilograms, we may readily believe that when the whole apparatus is used circulation will be sufficient for a normal man of about 64 kilograms bodyweight

One might ask whether we know that with our method the heart is really empty of blood In fact we do not know, it is possible of course that not all the blood is sucked away from the venae cavae, and that part of it still enters the heart cavities But this would not matter at all Our experiments just mentioned revealed that enough blood passes through the mechanical system to maintain life, and that is what we want If the artificial system is used to replace the heart or the lungs to relieve these organs temporarily, it is quite irrelevant if a fraction of the blood passes the organic heart and the lungs, the real test in such cases

is that the mechanical system be sufficient to sustain life. If, on the other hand, the artificial system is used in intracardial operations or the like, then the surgeon may, since the thorax is opened in these cases, clamp the venae cavae close to the heart to be sure that no caval blood enters the heart.

*The sterilization of the apparatus.* It is necessary of course that it be possible to sterilize the whole system. The 6 venous pumps are mounted on a detachable strip and can, together with their tubing, be put in a sterilizer. The 6 arterial pumps with their tubings can be sterilized by heating to 100 degrees C. in their own water baths. The rest of the glass-work and tubing and the reservoir can also be disconnected and sterilized by heat.

We are, however, looking for a more simple method of sterilization, so that the whole apparatus may be sterilized intact. Therefore experiments are in progress with very promising results. We proceeded as follows. After a general cleansing of the apparatus by perfusing it at its own power with water, a pepsine-HCl solution at 37 degrees circulates through the whole system for about 30 minutes. By this procedure the protein which might adhere to the walls is removed. Then a disinfecting solution circulates through the apparatus for some time, eventually heated to 55 or 60 degrees in the waterbath.

To control sterility, after such a procedure we filled the apparatus with a sterile bouillon solution which circulated for hours in the system. From this bouillon the bacteriologist took samples to test it on different kinds of solutions at various temperatures. In our last experiment he found that from 21 samples 17 were entirely sterile, the other 4 showed a few colonies of nonpathogenic bacteria. He estimates that not more than 1 bacterium per 30 cubic centimeters of bouillon was present. Thus this simple method of autosterilization will surely prove to be effective, as we have stronger disinfectants on our program. To be entirely on the safe side it may seem to be advisable to add penicillin to the blood in the apparatus when in the future the apparatus is used in operations on man.

*Special measures.* Clotting of the blood must be prevented of course. Until now we

did not apply silicon-coating to the apparatus, but, in our experiments on dogs, added an anticoagulant. We used chlorasol-pink or heparin. Both gave good results. Needless to say the necessity to make use of an anticoagulant is a weak point in any extracorporeal circulation procedure. We do not exactly know how a patient will react to a large dose of heparin and in case of extensive operations it is obvious that it may cause difficulties. The only statement I can make is that in our dogs such troubles were far less than we had expected. Especially when used in man we are of the opinion that it will be necessary to use pyrogen-free solutions in the apparatus.

#### SUMMARY AND CONCLUSIONS

We believe that our apparatus, from a technical standpoint, may be considered ready for a trial in man. For the surgeon there is of course still the question of the use of heparin, and perhaps other unforeseen difficulties of pure medical character may arise. However, in technical and physiological respects we are pretty sure. As to the technical performance, the apparatus did not show any failure during its long hours of use, the capacity of the pumps is such that even if one or two of both the venous or the arterial system might fail, the remaining pumps still have sufficient capacity, and if ever the whole apparatus might stop, nothing serious may occur, since the organic heart takes over its function immediately as soon as the blood is no longer sucked away from the venae cavae. If this should happen exactly at the moment the heart is opened by the surgeon, complications might arise, but this would seem to be a very special coincidence. As to the physiologic aspects, the mechanical heart maintains the whole circulation to brain, spine, liver, kidney, glands with internal secretion and so on, so that we may expect that all the functions in the organism, nervous, secretory, hormonal, etc., go on more or less normally.

We would not hesitate to use the artificial heart-lung system in a patient in whom other means had failed and there was the possibility of saving his life.

To make the apparatus as reliable as possible our first specimen is heavier and bigger

# JONGBLOED MECHANICAL HEART-LUNG SYSTEM

than really necessary. With the experience gained in the construction of this apparatus we intend to build a second one of smaller overall size.

A description of a mechanical heart-lung apparatus and a method for total artificial circulation are presented. The capacity of the apparatus is sufficient for future use in operations in man.

The artificial lung is based on a quite new principle, the spiral oxygenator causes neither hemolysis nor foaming of the blood.

The possibilities for its application in cases of intracardial operations and the like in man, or as a real artificial heart or artificial lung in cases of serious, acute heart or lung affections are discussed.

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## ABNORMAL BLEEDING — II

### Further Clinical Experience With Toluidine Blue and Protamine Sulfate

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**A**BNORMAL bleeding may arise from disorders of the plasma, the formed elements of the blood and the vascular wall. Hemorrhage may occur when any one of these systems is disturbed, although bleeding is frequently complex in origin and may result from disorders which directly or indirectly involve many or all factors concerned with hemostasis. It may be that the vascular factor is affected directly or indirectly in all types of abnormal bleeding.

This report comprises a series of studies carried out on a group of patients with a variety of bleeding disorders. Common to all of the patients of this group was a clotting disturbance revealed by a protamine titration (3).<sup>1</sup> This clotting abnormality was frequently associated with thrombocytopenia, but it also occurred in some patients whose platelet counts were normal. It was absent in others who had severe thrombocytopenia. Also associated with the increased protamine titration in some instances were petechial hemorrhages and positive Rumpel-Leede phenomena, but here again the protamine titration was increased in some patients who had no clinical evidence of vascular change. The clotting time of whole blood was often moderately prolonged, however, this change was detectable only with careful technique. The prothrombin activity was usually normal or near normal. The nature of the clotting defect revealed by the protamine titration remains in question.

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<sup>1</sup>Following the addition of a standard concentration of heparin to normal blood, a remarkably constant amount of protamine is required to restore clotting. (Laboratory normal for males and most females is 0.140 milligram of protamine per milliliter blood containing 0.091 milligram of heparin.)

There are certain similarities between this clotting disturbance and that produced by the injection of commercial beef heparin. However, there are certain distinct differences. (1) Resolution of this problem is difficult because many factors are involved, and because the methods of study are inaccurate and not necessarily specific. Present means for heparin identification are not suitable for human use because of the large amounts of blood required to isolate even a few micrograms of crystalline material (7). In addition, the crystalline material may vary considerably in anticoagulant potency (8), and when of poor quality, it may be difficult to identify. The inactivation of the anticoagulant activity of heparin by protamine sulfate or toluidine blue has been frequently interpreted as a biologic means for identifying heparin. Unfortunately, these reactions are shared by other biochemical compounds contained within the body. Some of these are chemically similar to heparin and some are not. Many of these compounds have some anticoagulant activity, although none is as potent as commercial heparin itself. This is further complicated by the fact that most studies have been concerned with beef heparin and that little is known of human heparin.

For these and other reasons the clotting disorder common to these patients and disclosed by the protamine titration can be considered only as resembling that produced by the injection of heparin. Whether the anticoagulant defect is heparin-like in the chemical sense remains to be seen. The term "heparinemia (?)<sup>2</sup>" was used to describe this syndrome in dogs (4). It was used generically to indicate certain similarities between the clotting defect of this syndrome and that produced by heparin in

# ALLEN ET AL ABNORMAL BLEEDING—II

jection. It was interrogated because certain aspects of the problem were and still are unsettled.

## METHODS OF STUDY

Coagulation studies included (1) the protamine titration (3), the normal titration end-point for humans is 0.140 milligram (protamine requirement) per milliliter of blood containing 0.091 milligram of heparin, (2) whole blood clotting time (1), for normal human blood this is 25 to 35 minutes with the technique used, (3) prothrombin activity—a one stage method with the normal being 100 per cent (10), (4) observation for clot retraction, and, (5) observation for clot lysis 6 and 24 hours after coagulation.

Studies on the formed elements of the blood included erythrocyte, leucocyte, thrombocyte, and leucocyte differential counts and hemoglobin content.

## CLINICAL OBSERVATIONS

An analysis of the data obtained on these patients suggests that their hemorrhagic tendency may be advantageously classified with respect to the presence or absence of hemocytologic disorders.

*Patients without evident hemocytologic disorders* This group of patients is composed primarily of women, although it has been demonstrated in 2 males who had excessive bleeding after surgical procedures. In women this clotting disturbance has been observed in some cases of menorrhagia (1) and some cases of delayed postpartum hemorrhage. In 2 of the postpartum patients, the hemorrhagic feature was serious, in 1 it was troublesome but less severe (Table I). All 3 showed a prolongation of the whole blood clotting time and an increased protamine titration. The platelet counts and prothrombin times were near normal. A marked increase of fibrinolytic activity was present in 1 patient, Case 2, but this was greatly reduced after the first toluidine blue and protamine administration. The protamine titration, when returned to normal (0.140 mgm), and maintained there for several days, remained normal. This suggests the self-limiting nature of the disorder in the postpartum group, although toluidine blue may be necessary to hasten the return to normal.

Of interest was the fact that none of these patients had petechiae or a "positive" Rumpel-Leede test, although ecchymoses occurred at the site of needle punctures.

The abstracts of the clinical courses of 2 of these patients are presented below. The menorrhagic group will be reported elsewhere (1).

**CASE 1 (Table I)** A 32 year old female, secundagravida, nullipara, was admitted to Chicago Lying-in Hospital, where she delivered after 9 hours of labor. A small cervical laceration was repaired with No. 6 chromic catgut sutures as were the deeper layers of the episiotomy wound. The skin was approximated with four interrupted cotton sutures.

On the ninth postpartum day, uterine bleeding occurred, for which a curettage was done and 600 milliliters of citrated blood were given. Because of the continued bleeding, an incomplete vaginal hysterectomy was performed on the following (10th) day. A 600 milliliter citrated blood transfusion was given. The uterus showed prominent lymphatic channels, no myomas and no retained placenta. Ascorbic acid and vitamin K were given daily thereafter. Bleeding continued from the lower episiotomy wound. This was temporarily controlled by three mattress sutures on the eleventh day, at which time she received 1200 milliliters of citrated blood. No bleeding occurred until the fourteenth day, when spotting was noted along the episiotomy suture line. This was resutured with one mattress suture, which controlled bleeding until the 16th day, when fresh bleeding resumed from the episiotomy site. This area was packed on the 16th day, but oozing continued and the episiotomy was resutured on the 18th day. One 700 milliliters citrated blood transfusion was given on the 16th day and 500 milliliters of blood were given as a direct transfusion on the 17th day.

On the 18th day the protamine requirement in the titration exceeded 0.200 milligram of protamine sulfate and the whole blood clotting time was 47 minutes. The platelet count was 244,000/cubic millimeter and the prothrombin activity was normal. The remaining studies were normal. One milligram of protamine sulfate per kilogram was given intramuscularly every 4 hours for 10 days, bleeding stopped within 4 hours after the initial injection and did not recur. The patient was discharged on the 29th postpartum day. The protamine titration and the clotting time were normal 12 hours after protamine therapy was instituted and remained so even after protamine was discontinued on the 26th day (10th day of protamine sulfate). The blood of the patient was examined 3 months later and found to be normal with reference to the above mentioned clotting studies.

During the hemorrhagic period (9th to 18th postpartum day), the patient received 3,600 milliliters of blood which maintained her



TABLE I—LABORATORY AND CLINICAL FINDINGS IN A GROUP OF PATIENTS WITH POSTPARTUM BLEEDING AND AN INCREASED PROTAMINE TITRATION

Patient	Age	Diagnosis	Protamine titration in mgm		Laboratory data clotting time in min		Prothrombin time %	Platelets	Therapy	Manifestations of bleeding	Clinical response and time of response
			Before therapy	After therapy	Before therapy	After therapy					
385320 (Case 1)	32	Postpartum hemorrhage	> 0.0	0.14	47	18	100	742,000	3.0 mgm /kgm Protamine Daily X 10	Uncontrolled vaginal bleeding which did not respond to numerous resuturing attempts blood transfusions or hysterectomy	Complete cessation of bleeding within 24 hours. No further bleeding. Responded at 3 months with all coagulation studies normal
418980 (Case 2)	25	Postpartum hemorrhage	0.40	0.20 (2 hr)	10	30	54	260,000	6.0 mgm /kgm toluidine blue 3.0 mgm /kgm protamine	Postpartum hemorrhage and blood transfusion reaction—profuse bleeding which slowed after perineal repair and vaginal pack. Marked fibrinolysis	Clotting time and protamine titration were decreased within 2 hours. A slight oozing around 1 pack continued
			0.20	0.14	30	30	64		6.0 mgm /kgm toluidine blue Daily X 2 3.0 mgm /kgm protamine Daily X 6	Continued slight oozing around pack	Clinical and laboratory response immediate. No further bleeding
451162 (Case 3)	26	Postpartum hemorrhage	0.16	0.14	25	18	80	180,000	6.0 mgm /kgm toluidine blue 3.0 mgm /kgm protamine	Irregular postpartum bleeding of 26 days which did not respond to dilatation and curettage. Vaginal pack was required. Oozing continued around pack	Oozing around pack slowed and stopped within a few hours
									6.0 mgm /kgm toluidine blue Daily X 5 3.0 mgm /kgm protamine Daily X 4	Pack removed with minimal bleeding	No further bleeding

erythrocyte count at 3,080,000 and her hemoglobin at 10 grams per cent. A slight febrile reaction followed the two transfusions given on the 11th postpartum day.

CASE 2 (Table I) Report of this case has been presented elsewhere (1).

CASE 3 (Table I) A 26 year old female, was delivered at the Chicago Lying-in Hospital. Bleeding was slightly in excess of normal immediately after delivery but required no transfusion. The placenta was intact. No abnormal bleeding occurred after 2 hours and the remainder of the postpartum course was uneventful. She was discharged on the 9th day on 0.0002 gram of ergotrate because of subinvolution of the uterus.

She was readmitted on the 18th postpartum day because of vaginal bleeding of 4 days' duration. On bed rest this subsided in 3 days and she was again discharged.

Two days later she was readmitted because of recurrent bleeding. On this day a dilatation and curet-

tage were performed, bleeding was excessive and the uterus was packed, but some bleeding continued through the pack for 36 hours and hysterectomy was contemplated. At this time (36 hours after packing), the whole blood clotting time was normal (25 minutes), but the protamine titration was increased to 0.160 milligram. The platelet count was 180,000 and the prothrombin activity was normal. There was no evidence of excessive fibrinolysis. She was given 6 milligrams of toluidine blue per kilogram and 3 milligrams of protamine sulfate per kilogram intravenously. Two and one half hours after administration the protamine titration was normal, as was the clotting time. At this time the uterine pack was removed and no bleeding occurred. Four milligrams of toluidine blue per kilogram was given 6 hours later. Six milligrams of toluidine blue per kilogram was administered daily after removal of the pack for 5 days and 1 milligram per kilogram protamine sulfate was given intramuscularly every 6 hours for 4 days. No further bleeding occurred. The protamine titration remained normal after the initial toluidine blue injection. She was discharged on the

9th hospital day and the 29th postpartum day. Follow-up studies have been normal to date (4 months).

*Patients with hemocytologic disorders* The primary diseases in the patients comprising this group were varied, but all showed severe marrow disturbances resulting from their primary disease or therapy. The protamine titrations in most cases were increased as were the whole blood clotting times. In addition, and in contradistinction to those patients presented above, most of these patients had thrombocytopenia, many had petechiae as well as ecchymoses. The bleeding tendencies in these patients were complicated in addition to the increased protamine titration. In this group all three of these factors contributed to the hemorrhage. The return to normal of the titration when toluidine blue was administered lessened the patients' hemorrhagic tendency only to the extent that the factors responsible for the abnormal titration contributed to bleeding. In no case was the platelet count appreciably altered by this therapy and, so far as clinical tests show, the vascular abnormality was not improved. Hence, this antihemorrhagic therapy was incomplete in that the vascular and platelet disorders remained unchanged.

Representative case abstracts of five patients are presented below.

**CASE 4 (Table II)** A 7 year old male, entered the Bobs Roberts Hospital with a diagnosis of acute stem cell leukemia. Aminopterin therapy was started as a 1 milligram daily dose for 3 days. During the second 3 days the dosage was increased to 2 milligrams per day and reduced to 1 milligram on the 7th day when petechiae appeared. On the 7th and 8th days there were large ecchymoses. On the 8th day hematemesis occurred and blood was present in the stool. Aminopterin was discontinued after the seventh day.

At this time the protamine titration was 0.180 milligram, the whole blood clotting time was 45 minutes, the platelet count was 24,000 and the prothrombin activity was 100 per cent of normal. Toluidine blue, 8 milligrams per kilogram, was given intravenously on the 8th and 9th days. This was augmented by a 1 milligram per kilogram dose of intramuscular protamine twice daily during the same period. All evidence of bleeding ceased after 48 hours and no new petechiae or ecchymoses formed. Except for a 24,000 platelet count, all other clotting studies were normal 24 hours after the first injection

of toluidine blue. Eight days later the first signs of remission of the leucemic process appeared, improvement continued, and temporary remission was obtained. Clotting studies were normal and there was no bleeding in the period of remission.

**CASE 5 (Table II)** A 38 year old white housewife, has been observed frequently in Billings Hospital for 8 years because of abnormal bleeding. As a very young child, she bled excessively and bruised so easily that there was a family interdiction against spanking. Menstruation from its beginning at 16 years of age was so excessive and prolonged that she became acclimatized to a constant state of profound anemia, her red blood count remained in the neighborhood of 2,500,000 per cubic millimeter and the hemoglobin around 5 grams per cent. The platelet count remained between 125,000 and 250,000 per cubic millimeter on numerous occasions until 1944, when more definite evidence of thrombocytopenia developed. She finally consented to x-ray sterilization, which was carried out March 24 and 25, 1944, a depth dose of 400 roentgens was given to each ovary. Vaginal bleeding, epistaxis and oral bleeding continued, and the platelet count fell and varied between 25,000 and 100,000. Because of this x-ray therapy of the spleen (total 800 r) was given over a 10 day period in late July, 1944. The platelet count was not appreciably affected, splenectomy was advised but refused. Whether related to x-ray therapy or not, the bleeding materially lessened, the red blood count and hemoglobin returned to normal levels, and the patient complained of plethora (dizziness, feeling of fullness in head, and warmth). The plethora disappeared in 1946 when severe menses resumed, although purpuric manifestations did not reappear until 6 months later, January, 1947. These bleeding manifestations continued, the period of menstrual flow increased from 10 days to 41 days. Of interest was the fact that the Rumpel-Leede test was always strongly positive, but spontaneous petechiae were absent. Ecchymoses were the only obvious manifestations of her cutaneous bleeding.

Her most recent hospital admission was after 40 days of vaginal bleeding. At this time the hemoglobin was 8.0 grams per cent, the red cell count was 2,400,000, the platelet count was 40,000, the bleeding time as always was prolonged to over 20 minutes. The clotting times throughout the 8 year study were normal.

The protamine titration was first performed on this patient June 22, 1948, at which time her bleeding state was active. The titration was increased to 0.180 milligram of protamine. Seven milligrams of toluidine blue per kilogram of body weight was given intravenously, 6 hours later the titration was normal, at the end of 24 hours, bleeding had stopped. Three blood transfusions, each 500 milliliters, were given over the next 3 days (June 23 to 25). Vaginal bleeding resumed June 28, at which time the protamine titration was again increased to 0.040 milligram above normal. On June 29, 7 milligrams of toluidine blue per kilogram of body weight were again given and

TABLE II—SUMMARY OF LABORATORY AND CLINICAL DATA OF BLEEDING PATIENTS WITH AN INCREASED PROTAMINE TITRATION

Patient	Age and sex	Diagnosis	Laboratory data						Therapy	Manifestations of bleeding	Clinical response and time of response
			Protamine titration in mgm		Clotting time in min		Prothrombin time %	Platelets per cu mm			
			Before therapy	After therapy	Before therapy	After therapy					
Group A. Acute Leucemia											
456363 (Case 4)	7—M	Stem cell leukemia with aminopterin Rx	0.18	0.16	27.45	12	100	140 000 24 000	8.0 mgm/kgm toluidine blue Daily X 3	Oral bleeding large subcutaneous hematomas and petechiae	Oral bleeding stopped no further subcutaneous bleeding. 24 hours
438819	26—M	Myelogenous leukemia	0.18	0.14	13	32	60	225 000	4.5 mgm/kgm toluidine blue Daily X 4	Diarrhea with fresh blood and tarry stools. Bleeding from sternal puncture site 3 days before had required sand bag pressure to control	Within 24 hours there were normal colored stools, but 4 benzidine within 48 hours stools were blood free
430803	5—M	Stem cell leukemia with aminopterin Rx	0.18	0.14	27	33	100	44 000	2.0 mgm/kgm toluidine blue Daily X 3	Hematomas at injection sites	No further bleeding at sites of needle trauma. 48 hours
453730	3—F	Stem cell leukemia with aminopterin Rx	0.18	0.14	45	18	100	190 000 17 000	3.0 mgm/kgm Protamine every 6 hrs Daily X 4	Gingival bleeding and ulcerations	Slow clearing of ulcerations and bleeding 48 hours
M. K.	24—F	Monocytic leukemia with aminopterin Rx	0.18	0.16	23	20	65	20 000	4.5 mgm/kgm toluidine blue Daily X 4 every other day thereafter	Oral nasal and rectal bleeding. Numerous fresh petechiae and ecchymoses	Oral and nasal bleeding stopped within 24 hours. Rectal bleeding stopped within 48 hours. No new ecchymoses and fewer petechiae. Only further bleeding was with trauma to nose. 48 hours
413730	25—F	Lymphatic leukemia	0.18	0.16	35	20	75	52 000	4.5 mgm/kgm toluidine blue Daily X 2	Oral bleeding moderate continuous vaginal bleeding	Oral bleeding stopped. Some slowing of vaginal bleeding 24 hours
Group B. Chronic Leucemia											
310214	54—M	Chronic myelogenous leukemia	0.18	0.16	56	30	80	172 000 135 000	4.5 mgm/kgm toluidine blue Daily X 6 2.5 mgm/kgm protamine irregularly	Marked gum bleeding	Bleeding slowed in 6 hours. Stopped in 3 days
451925	45—F	Chronic myelogenous leukemia	0.16	0.14	45	31	80	300 000	4.5 mgm/kgm toluidine blue and protamine	Bleeding from tooth sockets post extraction. Marked fibrinolysis	Required 1800 ml. of whole blood. Bleeding slowed in about 6 hrs. Stopped in 24 hours
Group C. Irradiation											
423054	40—F	Cancer of breast radio-phosphorous (P <sup>32</sup> ) therapy	0.18	0.16	30	—	100	100 000	6.0 mgm/kgm toluidine blue every 2 days X 6	Oral bleeding and leg petechiae	Oral bleeding stopped no fresh petechiae 6 hours
J. M.	65—M	Chronic leukemia 150r spray	0.18	0.16	30	15	90	10 000	4.5 mgm/kgm toluidine blue Daily X 5	Bleeding from nose, nasal pharynx and razor cut on chin (transfusions—no effect)	Bleeding less in 12 hr. Slowly ceased in 36 hr. No transfusions during this period
417462	45—F	Cancer of thyroid radio-iodine (I <sup>131</sup> ) therapy	0.16	0.14	20	20	100	—	6.0 mgm/kgm toluidine blue irregularly	Gross hematuria 7 wks following last isotope treatment. Recurrence in 2 wks	Initial hematuria stopped 12 hours after toluidine blue injection. Second episode stopped in 24 hours

# ALLEN ET AL ABNORMAL BLEEDING—II

## TABLE II—SUMMARY OF LABORATORY AND CLINICAL DATA OF BLEEDING PATIENTS WITH AN INCREASED PROTAMINE TITRATION—CONTINUED

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TABLE II—SUMMARY OF LABORATORY AND CLINICAL DATA OF PATIENTS WITH AN INCREASED PROTAMINE TITRATION—CONTINUED

Patient	Age and sex	Diagnosis	Laboratory Data						Therapy	Manifestations of bleeding	Clinical response and time of response			
			Protamine titration in mgm		Clotting time in min		Pro-thrombin time %	Platelets per cu mm						
			Before therapy	After therapy	Before therapy	After therapy								
Group D Hodgkin's Disease with Nitrogen Mustard Therapy														
1183	44—F	Hodgkin's disease	0 20	0 16	—	—	—	124 000	3 0 mgm./kgm. protamine	Oral bleeding and bleeding from sternal puncture wound (No response to local he-mastasis or trans-fusions)	Bleeding ceased and titration returned toward normal in 3 hours			
395060	28—F	Hodgkin's disease	0 20	0 14	52	60	60	83 000	6 0 mgm./kgm. toluidine blue Daily X 2	Oral bleeding and massive subcutaneous hematomas	Oral bleeding stopped in 12 hours			
409460	37—F	Hodgkin's disease	0 20	0 14	37	27	95	68 000 64 000	6 0 mgm./kgm. toluidine blue Daily X 5	Oral and gingival bleeding with ulcerations Rectal bleedings Many petechiae	Oral bleeding ceased within 24 hours. Rectal bleeding stopped in 48 hours			
435361	58—F	Hodgkin's disease	0 16	0 14	38	23	77	75 000	6 0 mgm./kgm. toluidine blue	Oral bleeding Bloody and tarry stools	Oral bleeding slowed and stopped in 48 hrs			
33179	62—F	Hodgkin's disease	0 16	0 14	105	34	85	19 000	6 0 mgm./kgm. toluidine blue Daily X 8 6 0 mgm./kgm. protamine 4 5 mgm./kgm. protamine irreg thereafter	Aplastic marrow bleed ing from sternal puncture wound Urinary tract bleeding	Sternal marrow bleed ing stopped in 30 hrs. Hematuria started 2nd day and de-creased on 5th day Titration returned to normal Micro-scopic hematuria lasted to the 8th day			
Group E Thrombocytopenia														
M S	30—F	Idiopathic thrombo-cytopenia purpura (Werthof's disease)	0 18	0 14	—	—	—	93 000	4 5 mgm./kgm. toluidine blue 4 5 mgm./kgm. prota mine Daily X 5 every other day to day 10	Vaginal bleeding and nasal bleeding (pregnant)	Within 72 hours, the vaginal bleeding slowed and epistaxis stopped Vaginal bleeding slowly less ened until splenec tomy on day 10 (Aborted post operatively)			
117	56—M	Toxic pan-cytopenia	0 18	0 14	42	29	86	16 000	3 0 mgm./kgm. toluidine blue Daily X 7	Oral bleeding Gross hematuria	Oral bleeding slowed and stopped in 3 days Hematuria stopped in 10 days Titration returned to normal			
235457 (Case 5)	30—F	Atypical thrombo-cytopenia purpura	0 18	0 14	15	15	100	60 000	7 0 mgm./kgm. toluidine blue	Vaginal bleeding of 30 days Petechiae and ecchymosis	After 6 hours the vaginal bleeding stopped No new ecchymosis. There was no effect on the petechiae			
			0 20	0 14	15	15	100	—	7 0 mgm./kgm. toluidine blue Daily X 3	Vaginal bleeding re-summed 2 days after discontinuance of toluidine blue	Bleeding stopped with in 12 hours Further remissions after stop-ping therapy were controlled			
15517 (Case 7)	26—F	Secondary thrombo-cytopenia purpura	0 18	0 18	—	—	—	100	6 0 mgm./kgm. toluidine blue 4 5 mgm./kgm. protamine	Vaginal bleeding of 20 days. Easy bruising	Spotting after prota mine Stopped within 14 hours after tolu-dine blue			
			0 18	0 14	—	—	—	85 000	6 0 mgm./kgm. toluidine blue	No bleeding	Titration returned to normal Stopped within 7 hours			
			0 18	0 14	50	32	—	15 000	4 5 mgm./kgm. protamine	Recurrent vaginal bleeding				
			0 18	—	53	—	100	—	6 0 mgm./kgm. toluidine blue	Vaginal bleed ing Signs of intracranial bleed ing	Died of intracranial hemorrhage. Had re-ceived no therapy for 2 days preceding terminal stage			

followed by one whole blood transfusion. Bleeding again stopped. The same toluidine blue dose was again given June 30 and July 1. The protamine titration promptly returned to normal until July 4, when it was increased to 0.200 milligram July 5, with bleeding continuing, 7 milligrams of toluidine blue per kilogram of body weight and 500 cubic centimeters of blood were given, and bleeding stopped. Splenectomy was performed on July 6. The immediate preoperative protamine titration was normal, 4 hours after operation it increased to 0.180 milligram and 7 milligrams of toluidine blue per kilogram of body weight were given later in the day. The following day the titration was decreased to 0.160 milligram but, because the platelet count was normal (340,000), no more dye was given. The titration returned to normal on July 9, the third postoperative day. Abnormal bleeding did not recur, the Rumpel-Leede test returned to normal, the bleeding time was 3 minutes. These tests, including the protamine titration, have continued normal to date (7 months).

The diagnosis of idiopathic thrombocytopenic purpura in this patient was based upon thrombocytopenia and marrow studies in which no platelets were seen in spite of numerous megakaryocytes. The fact that the history of bleeding antedated the thrombocytopenia by so many years raises the question as to the basic disturbance. An agnogenic clotting defect was described in this patient 8 years ago (5). This was demonstrated on recalcification of plasma and the addition of extreme dilutions of thromboplastin. It may be that the original plasma clotting defect and the thrombocytopenia which developed later were independent phenomena or that there were a cause and effect relationship not otherwise understood.

CASE 6 (Table IV). This patient suffered from idiopathic thrombocytopenic purpura without any increase in the protamine titration and did not respond to toluidine blue therapy. This patient was a 28 year old male who was admitted to Billings Hospital. He was troubled with epistaxis and cutaneous petechial hemorrhages most marked over the legs. The spleen was not palpable. Laboratory findings showed no anemia but thrombocytopenia was present, varying from 35,000 to 100,000 platelets per cubic millimeter. The leucocyte count was 8,500, the differential count was normal. The bleeding time was moderately prolonged up to 24 minutes but the whole blood clotting time was normal. The protamine titrations were normal on 5 occasions. The sternal marrow disclosed no free platelets, although the megakaryocytes were normal in number. The diagnosis of Werlhof's disease was made.

The patient was given toluidine blue on 4 occasions with no effect on petechiae formation as measured by the Rumpel-Leede test before and 12 hours after dye administration. Splenectomy was performed and the platelet count responded rapidly, reaching 200,000 within 24 hours. The Rumpel-Leede test was negative when tested 4 days after splenectomy. One week after operation the sternal marrow contained large numbers of platelets in and around the megakaryocytes (normal). The patient is asymptomatic with a normal platelet count 5 months after splenectomy.

CASE 7 (Table II). A 28 year old white female, was admitted to Billings Hospital September 30, 1948, with the chief complaints of easy bruising and intermittent vaginal bleeding for 5 weeks. She stated that she had been well until August, 1948, when she noted the spontaneous appearance of small red spots and bruises on her skin. Her menstrual period at this time was exceptionally heavy. The flow continued and she was admitted to another hospital September 10. There she received six blood transfusions with no effect on her bleeding. Her protamine titration at this time was increased to 0.180 milligram of protamine. She was given 4.5 milligrams per kilogram of body weight of protamine sulfate and 24 hours later she was only spotting. She was then given 6 milligrams per kilogram of body weight of toluidine blue and the vaginal bleeding stopped. The protamine titration returned to normal. Clotting times were not done at this time. She continued to show petechiae. The stools remained positive for blood. On September 21, 5 days after discontinuing toluidine blue therapy, she began bleeding vaginally and continued until admitted to Billings Hospital on September 30. Numerous hemorrhages were present in the eye grounds and in the mucous membranes of the mouth. There was no nasal or oral bleeding.

The urine contained many red blood cells. The erythrocyte count was 2,020,000 per cubic millimeter. The hemoglobin was 8.5 grams per cent. The leucocyte count was 1,900 per cubic millimeter. The differential leucocyte count showed 76 per cent small lymphocytes and 18 per cent neutrophils. Normoblasts were present in the peripheral blood. The thrombocyte count was 15,000 per cubic millimeter. Prothrombin activity was normal, the protamine titration was 0.180 milligram and the whole blood clotting time was 50 minutes. The bone marrow showed absence of platelets and megakaryocytes.

On the evening of admission she was given 4.5 milligrams per kilogram body weight of protamine sulfate intravenously. The vaginal flow stopped within 12 hours and the protamine titration returned to normal. A single daily dose of 2.5 milligrams per kilogram of protamine sulfate was given for 5 days. The bleeding was controlled and the clotting studies remained normal until the fifth day when the titration suddenly increased to 0.180 milligram and the clotting time increased to 53 minutes. On the sixth day vaginal bleeding resumed and new ecchymoses

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appeared. She refused toluidine blue because of nausea. The following day (7th hospital day), she complained of severe headache and nuchal rigidity was demonstrated. She became comatose several hours later, and, despite whole blood transfusions, protamine sulfate, toluidine blue, and hypertonic glucose, she became progressively worse and died 18 hours later.

At autopsy massive intracranial hemorrhage, hemorrhagic gastroenteritis, and about 100 milliliters of free blood in the peritoneal cavity (probably from a ruptured hemorrhagic ovarian cyst) were found. Blood drawn at the time of death showed a complete absence of fibrinogen. The patient's blood lysed normal blood clots in dilution of 1 part patient's blood to 9 parts normal blood.

CASE 8 (Table III). A 38 year old white female, had carcinoma of the breast with metastases to the ribs, spine, and pelvis. During a period of 4 months, she received repeated heavy doses of x-ray (an original 5000 r and then 2400 r to each of four involved bony areas). One month after the last dose, bleeding occurred about the mouth, especially from the lips and the tongue. There were large submucosal hematomas which threatened occlusion of the respiratory and alimentary tracts. At this time the platelet count was 10,000 per cubic millimeters and the leukocyte count was 800. Numerous blood transfusions, vitamin K, vitamin C and rutin failed to check the bleeding.

Toluidine blue (60 mgm per kgm) was given daily for 5 days. Bleeding stopped a few hours after the first injection and the hematomas began to organize. Five days after discontinuing therapy bleeding returned. She was then given on alternate days 60 milligrams per kilogram of toluidine blue and 60 milligrams per kilogram of protamine sulfate for 2 weeks. The bleeding stopped and sloughs disappeared. No further bleeding occurred to the time of her death 6 weeks later from carcinomatosis.

Table III lists a group of bleeding patients with a clinical response to toluidine blue and protamine sulfate. Laboratory data were incomplete or obtained early in the study and were not suitable for comparative purposes.

Table IV lists a group of bleeding patients with little or no clinical response. Many of these patients demonstrate the failure of therapy when the titration was normal. Some of these received inadequate therapy by present standards. Patient B R I is notable as a complete failure on routine therapy, however, the abnormal protamine titration was likewise unaffected. This failure was not understood and based on the studies of other patients, some response was expected.

Table V presents clotting studies and platelet counts on a group of patients with a variety

of disorders. The lack of association of thrombocytopenia with the protamine titration is again demonstrated. Of 11 patients with idiopathic thrombocytopenic purpura, 6 had normal protamine titrations. One patient, Case 5, with an abnormal titration, had fairly good though incomplete clinical response to toluidine blue and protamine. Four bleeding patients with normal protamine titrations had no response to therapy. Three other bleeding patients had some clinical response to therapy, but in none was the response sufficient to warrant withholding splenectomy.

Clotting factor deficiencies, as in hemophilia and prothrombin deficiency (dicumarol therapy) produce abnormalities in the titration only in so far as they prevent clot formation, the end-point. These disorders can be recognized with other tests, and they do not respond to toluidine blue and protamine therapy.

### TOLUIDINE BLUE AND PROTAMINE SULFATE ADMINISTRATION

The factors responsible for the increased protamine titration and prolonged clotting time persist for varying periods of time. Successful therapy should afford adequate and continuous control of bleeding as long as they contribute to bleeding. In most instances the resultant defects appear to be temporarily controlled by adequate toluidine blue for 12 to 36 hours. The action of protamine sulfate was much shorter, probably less than 2 hours, and was less efficient than toluidine blue in patients whose hemorrhagic disease was complicated by other blood disorders. In the profusely bleeding patient the simultaneous administration of protamine sulfate with toluidine blue was used to take advantage of the faster initial action of protamine.

The amount of toluidine blue required to control bleeding and to restore the protamine titration to normal varied considerably in different patients. The extent to which the protamine titration was increased did not prove indicative of the toluidine blue requirement. However, a return to normal of the titration paralleled clinical improvement from the standpoint of hemorrhage in most patients.

The following therapeutic regimen is currently employed. During the first 3 days, a

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TABLE III.—THERAPEUTIC AND CLINICAL DATA ON A FURTHER GROUP OF PATIENTS

Patient	Age and sex	Diagnosis	Therapy	Manifestations of bleeding	Clinical response
L.A.U.	2½—F	Acute monocytic leucemia	3.0 mgm./kgm. toluidine blue 2.0 mgm./kgm. toluidine blue Daily X 7	Oral, lip, gum, and cheek bleeding which did not respond to blood transfusions, vitamins C and K or rutin. Skin petechiae	Bleeding about the mouth stopped within a few hours. No new petechiae. Repair of ulcerations took 10 days
L.U.S.	49—F	Acute myelogenous leucemia	1.0 to 3.0 mgm./kgm. (varying dosage) toluidine blue Daily X 4	Oral bleeding making basin under chin necessary. Did not respond to blood transfusions, vitamins C and K, rutin or calcium gluconate	Bleeding cleared within 1 to 3 hours after 3.0 mgm./kgm. of toluidine blue. Lower doses allowed recurrences which immediately responded to the 3.0 mgm./kgm. dose
I.P.D.	5—F	Acute stem cell leucemia	2.5 mgm./kgm. toluidine blue Daily X 2	Bleeding from mouth, nose and eyes. Hematuria	Diminution of bleeding from eyes, nose and mouth. No effect on hematuria. Note low dose and short period of therapy
A.L.R.	23—M	Acute lymphatic leucemia	6.0 mgm./kgm. toluidine blue	Severe oral bleeding	Bleeding stopped 3 hours after single dose of toluidine blue. Pt. died in 2 days. Autopsy showed no hemorrhage
M.S. Case 8	38—F	Metastatic breast carcinoma. Irradiation 5000 r to skull ribs 2400 r to pelvis and lumbar spine	6.0 mgm./kgm. toluidine blue Daily X 5 No therapy—5 days 6.0 mgm./kgm. toluidine blue and protamine, alternate days X 5	Bleeding from gums, cheeks and tongue with massive submucosal hemorrhages threatening to close off respiratory and alimentary tracts. Bleeding of gums and cheeks recurred after 5 days of no therapy	Bleeding controlled within 2 days and ulcerations cleared within 4 days of initial therapy. Bleeding cleared within 2 days of second period of therapy
P.E.R.	27—F	Chronic pyelonephritis and uremia	6.0 mgm./kgm. toluidine blue	Vaginal bleeding and pressure cuff on arm produced petechiae	Vaginal bleeding stopped within 12 hours. Pressure cuff negative. No further bleeding
J.A.R.	34—M	Chronic glomerulonephritis and uremia	4.5 mgm./kgm. toluidine blue	Severe nasal bleeding	Nasal bleeding stopped within 24 hours. Single dose of dye. Excretion was slow
C.H.R.	41—F	Idiopathic thrombocytopenia purpura (Werthof's disease)	2.5 mgm./kgm. toluidine blue every other day X 6 Single dose 1 wk. later	Oral bleeding of 8 months' duration. Many petechiae over extremities. Recurrence while off therapy. Refused treatment, died of intracranial hemorrhage	Oral bleeding stopped after each period of therapy. No new petechiae appeared
H.O.L.	10—F	Idiopathic thrombocytopenia purpura (Werthof's disease)	3.0 mgm./kgm. toluidine blue Daily X 4	Spontaneous petechiae. Bleeding from gums	Gum bleeding stopped and spontaneous petechiae decreased
O.A.K.	22—F	Idiopathic thrombocytopenia purpura (Werthof's disease)	2.0 mgm./kgm. toluidine blue irregularly	(Postsplenectomy) Showers of petechiae. No change with transfusions. Menorrhagia requiring hysterectomy	At various intervals there was suppression of petechiae formation after toluidine blue therapy in the presence of a decreasing platelet count. This low dosage failed to alter menstrual flow

daily intravenous dose of toluidine blue of 7 to 10 milligrams per kilogram of body weight is given regardless of the clinical response. If bleeding is not controlled, this dosage is continued for a total of 6 days. If after the third day the titration has returned to normal, the dosage is cut in half and this reduced dose is given daily on the fourth, fifth, and sixth days. Thereafter, it is administered when the protamine titration increases. This dosage schedule is followed in both children and adults.

Toluidine blue was prepared from the powder as a 1 gram per cent aqueous solution and was sterilized by Seitz filtration. This procedure served not only to sterilize but also to remove particulate matter. It was not auto-

claved. The amount required for each patient was pipetted into 500 milliliters of normal saline and was administered intravenously over a period of 2 to 3 hours.

Protamine sulfate was administered intravenously in 200 to 300 milliliters of normal saline over a period of not less than 40 minutes, because some anaphylactoid reaction may occur with rapid administration.

Reaction to toluidine blue thus far has been limited to brief periods of nausea and vomiting in about 15 per cent of our patients. Patients who developed these symptoms on one occasion frequently failed to have them on subsequent doses and vice versa. Protamine sulfate produced occasional headache and flushing.

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TABLE IV—SUMMARY OF LABORATORY AND CLINICAL DATA ON BLEEDING PATIENTS WITH LITTLE OR NO RESPONSE TO TOLUIDINE BLUE AND/OR PROTAMINE SULFATE THERAPY

Patient	Age and sex	Diagnosis	Protamine titration in mgm		Clotting time in min		Prothrombin time %	Platelets per cu.mm				
			Before therapy	After therapy	Before therapy	After therapy						
SUT (Case 6)	28-M	Idiopathic thrombocytopenia purpura (Werlhof's disease)	0 14	0 14	28	31	90	40 000	60 mgm./kgm. toluidine blue X 4 irreg	Showers of petechiae	No effect	
HAN	13-F	Idiopathic thrombocytopenia purpura (Werlhof's disease)	0 14	0 14	—	—	—	100	3 000	30 mgm./kgm. toluidine blue	Numerous petechiae Vaginal bleeding	No effect. Splenectomy performed—bleeding stopped
MOR	26-F	Idiopathic thrombocytopenia purpura (Werlhof's disease)	0 14	0 14	—	18	18	100	168 000	1 mgm./kgm. toluidine blue 2 times wkly for period of 2 mo	Showers of petechiae. Vaginal bleeding	Petechiae were controlled during dye therapy, but would recur Vaginal bleeding controlled only one time
YOU	28-F	Idiopathic thrombocytopenia purpura (Werlhof's disease)	0 14	—	—	42	—	72	66 000	4.5 mgm./kgm. protamine	Many petechiae. Vaginal bleeding 5000 ml. Blood had no effect.	No effect from protamine. Splenectomy done
SKY	30-F	Thrombocytopenia purpura	0 14	—	—	—	—	—	60 000	30 mgm./kgm. toluidine blue	Purpura oral bleeding and ulceration vaginal bleeding	No effect
SPE	8-M	Hemophilia	0 20	0 20	—	—	—	—	—	30 mgm./kgm. protamine	Hematoma in neck and under tongue	No effect no change in titration
RPB	51-M	Chronic myelogenous leukemia	—	—	—	—	—	—	2 000	1 mgm./kgm. toluidine blue	Mild gum bleeding for 1 mo severe for 7 days	No effect from single small dose
PET	26-F	Mycosis fungoides	0 20	0 20	—	—	—	—	78 000	30 mgm./kgm. toluidine blue	Oral bleeding Bleeding from needle puncture sites Subcutaneous hematomas	No effect from single small dose
WIL	48-F	Aplastic anemia	—	—	—	—	—	—	20 000	0.5 to 1.5 mgm./kgm. toluidine blue irregularly	Oral bleeding	Complete but temporary control of bleeding after each administration of dye. Short period and low dosage
BRI	40-M	Lymphoma	0 18	0 18	42	60	80	26 000	60 mgm./kgm. toluidine blue	Severe nasal bleeding unaffected by transfusions Hematuria	No effect on the bleeding Titration unaffected	
			0 18	0 18	25	39	75	28 000	60 mgm./kgm. toluidine blue	Hematuria losing 100 to 200 c.c. of blood every 3 hours. Irregular nasal bleeding	No effect Titration unaffected	

stances which are more physiologic than toluidine blue may be equally effective, such as gelatin (i)

DISCUSSION

the data herein

Intramuscular protamine produced some local pain, similar to that seen on intramuscular administration of free penicillin. These doses do not relate to the therapeutic control of hemorrhage from overheparinization. Current studies indicate that other sub-

stances which are more physiologic than toluidine blue may be equally effective, such as gelatin (1)

DISCUSSION

In connection with the data herein presented, the work of Astrup and Volkert (11,



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TABLE V—CLOTTING STUDIES AND PLATELET COUNTS IN VARIOUS PATHOLOGIC STATES

Patient	Diagnosis	Pro- tamine titration in mgm	Clot ting time in minutes	Pro- throm- bin time— %	Plate lets
EV	Werthof's	0.14	23	100	90 000
NB	Werthof's	0.20		100	44 000
BI	Werthof's	0.14		100	96 000
SAR	Hypersplenism presplenectomy 24 hrs post splenectomy 7 days post splenectomy	0.18 0.16 0.14		100	54 000 418 000 448 000
FEO	Endometriosis Easy bruising	0.14	16	100	108 000
POL	Easy bruising	0.14	25	100	243 000
JP	Easy bruising	0.14		100	
JAN	Hemophilia	>0.20	23		
STE	Hemophilia	>0.20	128		
7UL	Hemophilia	>0.20	270	100	
JS	Hemophilia	>0.20 0.32	167 260	100 100	
DOY	Hemophilia	0.18 >0.20 >0.20	58 99 195	100 100	204 000
RA	Hemophilia	>0.20	180	97	280 000
GS	Hemophilia	>0.20	120	86	250 000
RO	Thrombophlebitis dicoumarol Rx	>0.20	63	100	
BOS	Thrombophlebitis dicoumarol Rx	>0.20	150	10	
HAR	Thrombophlebitis	0.14	51	86	
LEN	Thrombophlebitis	0.14	18	95	190 000
LW	Thrombophlebitis	0.14	37	56	
MIC	Chronic nephritis uremia	0.18	12	100	
MO	Chronic nephritis uremia	0.18	14	95	12 000
BAR	Giant urticaria and edema	0.14	40	87	
WS	Hodgkin's with nitrogen mustard 10 days before	0.14	15		
UC	Postirradiation	0.14	10	97	58 000
AL	Lupus erythema- tosis	0.14	35	96	157 000
B	Erythroblastosis 24 hrs postpartum 30 hrs postpartum	0.14 >0.0	30 15 Incoag	100	(Blood not checked for presence of fibrinogen or prothrombin)

is of interest. They have demonstrated an increased antithrombin titer in 11 of 26 patients with acute leucemia and in certain other cases. Minot and Denny reported a similar finding in 1 case of splenomegaly and leucemia.

Castex more recently reported on 5 patients with "pseudohemophilia" who had prolonged clotting times, which were shortened but not always returned to normal when protamine sulfate was given.

The bloods of these patients are much more susceptible than normal to the effect of added heparin (2). This decreased tolerance is due primarily to the decreased thromboplastin associated with thrombocytopenia, as indicated by Howell (9) in 1917. However, bloods with reduced prothrombin activity are also more sensitive to the effects of added heparin (1). The protamine titration has been made sufficiently insensitive so that the effects of moderate prothrombin deficiency, heparinization as therapeutically employed, and thrombocytopenia were not in themselves capable of increasing the titration in otherwise normal blood.

The clinical response of these patients to toluidine blue and protamine sulfate does not necessarily imply that these agents are reacting with human heparin. Both of these agents are basic compounds containing amino groups and are capable of reacting with other compounds, many of which are normal body constituents, and some of which are not even heparin-like.

The therapeutic response appeared to be limited to the extent that this clotting defect contributed to the over-all hemorrhagic picture. Good and apparently permanent correction of the hemorrhagic state occurred in the patients listed in Table I. In this group the only detectable abnormalities were the increased protamine titration and the prolonged whole blood clotting time, except for fibrinolysis and moderate prothrombin deficiency as shown in Case 2. Temporary and slower responses occurred in the complicated hemorrhagic states listed in Tables II and III. In these patients, when ulcerations were present, the response was slow and often incomplete, this, presumably, was due to local infection, thrombocytopenia, vascular injury, and continued trauma.

Aminopterin in excessive amounts produces an ulcerative and hemorrhagic enteritis in the normal animal (1). This intestinal bleeding, like that of ulcerative colitis, is primarily local in origin, and neither of these drugs

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sponds to toluidine blue Aminopterin therapy also increases the protamine titration and usually prolongs the whole blood clotting time in the normal dog, this process is reversible with toluidine blue

The prolonged clotting time, increased protamine titration, thrombocytopenia and vascular defect in leucemia, and perhaps in certain other disorders, are probably dependent upon a common defect(s), the nature of which is not known

The vascular disturbance was probably the most important single defect in the patients listed in Tables II, III, and IV Petechiae as well as ecchymoses were prominent features in most of these hemorrhagic disorders While the vascular disorder may be exaggerated by changes in the clotting mechanism, it is probably independent of the prolonged clotting time, because hemophilia and severe prothrombin deficiency with lengthened clotting times do not characteristically produce petechiae

In a previous report (2) the fact that subcutaneous extravasation of blood was lessened in some cases led us to the erroneous conclusion that toluidine blue improved the vascular defect Any improvement in spontaneous petechiae formation appears due to changes in the clotting mechanism and not in the vascular wall Consequently, hemorrhage from vascular defects can be expected to occur and may be disastrous in the case of intracranial hemorrhage, even though toluidine blue has been given and the clotting defects returned to normal

Toluidine blue and protamine sulfate therapy proved to be of definite value in properly selected cases In a few instances it may have prolonged the life of the patient In others it gave palliative relief and lessened the amount of nursing attention required Its use in properly studied patients will not only lead to poor clinical results, but may cause withholding from the patient other forms of indicated therapy that might be life-saving This is es-

pecially true in idiopathic thrombocytopenic purpura where splenectomy is the treatment of choice and these agents are only of value in the occasional patient

## SUMMARY

1 A clotting defect is described which is similar but not identical with that produced by the intravenous injection of commercial beef heparin It is characterized by an increased protamine titration

2 The clotting defect was found in frequent association with thrombocytopenia and vascular disorders, but these associations apparently were not ones of cause and effect

3 The defect was found in a variety of diseases, many of which were severe disorders of the hematopoietic system It also occurred when no hemocytologic or coagulation disorder could be recognized

4 The defect usually responded to toluidine blue and protamine sulfate administration Clinical bleeding was influenced only to a degree commensurate with the importance of the plasma defect in the overall picture

5 The methods of administering toluidine blue and protamine sulfate are presented

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# EXTENSION OF PRIMARY NEOPLASMS OF BONE TO BONE MARROW

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GROSS, in 1879, in his classical paper on bone sarcomas said, "From a practical point of view, it should be remembered that the medulla may be affected not only at the immediate seat of the tumor but at some distance beyond. When it is remembered that not only the soft parts and corresponding portion of the medulla of the bone around which the tumor is seated are liable to be invaded by the morbid product, but that nodules of sarcomatous tissue may exist in the medullary canal at some distance from the original growth, the line of practice to be followed in the periosteal sarcomas is to amputate as far as possible from the seat of the disease as may be consistent with the patient's safety." Since this statement by Gross, many other authors have reported the observance of medullary extension from various types of primary osseous neoplasms and some have taken note of this medullary extension in their discussions of the treatment of bone tumors. However, a search of the literature revealed no evidence of a primary study of the characteristics of extension to bone marrow as displayed by the various individual neoplasms of bone. Accordingly it was decided to study this problem and also the relationship of medullary extension to prognosis, diagnosis, and treatment in various primary tumors of bone.

## MATERIALS AND METHODS

The following primary neoplasms of bone were studied: osteogenic sarcomas, Ewing's tumors, and primary chondrosarcomas. The myeloma series of bone neoplasms was not

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studied because it is well known that a diffuse involvement of the bone marrow is usually present and also because of the lack of proper material for study since amputation is rarely performed in these cases. Study of the vascular neoplasms of bones was confined to Ewing's tumor or malignant hemangioendothelioma of bone (Broders' classification). Although periosteal fibrosarcomas are known to invade the medullary cavity secondarily, they are not a primary neoplasm of bone and were not included in this study. The so-called endosteal fibrosarcomas have been classified as fibroblastic types of osteogenic sarcoma and will be discussed under this heading. The controversial malignant giant-cell sarcoma was not studied. No case of liposarcoma, reticulum-cell sarcoma, lymphosarcoma, erythroblastoma, chloroma, or adamantinoma was included either because of its rarity or obvious behavior as regards bone marrow extension. Metastatic lesions of bone were not considered.

The tumors selected for study were located in the long bones of the extremity. Material was obtained from extremities amputated prior to death in all cases. The basis for selection was that the tumor be located in a long bone and that the entire extent of the amputated specimen had been suitably preserved. Unfortunately many specimens had been ruined for purposes of this study by the distal dissection of bone and soft tissue proximal and distal to the lesion in order to conserve storage space, or by the longitudinal sectioning of the bone which had allowed disintegration of the bone marrow. The actual location of the tumor in the long bone, site of amputation, period of survival, grade of malignancy, or in the cases of osteogenic sarcoma, the predominant cell type, were not factors considered in the selection of specimens but were considered as the study progressed. Our study

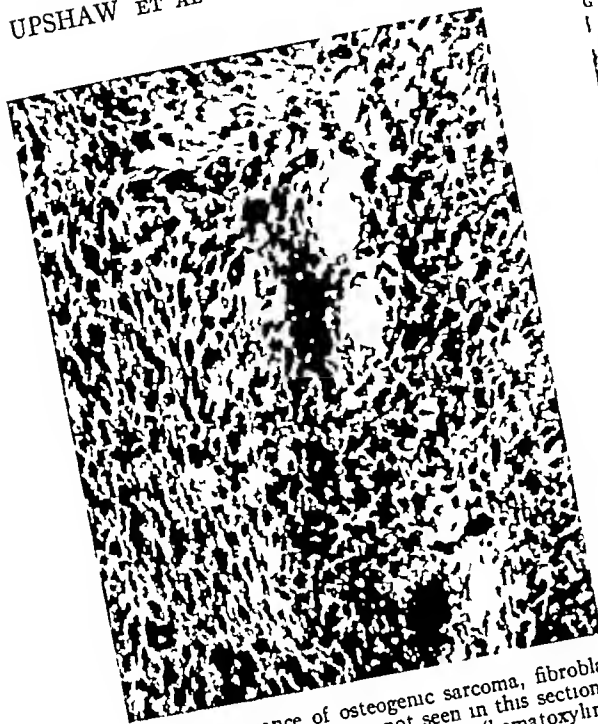


Fig 1 Appearance of osteogenic sarcoma, fibroblastic type. New bone formation is not seen in this section but was present in other areas of the tumor (hematoxylin and eosin,  $\times 160$ )



Fig 2 Osteogenic sarcoma, chondroblastic type. The predominance of cartilage cells and hyaline matrix with new bone formation is characteristic of the chondroblastic type of osteogenic sarcoma (hematoxylin and eosin,  $\times 80$ )

gross and microscopic examinations of the bone marrow in specimens available in 50 cases of osteogenic sarcoma, 20 of Ewing's tumor, and 5 of primary chondrosarcoma. In each, the soft tissue was dissected from the bone containing the lesion and the limits of cortical involvement as seen grossly were measured carefully and recorded. The remainder of the bone was then examined for evidence of medullary extension past the confines of the cortical involvement. The gross features indicating involvement of the bone marrow were noted and the amount of medullary extension as seen grossly past the confines of cortical involvement were measured carefully and recorded.

Specimens were taken from the bone marrow for microscopic study at regular short intervals throughout the length of the bone containing the lesion, and the location of each specimen with regard to the bone and to the gross confines of the cortical and medullary lesion was noted. Slides were made from these specimens and these were examined. The

limits of medullary involvement were determined by microscopic study. Slides of the main lesion also were examined and the type of neoplasm and grade of malignancy were established carefully. Only Ewing's tumors were not graded.

Osteogenic sarcomas were divided into the subtypes of fibroblastic, chondroblastic, or osteoblastic on the basis of the predominant cell appearing in the lesion. In most cases all three types of cells could be demonstrated, but in every instance, one of the three types of cells was predominant and determined the type of osteogenic sarcoma. While the basis for classification of the fibroblastic (Fig 1) and chondroblastic (Fig 2) groups is evident, some explanation may be due in regard to the cases placed in the osteoblastic (Fig 3) group. The osteoblastic group was characterized by a histologic picture showing myriads of osteoblasts, new bone spicules, an osteomucoid or osteoid matrix, and anastomosing trabeculae of well formed bone, the picture predominantly was that of osteoblastic or bone-forming

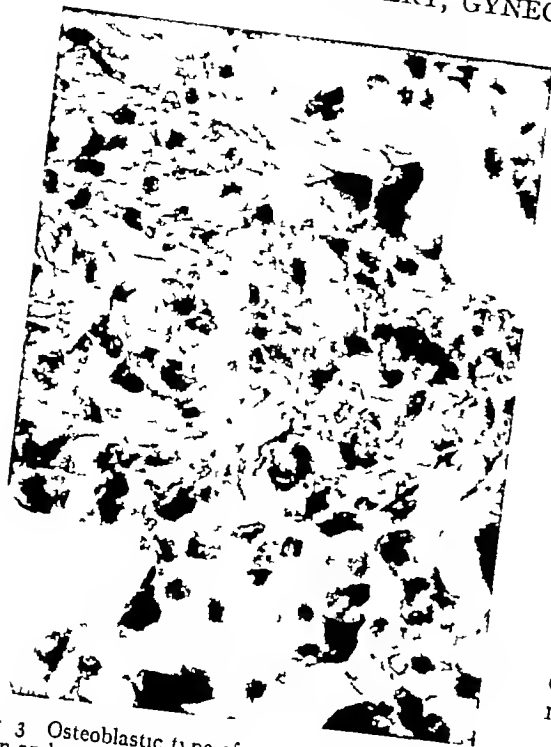


Fig 3 Osteoblastic type of osteogenic sarcoma (hematoxylin and eosin,  $\times 310$ )

activity This classification is not original with us, having first been described in 1943 by MacDonald and Budd, and prior to these authors' paper, Simmons made a similar classification of the osteogenic sarcomas, in which he divided them into fibroblastic, chondroblastic, and anaplastic varieties. The reasons for the division of the osteogenic sarcomas into these three predominant cell types was to see whether the characteristics of medullary extension differed in the three types. That there is a definite difference in the prognosis in the osteosarcomas of various cell types and that osteoblastic or "osteosarcoma" described by MacDonald and Budd has the worst prognosis, had been well established by these authors before our study was begun.

In an attempt to determine whether or not there was any correlation between the location of the primary lesion and its tendency toward medullary extension, the amounts of medullary extension exhibited by tumors located in the lower part of the tibia or fibula, upper part of the tibia or fibula, lower part of the femur, upper part of the femur, lower part of the

radius or ulna, upper part of the radius or ulna, lower part of the humerus, and upper part of the humerus were compared for each of these bones.

The grade of malignancy was compared with the amount or extent of medullary extension in each of the cases of osteogenic sarcoma and chondrosarcoma in order to determine whether there was any relation between the grade of malignancy and the tendency toward bone marrow invasion. Ewing's tumors as said previously were not graded.

The limits of medullary involvement as seen on the preoperative roentgenograms were measured as accurately as possible and compared to the amount of extension found by gross and microscopic study of the medullary cavity of the specimen. The roentgenograms had been discarded in some of the earlier cases so that this comparison was not entirely complete but fortunately could be made in the majority of the cases.

Follow-up data were obtained in most of the cases. The following facts were ascertained as completely as possible for each patient: period of survival after amputation, if the patient was deceased, the date and cause of death were obtained, if he was living, evidence indicative of metastasis was sought. After these facts were obtained, an attempt was made to correlate neoplastic medullary extension with survival rate in each of the types and subtypes of neoplasm studied. The end results obtained in cases in which amputation had been performed across the bone containing the lesion were compared to the end results in cases in which the extremity had been removed by disarticulation of the joint or amputation across the bone proximal to the bone containing the lesion; this comparison was made in the cases of osteogenic sarcoma, Ewing's tumor, and chondrosarcoma, respectively.

The final portion of this work consisted of a statistical study of a separate group of cases of osteogenic sarcoma in an attempt to determine whether some of the observations made in the 50 cases of osteogenic sarcoma selected for the primary study were statistically significant. In the original cases of osteogenic sarcoma studied, it was found that when am-

putation had been carried out through the next higher bone or joint above the bone containing the lesion a higher percentage of patients survived for 5 years than did the group in which amputation was across the bone containing the lesion. Accordingly, it was decided to determine whether or not a larger series of cases would give similar results. The records in all cases of osteogenic sarcoma encountered at the Mayo Clinic between the years 1910 and 1935 were examined and all cases satisfying the following criteria were chosen for study. The lesion had been located in the humerus, radius, ulna, femur, tibia, or fibula, treatment had been amputation of the extremity, and finally complete follow-up history was available. Cases in which metastatic lesions were known to be present before operation were excluded. Ninety-five cases were found to satisfy these conditions, 7 of which had been included in the primary study. The remaining 88 cases were divided according to whether amputation had been by transection through the bone containing the lesion or by disarticulation of the proximal joint or amputation through the bone proximal to the bone containing the lesion. The survival rates in these two groups of cases were then compared.

#### FINDINGS

The gross appearance of the neoplastic involvement of the medullary cavity was similar to that of the principal lesions in almost all cases. For example, in the chondroblastic types of osteogenic sarcoma, the medullary lesion was of an osteocartilaginous nature. The variations in gross appearance of these tumors has been described at length in several textbooks and our observations corresponded with these previous descriptions. In the osteogenic sarcoma the entire circumference of the bone marrow was usually grossly involved at the point of the principal or cortical lesion, while as one progressed away from this point, medullary extension, if it occurred, tended to be along one wall or segment of the circumference of the medullary canal. The medullary extension occurring in the fibroblastic type of osteogenic sarcoma was particularly likely to spread in this manner, a small tongue-like projection being seen along one wall for several inches in

some cases. In the osteogenic sarcomas gross medullary extension was usually easy to see if it occurred, the neoplastic tissue being sharply delineated from the normal bone marrow. Medullary extension seen in Ewing's tumors was diffuse, involving the entire diameter of the medullary canal as it progressed away from the main lesion. The extension of Ewing's tumor was always of a soft, vascular nature without definite borders, and the extent of medullary involvement was difficult to determine grossly as tumor tissue faded indefinitely into normal bone marrow. The primary chondrosarcomas observed failed to exhibit any medullary extension that could be discerned by gross or microscopic examination. In all the cases studied regardless of type, the cartilaginous epiphyseal plate was noted to present an effective barrier to neoplastic extension, erosion and extension through this structure being seen only infrequently.

The microscopic appearance of neoplastic extension was the same as that of the main lesion, even the smallest microscopic projections usually exhibited the morphologic and cellular characteristics of the principal lesion. A tendency for the neoplastic cells to extend along one segment of the endosteal surface of the cortex was noted in the osteogenic sarcoma on microscopic, just as in gross, examination. In these cases, a search for malignant cells made about the periphery or circumference of the bone marrow yielded much better results than a search of the central portion, as extension was rarely seen in the central area without finding it at the periphery of the bone marrow next to the cortex for an even greater distance away from the principal lesion. In Ewing's tumor, medullary extension, being of a diffuse character, was likely to be seen all through or in any part of a cross section of the bone marrow. Invasion of, and extension along, the haversian canals in the cortex was noted in many instances, particularly in Ewing's tumors, but in no case was extension in a haversian canal found to exceed medullary extension in distance from the principal lesion. Some tendency for the lesion to extend along the outside of blood vessels was noted, particularly in the fibroblastic type of osteogenic sarcoma. In some instances plugs of tumor



Fig 4 Osteoblastic type of osteogenic sarcoma of the lower part of the femur with roentgenologic evidence of medullary involvement extending only to the midshaft

tissue were seen inside blood vessels in the bone marrow and accounted for one of the sources of distant metastasis found in primary sarcoma of bone. No barrier inhibiting medullary extension, such as a fibrous wall or capsule, was found in any specimen studied.

In all cases studied regardless of type or subtype, direct extension was responsible for medullary involvement. In no cases could a defect in the continuity of the medullary neoplastic progression away from the principal

TABLE I — AMOUNT OF MEDULLARY EXTENSION FOUND IN CASES OF OSTEOGENIC SARCOMA

Medullary extension	Cases	Per cent
Beyond cortical lesion		
1 to 3 inches (gross + microscopic evidence)	10	20
3 inches or more (gross + microscopic evidence)	10	20
None found	30	60
Total	50	100

TABLE II — AMOUNT OF MEDULLARY EXTENSION FOUND IN THE PREDOMINANT CELL TYPES OF OSTEOGENIC SARCOMA

Medullary extension	Predominant cell type					
	Fibroblastic		Chondroblastic		Osteoblastic	
	Cases	Per cent	Cases	Per cent	Cases	Per cent
Gross + microscopic evidence						
1 to 3 inches	13	39	3	43	4	40
3 inches or more	6	18	0		4	40
No medullary extension	14	43	4	57	2	20
Total	33	100	7	100	10	100

lesion be definitely established either by gross or microscopic examination of the bone marrow.

In regard to the actual amount of extension (Table I) one-fifth of the osteogenic sarcomas studied revealed pronounced extension in the bone marrow varying from 3 inches (7.6 cm) past the limits of the cortical lesion to an involvement of the entire shaft. In another fifth of the cases extension of 1 to 3 inches (2.5 to 7.6 cm) was present and in the remaining three-fifths no medullary extension could be demonstrated. On microscopic examination medullary extension of 3 inches or more past any evidence of the lesion as seen grossly was found in 18 per cent of cases. Of the osteogenic sarcomas (Table II) the osteoblastic type showed the greatest tendency, the fibroblastic type the next to greatest, and the chondroblastic type the least tendency to medullary extension. Ewing's tumors displayed a greater tendency to extension to the bone marrow than either the osteogenic sarcomas or chondrosarcomas. Forty-five per cent of Ewing's tumors extended 3 inches or more past the cortical lesion, in 6 cases (two-thirds of this group or 30 per cent of the total group) the entire medullary cavity was involved. In 30 per cent of the cases of Ewing's tumor extension for 1 to 3 inches had occurred, and in the remaining 25 per cent, no extension was found. No extension was found past the limits of gross cortical involvement in any of the cases of primary chondrosarcoma studied.

The actual position of the main lesion in the bone was found to be of no particular value in



TABLE III—ROENTGENOLOGIC EVIDENCE OF MEDULLARY EXTENSION COMPARED WITH MICROSCOPIC EVIDENCE OF MEDULLARY SPREAD

Evidence of medullary extension	Osteogenic sarcoma		Ewing's tumor		Chondrosarcoma	
	Cases	Per cent	Cases	Per cent	Cases	Per cent
Roentgenologic and microscopic same	29	69	4	44	4	100
Microscopic exceeded roentgenologic	13	31	5	56	0	
Total (with suitable roentgenograms)	42	100	9	100	4	100

predicting whether or not medullary extension would occur. However, in the osteogenic sarcomas, the incidence of extension up the medullary cavity from lesions of the lower part of the femur was greater than the incidence of spread down the medullary canal from lesions located in the upper part of the tibia. The reason for this cannot be explained.

In the osteogenic sarcoma group the greatest amount of medullary extension was found in the higher grades of malignancy. Medullary extension of 3 inches or more was found in 25 per cent of lesions of grade 3 malignancy and in 29.3 per cent of the lesions of grade 4, but extension was less than 3 inches in all cases in which lesions of grade 1 and grade 2 were present. This was an expected finding in view of the greater invasive tendency and rate of mitosis exhibited by higher grades of malignancy. However, the grade of malignancy made no difference in the amount of extension in the chondrosarcoma group, none being found regardless of grade. Ewing's tumors were not graded.

The results obtained in the comparisons made between the amount of medullary extension evident on the preoperative roentgenograms as against the amount of medullary extension actually found by gross and microscopic study of the amputated extremities are given in Table III. The distance by which microscopic extension exceeded roentgenologic evidence of medullary involvement was recorded in each of the cases showing this difference and varied from 1 inch (2.5 cm) to an involvement of the entire shaft above the lesion as seen roentgenologically (Figs 4 and 5).

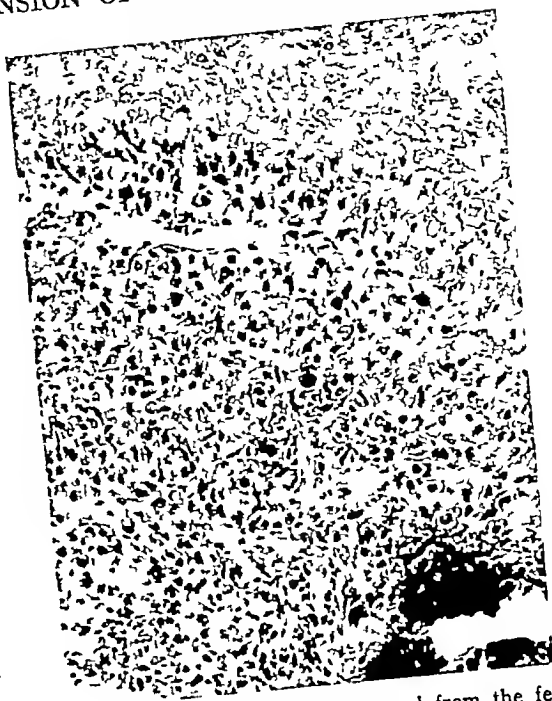


Fig 5 Medullary material removed from the femur shown in Figure 4. This section was from the intertrochanteric region and shows that the sarcoma has extended throughout the medullary cavity of the involved femur (hematoxylin and eosin,  $\times 120$ ).

Survival periods following the date of amputation have been compared with the amount of medullary extension found on gross and microscopic examination. These results are given in Table IV. Those cases in which adequate follow-up data could not be obtained or in which the postoperative period was less than 3 years at the time of this study were excluded. The patient who was free from clinical or roentgenologic evidence of metastasis or recurrence of the lesion in the stump was classed as well. Data on the primary chondrosarcomas are not included in Table IV. Of the 5 patients studied, none had any medullary extension, 1 patient was considered cured, 1 died 1 year after operation, 2 were living and well but the postoperative period was less than 3 years, and 1 patient could not be traced.

The survival rates in cases in which amputation was carried out through the bone containing the lesion were compared with those in cases in which disarticulation or amputation through the bone proximal to the bone con-



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TABLE IV—COMPARISON OF SURVIVAL RATE WITH AMOUNT OF MEDULLARY EXTENSION

Lesion and medullary extension	SURVIVAL RATE WITH AMOUNT OF MEDULLARY EXTENSION									
	Results after operation								Total (with adequate follow up)	
	Dead or with known metastasis				Living and well 3 to 5 years		Living and well 5 years or more			
	Less than 3 years		3 to 5 years							
	Cases	Per cent	Cases	Per cent						
Osteogenic sarcoma No extension	14	61	3	13	3	13	3	13	23	
Extension 1 to 3 in	7	88	1	12	0		0		8	
Extension 3 in or more	5	71	0		1	14	1	14	7	
Ewing's tumor No extension	1	17	1	17	1	17	3	50	6	
Extension 1 to 3 in	4	80	0		1	20	0		5	
Extension 3 in or more	7	78	1	11	0		1	11	9	

taining the lesion was performed. The results are shown in Table V for the entire series of cases and in Table VI for the cases in which the various predominant cell types of osteogenic sarcoma were present. Patients were listed as cured who were living and well 5 years from the date of amputation and who had no clinical or roentgenologic evidence of metastasis. Not evident in the tables is the fact that of 6 patients who underwent disarticulation or hemipelvectomy for osteogenic sarcoma of the femur 1 died 6 months after operation, 2 patients were considered cured, 1 being alive and well 16 years after operation and the other 7 years after operation, and the 3 remaining patients were living and well, but less than 3 years had elapsed since the date of amputation.

The results obtained from the statistical study on the 88 additional cases of osteogenic sarcoma, which were selected as described previously in this paper, are contained in Table VII.

## COMMENT

The lack of evidence suggesting that multiple foci of medullary involvement might evolve by the process of embolism from a primary sarcoma located in the same bone, and the demonstration of direct extension as the means by which a primary bone sarcoma spreads in the bone marrow, was interesting. It has been established that the capillaries and blood vessels conducting blood in the bone marrow are closed structures and not in communication with the parenchyma of the bone

marrow (1, 2). Therefore, malignant cells making their way through the walls of blood vessels in the medullary cavity evidently are conducted out of the medullary cavity to some distant point of the body rather than setting up a new focus of medullary involvement in the same bone. There was no evidence to suggest that spread had occurred through the lymphatics of bone marrow in any of the cases studied. Direct extension being the method of medullary spread from a primary bone sarcoma, the actual position of the neoplasm should have little influence on the incidence or amount of medullary extension that occurs. Accordingly lesions located in either the proximal or distal end of the bone were found to spread comparable distances down or up the medullary cavity as the case might be and lesions of the shaft extended in either direction.

An interesting fact was that in 10 of the 50 cases of osteogenic sarcoma studied (an incidence of 20 per cent) medullary extension was found for 3 inches or more past any cortical evidence of the lesion. In 3 of the 10 cases medullary extension was found to the point of amputation. In these 3 cases there was no record that microscopic examination of the bone marrow had been made at the time of amputation. Medullary extension was found by microscopic means 3 inches or more past any gross evidence of medullary involvement in 18 per cent of the cases of osteogenic sarcoma. This fact indicates that gross inspection of the bone marrow for evidence of medullary extension at the point of amputa-

TABLE V—RESULTS AFTER AMPUTATION THROUGH BONE CONTAINING LESION AND PROXIMAL TO BONE CONTAINING LESION

Site of amputation and result	Osteogenic sarcoma		Ewing's tumor		Chondrosarcoma	
	Cases	Per cent	Cases	Per cent	Cases	Per cent
Through bone with lesion Follow up adequate	19		6		2	
Postoperative survival 3 yr or more*	5	26	4	67	1	50
5 yr or more*	2	11	2	33	1	50
Cures	1	5	2	33	1	50
Proximal to bone with lesion Follow up adequate	19		13		0	
Postoperative survival 3 yr or more*	7	37	4	31	0	
5 yr or more*	4	21	2	15	0	
Cures	3	16	2	15	0	

\*Patients considered cured included

tion is not sufficient, and that in those cases in which amputation has been performed through the bone containing the lesion, the surgeon should insist on microscopic examination of the bone marrow before deciding that the point of amputation is high enough. As was expected, the greatest incidence of medullary spread was found in cases of Ewing's tumor, the entire medullary canal was involved in 30 per cent of the cases. Too few cases of primary chondrosarcoma in the long bones were studied to permit positive statements, but the finding of no medullary extension, either by gross or microscopic means, in the 5 cases studied, suggests that the tendency toward medullary extension is much less in this form of primary bone neoplasm than in other types. The fact that in none of the cases of osteogenic sarcoma of chondroblastic type studied was medullary extension of 3 inches or more evident, also would seem to support the contention that cartilaginous neoplasms of bone show the least tendency toward medullary extension.

In the cases of osteogenic sarcoma comparison of survival rates with the amount of medullary extension failed to reveal any significant differences in the survival periods in cases in which no medullary extension was found and in cases in which marked medullary

TABLE VI—PREDOMINANT CELL TYPES OF OSTEOGENIC SARCOMA RESULTS AFTER AMPUTATION THROUGH BONE CONTAINING LESION AND PROXIMAL TO BONE CONTAINING LESION

Site of amputation and result	Predominant cell type of osteogenic sarcoma					
	Fibroblastic		Chondroblastic		Osteoblastic	
	Cases	Per cent	Cases	Per cent	Cases	Per cent
Through bone with lesion Follow up adequate	13		3		3	
Postoperative survival 3 yr or more*	4	31	1	33	0	0
5 yr or more*	1	8	1	33	0	0
Cures	0	0	1	33	0	0
Proximal to bone with lesion Follow up adequate	11		4		4	
Postoperative survival 3 yr or more*	4	36	3	75	0	0
5 yr or more*	3	27	1	25	0	0
Cures	2	18	1	25	0	0

\*Patients considered cured included

extension was present. This finding is of significance in that it tends to show that the incidence of distant metastasis is not increased regardless of the amount of medullary extension. Invasion of blood vessels and distant metastasis occur with about the same frequency in cases in which medullary involvement is confined to the region of the cortical lesion as in cases in which lesions have spread along the bone marrow. It was thought that the incidence of distant metastasis might be increased in cases in which medullary extension was present and be reflected in a lower survival rate in these cases. The reason for this opinion was that the lesion which extends in the medulla surrounds a larger amount of the blood vessels in the bone marrow and a larger surface area is presented for invasion of the vessels. In this study, however, the results obtained seem to indicate that if amputation is carried out proximal to the lesion, the effect of medullary extension, regardless of amount, on the survival rate is nullified.

Our study of Ewing's tumor on the contrary, revealed a significant difference in the survival rates in cases in which no medullary

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TABLE VII—RESULTS AFTER AMPUTATION THROUGH BONE CONTAINING LESION AND PROXIMAL TO BONE CONTAINING LESION IN 88 CASES OF OSTEOGENIC SARCOMA\*

Result	Amputation through bone containing lesion		Amputation proximal to bone containing lesion	
	No	Per cent	No	Per cent
Died less than 3 yr postoperative	36	78	21	50
Postoperative survival of 3 to 5 yr †	3	7	3	7
5 yr or more †	7	15	18	43
Cures	6	13	13	31
Total cases	46	100	42	100

\*Cases selected as described in text  
 †Patients considered cured included

extension was present from those in which medullary extension had occurred. Sixty-six per cent of the patients who did not have any medullary extension were living and well 3 years after operation and 50 per cent were considered cured by the amputation. Of the patients who had medullary extension of 3 inches or more, only 11 per cent were living and well 3 years after operation, and 11 per cent were considered cured. These results tend to show that in cases of Ewing's tumor the greater the invasive tendency, as shown by the amount of medullary spread, the poorer the prognosis. Presumably this is because of a higher incidence of blood vessel invasion with distant metastasis in the cases in which medullary extension is increased.

If the surgeon could be sure that the point of amputation was above the most proximal point of a primary bone sarcoma, then the dictum of never amputating through the bone containing the lesion unless absolutely necessary would be invalid, and the end results of transection through the bone containing the lesion and disarticulation at the joint or amputation through the bone proximal to the bone containing the lesion should not differ. The surgeon, however, is confronted by many obstacles in determining whether or not the site of amputation is proximal to the lesion, if he chooses to amputate through the bone containing the lesion rather than above it. Roentgenograms may not portray the medullary extension that is present. Gross examination

of the bone marrow at the point of amputation may give an erroneous impression as microscopic medullary extension often exceeds any medullary extension that can be seen grossly. The number of errors that are made in this determination is well demonstrated by the poorer results (Tables V and VII) found in the cases of osteogenic sarcoma in which transection was done through the bone containing the lesion than in those in which disarticulation or amputation through the bone proximal to the bone containing the lesion was done. The better results obtained by the radical amputation above the bone containing the lesion take on added significance when it is remembered that the most advanced lesions showing the most involvement of cortical and soft tissues were almost always in the group treated by amputation or disarticulation proximal to the bone containing the lesion. The better prognosis offered by amputation proximal to the bone containing the lesion, is no doubt due in part to the fact that the higher amputation increases the incidence in which plastic infiltration of soft or subperiosteal tissue. An even more important factor in the better prognosis offered by the more radical surgical procedure is believed to be the fact that amputation is certain to be above the highest medullary extension of the neoplasm. Of the 14 patients who had osteogenic sarcoma treated by transection through the bone containing the lesion and who survived less than 3 years, 3 (21 per cent) displayed microscopic evidence of medullary neoplasm at the point of amputation. The failure to find more cases of extension to the site of amputation in this group is believed due to the difficulty in demonstrating malignant changes in individual cells, or in small clusters of cells which lack the morphologic arrangement of the main lesion, in the bone marrow of specimens preserved in formalin for several years. Exact information regarding the incidence of local recurrence in the amputation stump could not be obtained, but the fact that local recurrence is known to have occurred in at least 1 of the cases in which malignant change could not be found at the proximal end of the amputated specimen tends to support the view that

malignant cells were present at the site of amputation in a higher percentage of cases than could be demonstrated in the specimens available for this study

Comparison of the end results obtained by transection through the bones containing the lesion with those obtained by higher amputation was interesting in cases of the various types of osteogenic sarcoma. The fibroblastic and chondroblastic types gave findings in keeping with the results discussed for the osteogenic sarcoma group as a whole. When amputation had been performed through the proximal bone or through the joint proximal to the lesion results were much better than when transection had been done through the bone containing the lesion. In the osteoblastic type of osteogenic sarcomas these findings did not apply. No patient survived for 3 years after operation regardless of the site of amputation. This finding is in keeping with the observations of MacDonald and Budd. These authors in 1943 published the results of a study of the 118 five year cures in cases of osteogenic sarcoma listed in the bone sarcoma registry of the American College of Surgeons. They divided these cases into fibroblastic, chondroblastic, and osteosarcoma subtypes and stated, "A comparative analysis of the cases of cured and uncured osteogenic sarcoma indicates that true osteosarcoma is an almost uniformly fatal form of neoplasm, accounting for but a fraction of the cures." Their description of the histologic features of osteosarcoma corresponds to those of the lesion called "osteoblastic type of osteogenic sarcoma" in our study. Apparently the osteoblastic type of osteogenic sarcoma invades blood vessels much sooner than the fibroblastic or chondroblastic types and metastasis has occurred before the patient comes to surgery in the majority of cases.

The percentage of 5 year survivals and patients cured was twice as great in the cases of Ewing's tumor in which transection was performed through the bone containing the lesion as in the group in which amputation was carried out proximal to the bone containing the lesion. In view of the exactly opposite results in cases of the osteogenic sarcoma, this seemed unusual. Inspection of the 6 cases in

which transection through the bone containing the lesion was performed revealed that in 4 there was medullary extension of less than 1 inch, and in 2 of more than 3 inches, in 1 of these last 2 cases medullary extension was demonstrated at the site of amputation. In 7 of the 13 cases in which the limb was amputated proximal to the bone containing the lesion, medullary extension was marked, in 6 the entire shaft was involved. In 3 cases there was medullary extension of 1 to 3 inches, and in 3 no medullary extension. The 3 patients who had no medullary extension were living and well, 10, 7, and 3 years after operation, respectively. It was observed in a previous paragraph that the prognosis was poorer in cases of Ewing's tumors with marked medullary extension than in cases with little such extension, presumably because the lesions showing the greater invasive tendency, as reflected by medullary extension, also invade the blood vessels and metastasize earlier and more often than do less invasive lesions. Probably this factor is the one responsible for the failure to obtain better results in the group of Ewing's tumors treated by removal of the extremity proximal to the bone containing the lesion than were obtained in the group treated by transection of the bone containing the lesion.

### CONCLUSIONS

From this study the following conclusions were drawn

- 1 Direct extension is the usual method by which a primary bone sarcoma spreads in the bone marrow from its initial location in a long bone
- 2 Medullary extension from a primary bone sarcoma may occur without roentgenologic evidence of its presence
- 3 Neoplastic medullary involvement may be found on microscopic examination for a considerable distance past any gross evidence of medullary extension in many cases of primary bone sarcoma
- 4 Of the primary bone neoplasms studied, Ewing's tumor exhibited the greatest tendency, osteogenic sarcomas the next greatest, and primary chondrosarcomas the least, to spread in the bone marrow. In this series, 45 per cent of Ewing's tumors, 20 per cent of

osteogenic sarcomas, and none of the primary chondrosarcomas showed medullary extension for 3 inches or more past the limits of cortical involvement by the lesion

5 Of the predominant cell types of osteogenic sarcoma, the osteoblastic type exhibits the greatest tendency, the fibroblastic type the next greatest, and the chondroblastic type the least, to extend in the bone marrow

6 In osteogenic sarcoma, the higher the grade of malignancy, the greater the amount of medullary involvement that is likely to be found In this study no medullary extension was found in cases of primary chondrosarcoma regardless of grade of malignancy and no attempt was made to grade malignancy in Ewing's tumors

7 The amount of medullary extension per se cannot be used as a basis for prognosis in osteogenic sarcoma, while in Ewing's tumors, cases with marked medullary involvement have a distinctly worse prognosis Apparently invasion of blood vessels and metastasis is as likely to occur in cases in which osteogenic sarcomas show no spread in bone marrow as in those in which marked medullary extension occurs past the confines of the cortical lesion In Ewing's tumors, however, those which have a greater invasive tendency as reflected by increased medullary extension, are more likely to invade blood vessels early and have caused undetected metastatic lesions at the time of surgery

8 In the treatment of primary bone sarcoma by amputation, microscopic examination of the bone marrow at the point of amputation should be mandatory in every case

in which amputation is performed through the bone containing the lesion before the surgeon concludes that the amputation is proximal to the lesion The recognition of malignant cells individually or in small clusters may be very difficult, and when any doubt exists, amputation should be performed at a higher level In this study the inadequacy of roentgenologic and gross methods of examination used alone for the detection of extension in the bone marrow was illustrated in the study of the survival rates in cases of the osteogenic sarcomas Microscopic examination of the bone marrow at the site of amputation was not routine in these cases It was found that in the cases of osteogenic sarcoma in which amputation was proximal to the bone containing the lesion results were superior to those in cases in which transection was carried out through the bone containing the lesion One important cause of the poor results of amputation through the bone containing the lesion, as compared to the results of amputation above the affected bone, was failure to amputate proximal to the lesion, since the amputation occasionally was through an area of medullary extension which was undetected at the time of surgery

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# CEREBRAL BLOOD FLOW AND METABOLISM IN TOXEMIAS OF PREGNANCY

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IN 1945 Kety and Schmidt (12) reported the determination of cerebral blood flow in man with a technique which permitted the quantitative clinical measurement of this important physiologic function. The safety and significance of this method (9) have since been established by studies on normal young men (14) as well as on groups of individuals with varied pathologic states (10, 11, 13, 15, 16). The development of this procedure makes it possible for the first time for the clinician to study certain phases of the dynamics of disease entities which may in some degree affect intracranial physiology. Toxemia of pregnancy is typically manifested by symptoms referable to the brain. While much has been postulated concerning the cause and mechanism of this effect, actually very little indeed is known concerning the pathologic physiology of this organ which hitherto had been inaccessible to significant study. It was therefore thought worth while to use the new method in the study of toxemia of pregnancy as well as of normal pregnant women (18).

## METHOD

The method is based upon the fact that if the nitrous oxide concentration be determined in arterial and cerebral venous blood for a 10 minute period from the beginning of inhalation of a low concentration of this gas, curves will be obtained as exemplified by the typical one in Figure 1. The venous concentration curve is a fairly complex function of the arterial curve and the cerebral blood flow. From these curves the cerebral blood flow can be calculated by the application of the Fick principle. This postulates, in its simplest form, that the quantity of any substance taken up in a given time by an organ from the blood which perfuses it is equal to the

total amount of substance carried to the organ by the arterial inflow less the amount removed by the venous drainage during the same period of time. It has been shown that the cerebral blood flow (CBF) can be calculated from the following formula

$$CBF = \frac{100 V_{10} S}{10 (A - V) dt}$$

Where V = Venous  $N_2O$  concentration  
 $V_{10}$  = Venous  $N_2O$  concentration at 10 minutes  
 A = Arterial  $N_2O$   
 S = Partition coefficient of  $N_2O$  between the brain and blood

$\int_0^{10} (A - V) dt$  = The area between the arterial and the venous curves, over the ten minute period  
 This expresses CBF as cubic centimeters of blood flow per 100 grams of brain per minute

A gaseous mixture, consisting of 15 per cent nitrous oxide, 21 per cent oxygen, and 64 per cent nitrogen, is administered through a tightly fitting mask equipped with inspiratory and expiratory valves. For taking accurately timed arterial blood samples from artery and internal jugular vein, manifolds of 3 way stopcocks have been found to be very convenient (Fig. 2). Transparent plastic tubing connects the manifold to the needle and heparin is used in the system to prevent clotting. The first needle is placed into the superior bulb of the internal jugular vein after infiltration with procaine. The second needle is placed into the femoral artery. No untoward reaction or complication has accompanied this procedure.

Five samples of blood are taken simultaneously from the arterial and venous systems at regular intervals over a period of 10 minutes during which time the nitrous oxide mixture is administered. The heparin tipped syringes are sealed and placed in cracked ice immediately. The mean arterial blood pressure is

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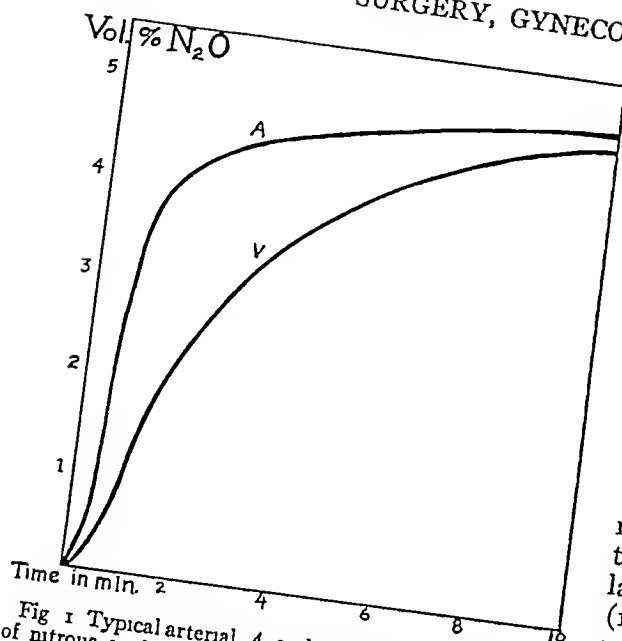


Fig. 1 Typical arterial, A, and internal jugular, V, curves of nitrous oxide concentration during a 10 minute period of inhalation of 15 per cent nitrous oxide

taken directly from the femoral artery. The specimens are analyzed for nitrous oxide, oxygen, and carbon dioxide in the manometric Van Slyke apparatus (9).

From these analyses several studies of cerebral metabolism and circulation are made possible. First, as pointed out, the actual cerebral blood flow may be determined. Second, the rate and amount of oxygen utilized by the brain may also be ascertained. This is called the cerebral metabolic rate in terms of oxygen and is determined by the formula

$$\text{CMR } O_2 \text{ in c.c. of } O_2/100 \text{ gm brain/min} = \text{CBF} \times \frac{(A-V)O_2}{100}$$

A third very important function which is made possible of evaluation is the cerebral vascular resistance. A satisfactory approximation is made by the formula

$$\text{CVR in mm Hg/c.c./100 gm brain/min.} = \frac{\text{Mean arterial blood pressure}}{\text{CBF}}$$

This convenient unit represents the pressure necessary to force 1 cubic centimeter of blood per minute through 100 grams of brain.

Fourth, the respiratory quotient of the brain may be measured. It will be recalled that the RQ represents the ratio of the vol-

ume of carbon dioxide produced by a tissue to the volume of oxygen absorbed. This is ascertained by the formula

$$\frac{(V-A)CO_2}{(A-V)O_2}$$

Finally, it is possible to calculate the so-called nutritive index of the brain which is determined by the formula

$$\frac{AO_2}{(A-V)O_2}$$

This represents the ratio between the amount of oxygen offered to the brain and how much it actually uses

#### NORMALS

The first problem was to establish the normal values for pregnant women in each of these measurable functions of cerebral circulation and metabolism. Kety and Schmidt (14) had studied 14 normal young men. The mean values obtained in these cases were compared with mean values which were determined from the study of 9 normal young women who were between 34 and 40 weeks' gestation.

TABLE I

	Normal young men	Normal pregnant women
Mean arterial blood pressure	86	90.5
Arterial oxygen in vol per cent	18	13.4
Arterial carbon dioxide in vol per cent	49	40.0
Venous oxygen in vol per cent	11.7	6.9
Venous carbon dioxide in vol per cent	55	46.2
Arteriovenous oxygen difference in vol per cent	6.3	6.5
Respiratory quotient of the brain	0.99	0.98
Cerebral blood flow	54	56
Cerebral metabolic rate in terms of oxygen	3.3	3.5
Cerebral vascular resistance	1.6	1.6
Nutritive index of the brain	2.8	2.1

It is at once obvious in Table I that the arterial and venous concentrations of oxygen as well as carbon dioxide are much lower in normal pregnant women than in normal males. The arterial oxygen content in these pregnant women close to term is 26 per cent.

Fisher's table of *t* was used throughout this study to test the significance of difference between normal pregnant women and normal young males as well as between normal pregnant women and patients with the various types of toxemia of pregnancy. The formulae followed were

$$\text{Standard deviation } (\sigma) \text{ of difference} = \sqrt{\frac{\sum_1(d^2) + \sum_2(d^2)}{(N_1-1) + (N_2-1)}}$$

$$\text{Significance of difference } (t) = \frac{\text{Difference between means}}{\sigma \text{ of Difference}}$$

$$\sqrt{\frac{N_1 N_2}{N_1 + N_2}}$$

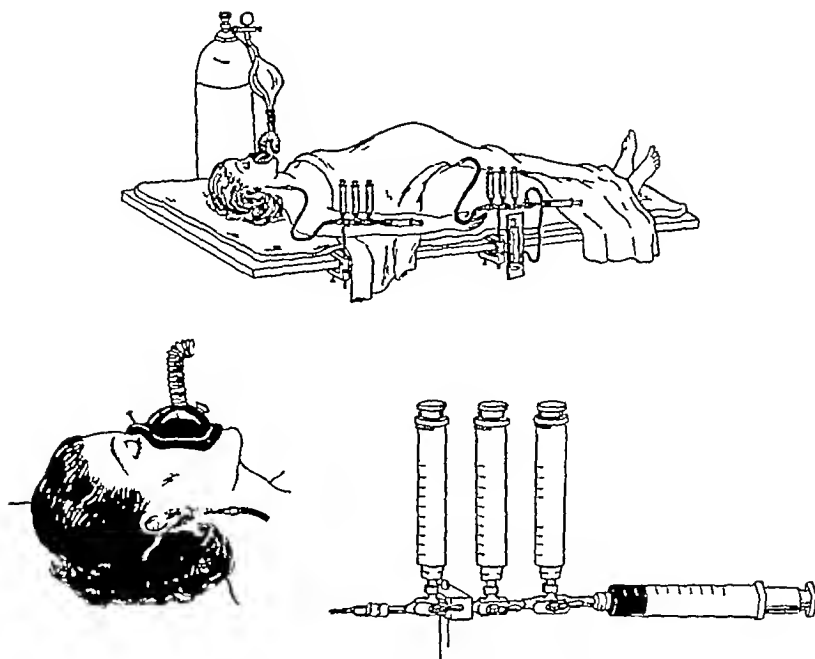


Fig 2 Setup for cerebral blood flow determination

lower. This is not surprising when it is recalled that it has been shown that there is normally an increased plasma volume at term (3, 5, 19, 23), the so called hydremia of pregnancy. Another factor frequently found in a group of unregistered patients who present themselves for the first time after a complication of pregnancy has developed is an abnormally lowered hemoglobin. This lessens the carrying power of the blood for oxygen and to a lesser extent for carbon dioxide. It is interesting that the arterial-venous oxygen differences  $(A-V)O_2$  were approximately the same showing that during pregnancy the brain has the ability to extract the usual amount of oxygen from the blood even though the blood coming to it carries less oxygen. Thus the oxygen content of the venous blood leaving the brain is even more depleted, it being 37 per cent less than in normal males.

The lowered nutritive index of the brain of 2.1 in pregnancy compared to 2.8 in males is highly significant. This emphasizes the fact that the brain in normal pregnancy is maintaining a normal oxygen utilization in the face of a diminished oxygen supply, the

latter being the result of the relative anemia which occurs in this condition.

In the comparison between the two series of normals, the nutritive index is the only one of the major functions being studied which shows a significant difference. As seen in the table, the cerebral blood flow, the respiratory quotient, the cerebral metabolism of oxygen, and the cerebral vascular resistance give very similar values in the two groups.

#### TOXEMIAS OF PREGNANCY

After the establishment of normal values for pregnant women, 29 patients with toxemia of pregnancy were studied. Using the classification proposed by the American Committee of Maternal Health in 1939 there were 16 patients with hypertensive toxemia, 8 patients with pre-eclampsia, and 5 convulsive eclamptics.

Because of the importance of excluding all possible factors which might alter the cerebral state in toxic patients, an effort was made to perform the studies before any therapy whatever had been given. In order that treatment might not be delayed, the equipment necessary for the study was kept in



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readiness at all times so that the investigation could be carried out immediately upon the patient's admission to the ward. Three of these tests were done between successive convulsions during coma. One had but one convulsion and was rational and conscious when the blood flow was performed. The only eclamptic who received any therapy before the tests were completed was still in a semicomatose state.

TABLE II — THE MEAN ARTERIAL BLOOD PRESSURE (FEMORAL) IN MILLIMETERS OF MERCURY

Normal pregnant women  
Hypertensive toxemia  
Pre-eclampsia  
Eclampsia

Millimeters  
of mercury  
90.5  
125  
118  
124

*Mean arterial blood pressure.* These values were taken directly from the femoral artery. Table II shows the increased mean values of toxemia patients over normal pregnant women.

TABLE III — CEREBRAL BLOOD FLOW

c.c. per 100 gm. brain/min  
 $CBF = \frac{100 V_{10} S}{\int_0^{10} (A-V) dt}$

Normal pregnant women  
Hypertensive toxemia  
Pre-eclampsia  
Eclampsia

56  
55  
54  
51

*Cerebral blood flow.* The flow of blood through the brain was found to be but little affected by the toxemias of pregnancy. The normal values obtained in the study of women afflicted with essential hypertension, in whom there was some degree of superimposed toxemia, bears out the work of Kety and his collaborators (10) on patients with essential hypertension per se that the blood flow is not affected by this condition. While the pre-eclamptics had comparatively normal blood flows, the patients with eclampsia showed a tendency toward lower values. While the flow of 51 cubic centimeters per 100 grams of brain per minute in eclampsia compared to the normal value of 56 cubic centimeters is not statistically significant in

this study, it may approach significance in a larger group of cases.

TABLE IV — THE CEREBRAL METABOLIC RATE IN TERMS OF OXYGEN

c.c. O<sub>2</sub> per 100 gm. of brain per minute  
 $CMRO_2 = \frac{CBF}{100} \times (A-V)O_2$

Normal pregnant women  
Hypertensive toxemia  
Pre-eclampsia  
Eclampsia

3.5  
3.4  
3.4  
2.8

*Cerebral metabolic rate in terms of oxygen.* The cerebral utilization of oxygen in patients with pre-eclampsia and hypertensive toxemia is normal. In convulsive eclampsia, however, the rate of oxygen consumption per 100 grams of brain per minute is 2.8 cubic centimeters in comparison with 3.5 cubic centimeters in normal pregnancy. This difference approaches significance when the usual statistical methods are used.

TABLE V — CEREBRAL VASCULAR RESISTANCE

mm Hg per c.c. of blood per 100 grams brain per minute  
 $CVR = \frac{\text{Mean arterial blood pressure}}{CBF}$

Normal pregnant women  
Hypertensive toxemia  
Pre-eclampsia  
Eclampsia

1.6  
2.3  
2.0  
2.5

*Cerebral vascular resistance.* The pressure necessary to force 1 cubic centimeter of blood per minute through each 100 grams of brain is significantly increased in all toxemias of pregnancy. The highest resistance is seen in cases of eclampsia, in these patients a value of 2.5 is obtained in contrast to the normal of 1.6.

TABLE VI — RESPIRATORY QUOTIENT OF THE BRAIN

$RQ = \frac{(V-A)CO_2}{(A-V)O_2}$

Normal pregnant women  
Hypertensive toxemia  
Pre-eclampsia  
Eclampsia

0.98  
0.94  
0.98  
1.06

*Respiratory quotient of the brain.* The RQ of the brain in normal human beings is approximately unity indicating that the brain utilizes carbohydrates almost exclusively as its source of energy. In normal pregnant

women, as well as in patients with toxemia of pregnancy, there is little deviation from this value

TABLE VII —ARTERIAL-VENOUS OXYGEN DIFFERENCES AND NUTRITIVE INDEX OF THE BRAIN

	$(A-V)O_2$	$\frac{AO_2}{(A-V)O_2}$
Normal pregnant women	6.5	2.1
Hypertensive toxemia	6.3	2.2
Pre-eclampsia	6.3	2.2
Eclampsia	5.5	2.8

*Arterial-venous oxygen differences  $(A-V)O_2$  (Table VII)* The amount of oxygen extracted by the brain per 100 cubic centimeters of blood in toxemia is not significantly different from that in normal pregnant women. However, once again there is seen a tendency toward a difference in the eclamptic group which in a larger series of cases would become increasingly significant. The patients in this group of most severe toxemias used an average of 5.5 volumes per cent of oxygen whereas the patients in the normal group used 6.5 volumes per cent.

As shown earlier, the  $CMRO_2$  (amount of oxygen consumed per 100 gm of brain per minute) is lowered in eclampsia. This, of course, is the reason for the decrease in the arteriovenous oxygen difference.

*The nutritive index of the brain (Table VII)* The NI is approximately the same in pre-eclampsia and hypertensive toxemia as it is in the normal pregnant woman (2.1). In eclampsia there is a significant increase in this index to 2.8. This fact further emphasizes that the brain is not suffering from a lack of oxygen supply but rather from a failure to utilize the oxygen which is provided by the incoming arterial blood to a normal extent.

#### DISCUSSION

This study offers evidence that the physiology of the brain in normal pregnancy is much the same as that of normal young males. The only exception to this is a propensity of the brain to utilize approximately the same amount of oxygen as does the nonpregnant individual even though the arterial blood coming to it was shown to carry 26 per cent less oxygen. The decreased oxygen carrying

power of the arterial blood of pregnancy is thought to be mainly due to the physiologic hydremia.

In the toxemias of pregnancy several pertinent facts appear to be evident from this investigation. It seems significant that, aside from a slight degree of reduction in eclampsia, the blood flow is found to be constantly normal. This fact assumes importance to us inasmuch as several theories concerning the causation of eclampsia postulate that there is a greatly reduced blood flow to the brain.

Stander, in his monograph on toxemia, states that Traube and Rosenstein in 1864 first proposed that edema and actual anemia of the brain are the etiological factors in the production of eclampsia. More recently Zangemeister postulated that the development of cerebral edema caused such an increased extravascular pressure that the blood supply to the brain was greatly diminished. This "hydrops gravidarum" concept explained that the cells of the brain were inadequately nourished due to this anemia bringing about cerebral irritation and convulsions. However, the present study reveals that cerebral blood flow is maintained at normal levels which points to the conclusion that the symptoms of eclampsia cannot be explained upon the basis of generalized cerebral ischemia.

The cerebral vascular resistance is the function affected most frequently in toxemia of pregnancy. We found essential hypertension upon which toxemia was superimposed similar to that in nonpregnant patients with essential hypertension in this respect. In pre-eclampsia the resistance was quite high, but the greatest degree of cerebral vascular resistance was encountered in the presence of eclampsia.

The mechanism of this abnormality is most likely based upon a narrowing of the vessels within the brain. This might be due either to an intrinsic action within the vessel itself such as vasospasm, or to an extrinsic pressure caused by edema or increased intracranial pressure of the cerebrospinal fluid. In essential hypertension these extrinsic factors are not observed as a rule, nor are they in pre-eclampsia although generalized edema is

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more likely to develop. In eclampsia a wet brain is not an unusual finding at autopsy although there are many cases, especially the severe so-called "dry eclampsics" which do not exhibit this abnormality. In our experience, increased spinal fluid pressure is an inconstant finding. Therefore, while any of the three mechanisms may bring about the increased cerebral vascular resistance in eclampsia, it is likely that vasospasm is the most frequent cause.

It has been recently shown by Odell, Aragon, and Pottinger that there is an increase in the cohesiveness of red cells in toxemia of pregnancy. This has been called "sludging" by Knisely and brings about a slowing of blood flow through the smaller venules as observed in the conjunctiva. Whether or not such a phenomenon could increase the resistance to blood flow in the brain is problematic. If such takes place it might be postulated that there is an immediate reflex increase in blood pressure which maintains the cerebral blood flow at a normal level.

It has been shown that partial constriction of arterial inflow to various organs may cause vasospasm and hypertension. Cushing (1, 2) showed that restriction of the blood flow to the brain causes hypertension. The work of Goldblatt upon the kidney revealed a similar cause and effect as did the work of Ogden, Hildebrand, and Page upon partial constriction of the uterine arteries in pregnant dogs. While our study shows no interference with the blood flow to the brain during the disease, it is as yet conjectural as to whether or not there is a preliminary transient lessened blood flow to the brain, kidneys, or placenta which brings about the increase in blood pressure and vasospasm. A generalized capillary spasm over the body has been suggested by the work of Hinselmann, of Haselhorst, and of others.

Halbertsma, in 1884, postulated that a deficiency of oxygen is the immediate cause of eclampsia. Since then numerous writers have regarded a disturbance in oxidation as the exciting cause. Stander states, "Whatever theory ultimately explains the etiology of eclampsia will have to take decreased or deficient oxidation into account." In our tests

the oxygen consumption of the brain was depressed in eclampsia but was not in the nonconvulsive toxemias. Therefore, seems to correlate the amount of oxygen carried in the blood with the mental clearness of the patient. It is approximately the same in toxemia as it is in normal pregnancy. It is conceivable that the brain of the pregnant woman has lost the ability to utilize oxygen to a significant degree, this points to the fact that there is some inherent disturbance in the brain cells themselves rendering them less capable of using oxygen. It is hoped that this report will stimulate the further investigations which are necessary for a more complete understanding of the pathologic physiology of the brain in the presence of the toxemias of pregnancy.

## SUMMARY

- 1 By a recently devised method, the cerebral blood flow and related circulatory and metabolic functions of the brain have been studied for the first time in normal pregnancy as well as in patients with toxemia of pregnancy.
- 2 Normal pregnant women were found to have a lowered oxygen content of the arterial blood but were able to show the same amount of oxygen utilization by the brain as were normal nonpregnant individuals whose arterial blood carried 26 per cent more oxygen.
- 3 The cerebral blood flow was found to be normal in all toxemias of pregnancy.
- 4 The cerebral vascular resistance was significantly increased in each type of toxemia, the greatest degree being present in eclampsia.
- 5 The oxygen consumption of the brain was significantly decreased in eclampsia but was not impaired in the nonconvulsive toxemias.
- 6 The possible implications of these findings are briefly discussed.

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# STUDIES ON THE EFFECTS OF CONCOMITANT VENOUS LIGATION IN ACUTE ARTERIAL OCCLUSION

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SINCE Sir George Makins, on the basis of observations made during the Boer War, postulated the theory that concomitant vein ligation at the time of ligation of a major artery of an extremity lowered the incidence of gangrene, numerous contradictory clinical and experimental reports have been published on the subject. Strong evidence in support of the theory was that of Brooks, Johnson, and Kirtley, who reported that the incidence of massive gangrene in the extremities of rabbits was 14.5 times as high when the common and external iliac arteries alone were ligated as when the common iliac vein was ligated simultaneously. This result was not corroborated in experiments by Wilson.

Other important evidence comes indirectly from the reports of clinical improvement in circulation produced by the use of intermittent venous occlusion in peripheral vascular disease. Linton and his associates demonstrated experimentally with the thermostromuhr that concomitant venous occlusion increased the volume of the blood flowing in a ligated artery.

In carrying out our experiment two projects were undertaken. The first was to repeat the simple and logical experiment of Brooks and his associates. The second was to seek a more sensitive test for determination of circulatory changes in the limb following ligations of major vessels.

## METHODS

*Repetition of the experiment of Brooks, Johnson, and Kirtley.* Rabbits were used. Under nembutal anesthesia the right common iliac and external iliac arteries were ligated

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This study is being carried further under a medical research contract with the United States Army.

and divided through a transperitoneal incision. In another group of rabbits the right common iliac vein was ligated simultaneously with the arterial ligations. Repeated observations were made for 60 to 90 days, after which those animals which had survived were sacrificed and autopsies were performed whenever indicated.

With the exception of a single animal which died of an early massive gangrene about 36 hours postoperatively, we have excluded those animals which did not survive 48 hours postoperatively since rabbits are extremely sensitive to variable doses of anesthesia and to changes in climatic conditions. One hundred observations have been made—50 in each group.

*The use of radioactive sodium in circulation studies—modification of the method of Smith and Quimby with dogs.* With the dog lying on his back and each hind paw carefully strapped in place over the port in the lead shield covering the Geiger tube (Fig. 1), doses of 100 to 200 microcuries of radiosodium were injected into the jugular vein. Readings were taken continuously for 1 hour, alternating counts in each paw every minute. By this means relatively corresponding curves were obtained, representing the build-up of radiosodium ion concentration in the paws (Fig. 2). After normal controls had been established, the femoral vessels just below the inguinal ligaments were isolated under local anesthesia. Both superficial femoral arteries were ligated and divided, and the femoral vein on one side was ligated at the same level. Further doses of radioactive sodium were then injected into the jugular vein and similar readings taken immediately postoperatively and on the first and subsequent postoperative days. The total number of counts was charted, making necessary corrections for previous doses and

TABLE I —INCIDENCE OF COMPLICATIONS FOLLOWING LIGATION OF ILIAC VESSELS IN 100 RABBITS SURVIVING SURGERY 48 HOURS

	Artery only 50 rabbits per cent	Artery and vein 50 rabbits per cent
Massive gangrene	6	6
Focal necrosis	40	34
Contracture	36	22
Atrophy	60	36

changes in sensitivity of Geiger tubes Figure 3 represents curves obtained in this manner There were, however, wide individual variations

This method has not proved entirely satisfactory for our purposes because relatively large doses of radiosodium are required, each reading is continued for an hour, and the curves obtained proved to be at best qualitative whereas we were in search of an exact quantitative measurement of blood flow

*The clearance method of Kety* This is based on the assumption that radioactive sodium is a freely diffusible ion and if injected locally into muscle its rate of disappearance from the injection site is an index of effective circulation in that region A minute amount of sodium (50 to 100 microcuries in 0.1 c.c. of physiologic saline solution) was injected into the distal portion of the gastrocnemius muscle in the rabbits The portion of the leg injected was strapped over the port of the Geiger tube, and continuous readings were taken for a period of 15 minutes This series of counts produced an exponential curve which, when plotted on semilogarithmic paper, gave a straight line From the incidence of fall of this line a constant (K) was calculated which we have used as an index of the blood flow in the injected muscle

$$K = \frac{\log C_1 - \log C_2}{0.4343 (t_2 - t_1)}$$

$C_1$  = counts per minute at first reading

$C_2$  = counts per minute at second reading

$t_1$  = time at first reading

$t_2$  = time at second reading

0.4343 = log e

This technique was applied to a series of rabbits in which ligation of vessels was performed as described in the first method Curves obtained with this method were constant in shape and are illustrated in Figure 4

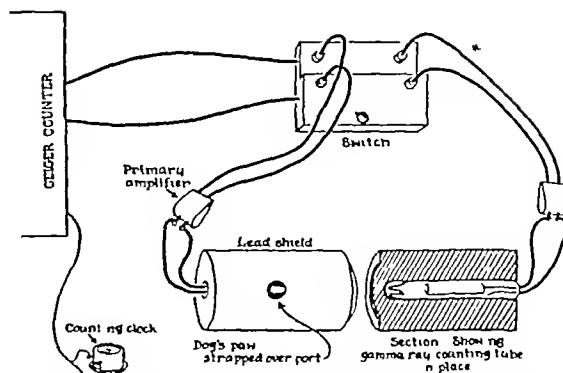


Fig 1 The  $\gamma$  ray counting tubes are kept in 2 inch thick lead shields and are connected as shown to the Geiger-Mueller counter The port in the shields is about the diameter of the Geiger tubes

## RESULTS

1 The tabulations in Table I show considerable disagreement with the observations reported by Brooks and his associates Our incidence of early massive gangrene after common and external iliac artery ligation was only 6 per cent and was unaffected by simultaneous concomitant vein ligation The most characteristic effect resulting from either of these procedures was the development of late focal necrosis beginning in the skin of the paw and often resulting in complete necrosis and separation of the entire paw This effect occurred in 40 per cent of rabbits following arterial ligations alone and in 34 per cent of rabbits who had concomitant vein ligations The difference is not statistically significant There was a somewhat higher incidence of contractures (36 per cent compared to 22 per cent) when vein ligation was not performed

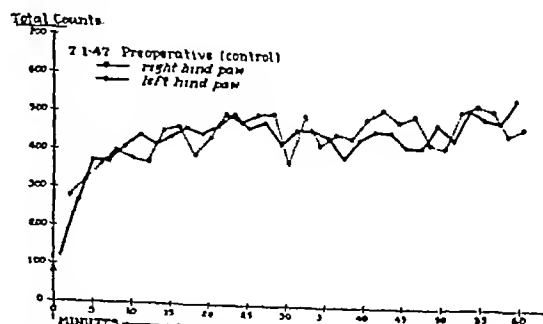


Fig 2 Type of curve obtained in both hind paws of a normal dog, representing the build up of radiosodium ion concentration after intravenous injection

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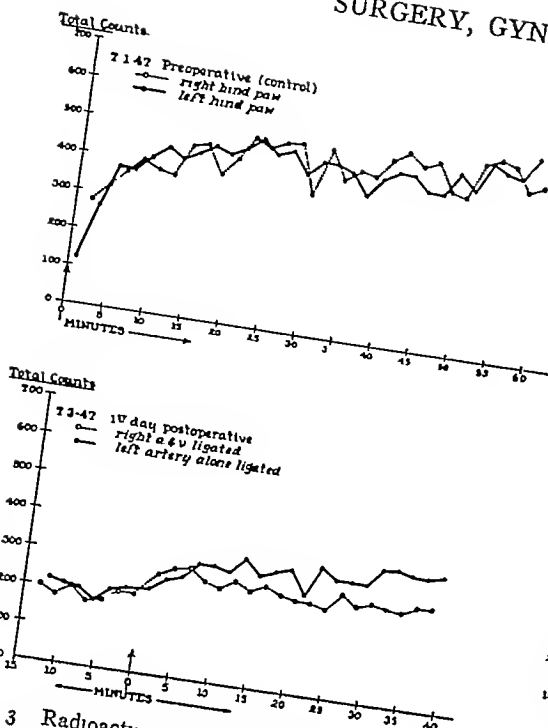
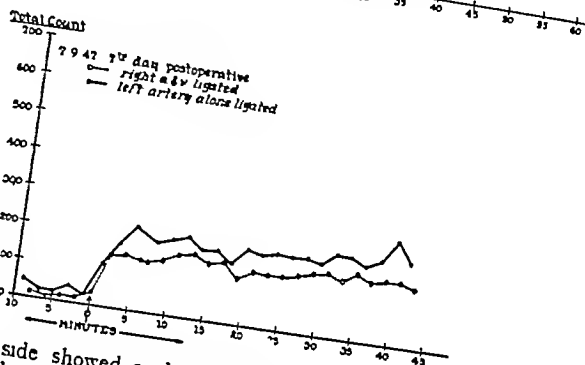
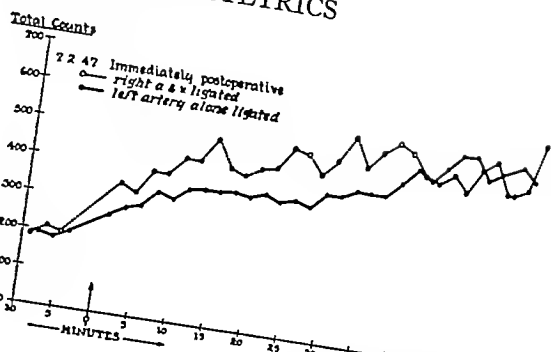


Fig 3 Radioactive sodium build up curves in the hind paws of a dog preoperatively and immediately and on the first and seventh days after ligation of the left femoral artery and the right femoral artery and vein. The left



side showed a slower build up rate immediately after ligation but a faster one on the first and seventh postoperative days. These results were not consistent in all animals.

2 Using the radioactive sodium technique of Smith and Quimby we have obtained no statistically significant records because of a lack of accurate quantitative measurements and because we were unable to obtain constantly reproducible curves.

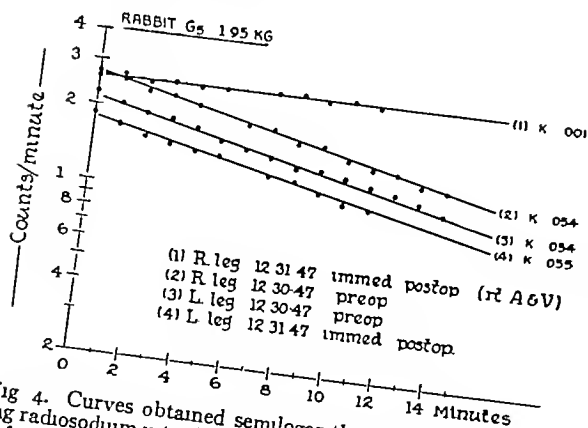


Fig 4. Curves obtained semilogarithmically after injecting radiosodium into the gastrocnemius muscles of a rabbit before and after ligation of the right iliac arteries and veins and measuring the rate of radiosodium clearance. The results which are shown in these curves are constantly reproducible.

3 The technique suggested to us by Kety yielded some most useful observations. By this method we have completed studies on 21 rabbits, some of which have been followed for over 2 months postoperatively. A number of others have been studied preoperatively and

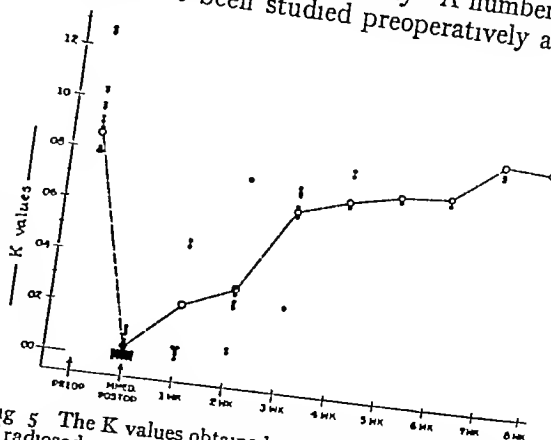


Fig 5. The K values obtained in week recordings of radiosodium clearance in 21 rabbits, including 12 arterial and 9 arterial and venous ligations. A mean line is drawn to demonstrate the fact that the same general trend occurred in all animals, i.e., an immediate postoperative drop and then a gradual return to preoperative levels.

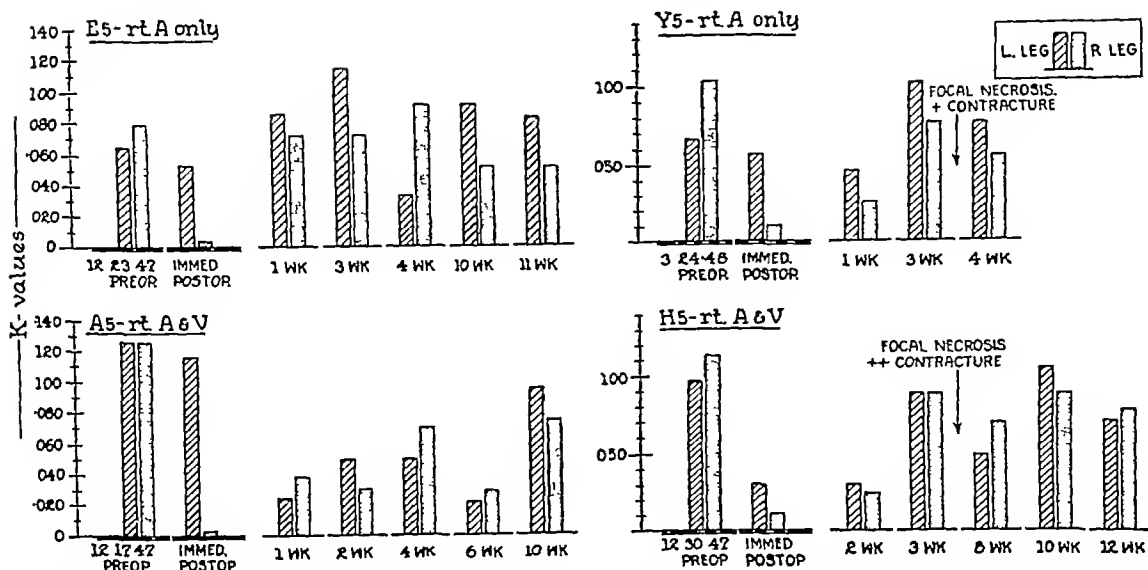


Fig 6 Demonstration in 4 rabbits showing that the rate of radiosodium clearance from the gastrocnemius muscle drops immediately after iliac arterial (or concom-

itant venous or both iliac arterial and concomitant venous) ligation and gradually returns to near preoperative levels

immediately postoperatively, but for various reasons (lack of a constant sodium supply, anesthetic deaths, etc) have not been followed sufficiently long to be included. However, the records that are not included because they lack completeness have conformed to the pattern of those shown (Fig 5, all K's, Fig 6, E5-A5, Y5-H5).

In Figure 5 are plotted the K values in these 21 animals week by week. Twelve arterial and 9 arterial and venous ligations are included here. Of this group 7 animals developed focal necrosis or contracture, 4 occurring in the combined ligation group and 3 in the arterial ligation group. The circulation in the gastrocnemius muscle of all of the animals determined in this way, regardless of which operative procedure was employed and regardless of the presence or absence of gross necrosis or contracture in the limb, followed the same general trend. There is an immediate postoperative drop in the circulation in the gastrocnemius muscle followed by a return to close to the preoperative flow during the next few weeks.

A simpler demonstration of this trend is given in Figure 6 representing 4 of the experiments. Two of each group are shown, and i-

stant venous or both iliac arterial and concomitant venous) ligation and gradually returns to near preoperative levels

of each group developed focal necrosis. In all 4 the immediate postoperative drop occurred, followed by recovery to near preoperative levels. Thus, we have observed that the circulation in the gastrocnemius muscle of the rabbit as determined by this method does not reveal what is occurring in the structures of the paw distal to it. Concomitant vein ligation has no effect on the clearance of radioactive sodium from the gastrocnemius.

#### DISCUSSION

The single striking feature in these experiments and in similar experiments of others is a serious lack of precise information about the peripheral circulation in the various component structures of the body. In an extremity which has been deprived of its major blood supply there have been few accurate measurements of blood flow in the skin, fascia, muscle, and bone. Thus, in these experiments, determination of blood flow in the gastrocnemius muscle gives inadequate indication of what is about to happen or has already happened to the paw just distal to it. Such fundamental phenomena require further investigation if we are to handle peripheral



## SURGERY, GYNECOLOGY AND OBSTETRICS

vascular diseases and injuries on anything other than an empirical basis

The use of radioactive sodium, especially in the manner described by Kety, is proving to be most helpful in these problems. Perhaps intradermal sodium injections may help to give more information on the problem although technical difficulties made its use impractical in these experiments

## CONCLUSION

We have been unable to determine that any benefit accrues from concomitant venous ligation in acute arterial occlusion. The evidence

of Brooks and his associates in support of this theory has not been confirmed. Studies of intramuscular circulation by use of radioactive sodium fail to show any improvement resulting from this procedure

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# THYROGLOSSAL TRACT ABNORMALITIES— CYSTS AND FISTULAS

Report of 105 Cases from the Johns Hopkins Hospital Observed during  
the Years 1926 to 1946

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**T**HYROGLOSSAL cysts and fistulas arise from epithelial rests in the remnants of the thyroglossal duct produced by the descent of the thyroid anlage. A brief review of the embryology shows that the thyroid anlage has its beginning as a diverticulum (i.e., evagination) from the floor of the pharynx, midway between the first and second pharyngeal grooves. Early in development, this anlage becomes a hollow stalked structure, known as the thyroglossal duct (23). This stalk usually loses its lumen to become a solid cord of epithelial tissue with its caudad, or pharyngeal end being marked by the foramen cecum at the base of the tongue. In the development of the embryo, the tongue forms at a later date than the thyroid anlage and the termination of the thyroglossal duct is buried within its substance. As a result of similar later development of the hyoid bone, the tract passes either anteriorly or posteriorly or through the hyoid. Caudal progression of the tract continues in the median line of the neck to a point below the thyroid cartilage where it terminates in the pyramidal lobe of the thyroid gland. Normally the epithelial lining of the tract undergoes degeneration and disappears (7, 12). When degeneration fails to take place, cysts or fistulas may occur anywhere along the course between the foramen cecum and the suprasternal notch. These cysts and fistulas are found either in the midline or slightly to one side. The drawings (Figs 1 and 2) illustrate where these lesions may occur, as determined by this series of cases.

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Histologically, the cyst or fistulous tract may be lined by stratified squamous, columnar, or transitional epithelium (Fig 3). After infection of the cyst or fistula, a heavy layer of fibrous connective tissue surrounds the tract. Lymphoid tissue, as seen in branchial cleft cysts and fistulas, is not observed in thyroglossal tract abnormalities (14). It has been reported that cancer may develop in the cyst wall or fistulous tract (7, 16). However, we have observed no neoplastic growths (23) in this present series.

Of the 105 cases seen in the Johns Hopkins Hospital, between 1926 and 1946, in 60 per cent the cysts or fistulas occurred between birth and the age of 10 years. The sex incidence was about equal for males and females there being 56 males and 49 females. These anomalies were noted in both white and colored patients. 70 cases were of the white race, and 35 of the colored race. In this series were seen all possible locations of the abnormality which have been reported: intratongue (4) (Fig 1, A and B), submental region (12), suprahyoid (11), at the level of the hyoid (12), infrahyoid (52), suprasternal (13), in the midline (19), to the right of the midline (13), and to the left of the midline (13). These locations are clinical, as noted in the hospital records and do not conform accurately to the anatomical locations of Figure 1. Too great an importance on these latter 2 figures cannot be stressed, since it is generally taught in the surgical text of today that thyroglossal tract abnormalities occur exactly in the midline (10, 12), and thus a great deal of confusion may be encountered.

Thyroglossal tract abnormalities are important, because they may be, and often are,

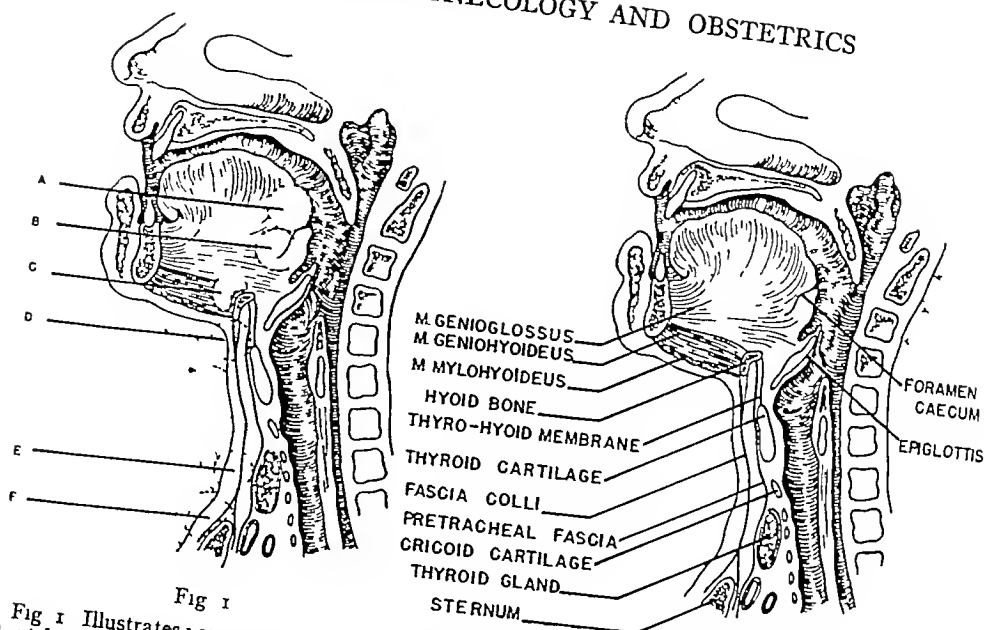


Fig 1

Fig 2

Fig 1 Illustrates various locations of remnants of the thyroglossal tract A, in front of foramen cecum, B, at foramen cecum, C, suprahyoid, D, infrahyoid, E, area of thyroid gland, and F, suprasternal

Fig 2 Drawing of sagittal section of neck (Illustrations, Fig 1 and Fig 2, from *Tumors of the Head and Neck* by Ward and Hendrick)

the seat of recurrent inflammatory disease and are a cause of cosmetic disfigurement. Infection occurring in these cysts is often the first direct symptom which causes the patient to seek medical aid. Recurrent infection was noted in 52 cases in this present series, which was extensive enough in 15 to cause spontaneous rupture of the cyst. Marked infection was present in 10 patients admitted to the hospital, and extensive cellulitis was present in 3, producing what is commonly termed "bull neck." In 6 of the 10 patients, the only treatment warranted after admission was incision and drainage. However, all of these 6 patients were subsequently readmitted for radical surgical procedure with complete elimination of the epithelial tract. The cyst can vary in size from several millimeters to 6 or 7 centimeters in diameter (Fig 4). A cyst located within the substance of the tongue usually presents the most alarming symptoms to the patient, such as, dysphasia, dysarthria, and choking sensations. Frequently, as cysts in the substance of the tongue or in the submental or suprahyoid area become larger, the patient notices tenseness in the tissues and also mild choking attacks.

The contents of the cyst is of a mucoid nature unless infection makes it purulent. Frequently, following infection, there is a rapid increase in the size of the cyst with pain and tenderness, and the cyst walls become thickened. Occasionally, there is a direct communication between the cyst and the foramen cecum, a thyroglossal tract sinus. In such a circumstance, pressure on the cyst will express fluid through the foramen cecum, thus clearly demonstrating a pharyngeal communication, present in only 2 of our cases. When infection occurs and progresses to suppuration with spontaneous rupture of the cyst, or if a cyst has been lanced, a sinus tract results. In this series, 34 per cent of the cases developed sinus tracts. Incision and drainage of a non-infected cyst, under any circumstances, is to be condemned.

In this series, admission examination revealed a cyst in evidence in 62 patients, or 59 per cent, a sinus tract in 36, or 34 per cent, and a palpable subcutaneous duct in 20, or 19 per cent. The term sinus tract is used to designate a discharging sinus in which the patient previously had a cyst which was lanced or became infected and suppurated (Fig 5). A



Fig 3 A sinus tract lined with squamous epithelium surrounded by dense fibrous tissue. There is an infiltration with lymphocytes, plasma cells, fibroblasts, and a few polymorphonuclear leucocytes. Striated muscle is also present.

definite cord of tissue palpated under the skin is termed "a congenital duct." Of the 20 cases reported, 6 were present without evidence of cysts. Of these 6 cases, 4 were incidental findings in the examination for another medical disorder, and the remaining 2 sought medical advice for an actual infection of the duct tract.

Of the 62 patients who presented a cyst when examined, 47, or 76 per cent, were midline lesions, and 15, or 24 per cent, were lateral to the midline. In this group of patients, 53, or 85 per cent, had cysts below the hyoid bone. There were 28 lesions above the hyoid bone, 9, or 33 per cent, were cysts, while 5, or 16 per cent, were sinuses, and the remaining 51 per cent presented combined lesions. When the 77 cases located below the hyoid were analyzed, 53, or 68 per cent, were cysts, 24, or 31 per cent, were sinuses, and the remaining 7, or 1 per cent, were combined lesions.

In making the diagnosis of thyroglossal tract cyst or fistula, it is to be remembered that the cyst or fistula may occur any place from the base of the tongue (foramen cecum) to the suprasternal notch, and that these abnormalities are the most frequent cysts or fistulas occurring in that area. Occasionally, as mentioned, they may occur just to the right or the left of the midline, but this deviation is not far enough to cause any difficulty



Fig 4 Typical example of a thyroglossal cyst located in the infrahyoid region.

in the differential diagnosis. One of our cases was located within the substance of the tongue above the foramen cecum (Fig 6). At examination, these cysts were smooth, ovoid or round, and translucent when examined with a transmitted light.

These cysts must be differentiated from a dermoid tumor, lipoma, sebaceous cyst, or from an enlargement of the pyramidal lobe of the thyroid gland, and enlarged lymphatic glands of the cricothyroid membrane. It was found that some of the cysts and fistulas were very superficially located, while others were quite deep. At operation, the lesions were found just beneath the skin, beneath the platysma muscle, beneath Colles' fascia, and still others beneath the pretracheal fascia. At examination, the tumor can usually be described as being cystic or fluctuant, but in 10 of these cases, the cyst was so tense that its cystic nature was overlooked and it was not until operation that the tentative diagnosis of a solid tumor was disproved. The cyst moved up and down with deglutition, and in the majority of cases movement of the cyst can be associated with movement of the hyoid bone. This was true in approximately 85 per cent of our cases.

Varying amounts of thyroid tissue may be found within the cystic mass or associated closely with it. This condition was present in 6 of our cases. It was noted in a 14 year old male who had a cyst measuring about 4 by 4



Fig 5 Thyroglossal sinus which resulted from the repeated incision of a cyst over a period of 20 years

centimeters in size that was within the substance of the tongue, anterior and above the foramen cecum. This patient had symptoms of a cyst for 11 years previous to admission to the hospital. The cyst was removed by local intraoral excision, and approximately 4 or 5 months following the operation, the patient developed symptoms of hypothyroidism, almost to the stage of cretinism. There was no palpable thyroid gland in the neck. This patient has been followed for a period of 21 years postoperatively, during which time it was necessary for him to continue taking thyroid extract regularly. At the present time he is completing a college education and is normal in every respect (Fig 6).

Thyroglossal tract fistulas or sinuses should not be confused with any other sinus tract. The opening of a branchial fistula or sinus tract is on the side of the neck and not "just to the right or left of the midline." Either fistulous tract may communicate with the oral cavity. If a thyroglossal tract fistula or sinus communicates with the oral cavity, it does so

always at the foramen cecum, whereas, branchial cleft fistulas or sinuses open at Rosenmueller's pouch in the lateral pharyngeal wall. If there is any doubt of the extent of the fistulous tract or sinus, it may be injected with a radio-opaque substance and a roentgenogram made. This injection is usually very painful and should be done only when necessary. However, if it is desired to visualize the fistulous tract with lipiodol for diagnosis, the external opening may be injected with a local anesthesia, a small catheter or lacrimal duct syringe passed just within the opening and 2 or 3 cubic centimeters of warm lipiodol solution injected.

#### TREATMENT

The treatment of thyroglossal tract abnormalities is entirely surgical excision of all the epithelial tissue. The authors would again like to stress the inadvisability of ever lancing a thyroglossal duct cyst unless it is infected and shows evidence of suppuration. Simple incision of the cyst serves no useful purpose, but does create a persistent draining sinus that is constantly discharging mucus and is very prone to become infected. In this series, in 21 cases the cysts had been lanced previous to the time the patients sought medical aid at the Johns Hopkins Hospital. All of these patients had very unsightly scars, and 18 had persistently draining sinuses. The election to incise and drain one of these cysts should rest on sound surgical judgment, such as would be used in determining when to open and drain any localized, fluctuant, obviously grossly infected lesion.

The injection of a sclerosing solution should never be used under any circumstances. The injected solution cannot be depended upon to reach all the minute epithelium-lined side pockets of the abnormality. Irradiation therapy, also, should not be used, since these lesions are not radiosensitive and the application of radium and x-ray serves only to complicate subsequent surgical procedures. One patient in this series was treated with radium which resulted in the destruction of so much skin that multiple plastic procedures were necessary to close the defect (Fig 7).

Gross and Connerley state that operative intervention for this disorder is not necessary



Fig 6 Patient with thyroglossal duct cyst located above the foramen cecum

in every case. However, we feel that by far the majority of these lesions will eventually become infected, and thus should be removed. In these cases, 54 (51%) gave a history of infection at some time during their course. Of these, 25 had gross infection when they sought aid at the Johns Hopkins Hospital. Certainly operative excision should be advised for all sinuses because of the high probability of recurring infection (Fig 5).

Regardless of the operative approach that is adopted for this condition, it is extremely necessary that the entire epithelial tract of the cyst, sinus, or fistula be completely removed. Forty-three of the patients in this group had a history of having had one or more surgical procedures previous to admission to the Johns Hopkins Hospital. Twenty-one patients gave a history of having had the cyst lanced, and 22 had local excisions of the abnormality.

Endotracheal anesthesia is the anesthesia of choice in removing these abnormalities.

The operative procedure outlined by Sistrunk (20, 21) in 1920 is the best basic procedure for radical removal of thyroglossal duct abnormalities (23). The authors believe that if the Sistrunk technique is carefully followed with a few modifications, there will be a minimal number of recurrences. It must be stressed that a midline vertical incision is contraindicated, as it does not give sufficient exposure and inevitably results in an unsightly midline contraction, which requires plastic procedures to correct. In following Sistrunk's principles, a transverse incision 5 to 8 centimeters in



Fig 7 Ugly scar after injudicious and repeated x ray treatment of a thyroglossal cyst.

length is made over the cyst, if a cyst is present, or an elliptical transverse incision around the opening of a sinus or fistula (Fig 8). The skin, subcutaneous tissue, and platysma muscle are reflected. The cyst or fistulous tract is followed to the level of the hyoid bone. At this point it will be noted that the longer fibers of the ribbon muscles, the sternohyoid, come into view. At the junction of these 2 muscles, the hyoid bone can readily be palpated. Again it should be stated that the fistulous tract can be anterior, posterior, or pass through the hyoid bone. In order to insure complete removal and to facilitate exposure above this point, the central portion of the hyoid bone is freed above and below, and 1 centimeter of the hyoid directly adjacent to the fistulous tract is removed with a generous block of tissue well around the sinus or fistulous tract. To facilitate the removal of a portion of the hyoid bone, the hyoid is grasped with forceps just to one side of the proposed site of resection. The bone is pulled forward and the center is removed with scis-

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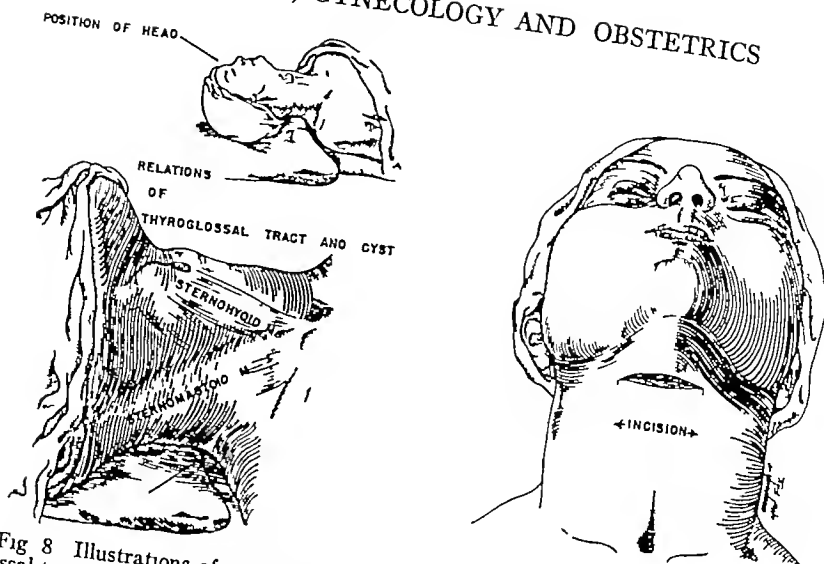


Fig 8 Illustrations of position of head and type of incision for removal of thyroglossal tract abnormalities in the upper neck. A similar type of incision is used for thyroglossal abnormalities in the lower part of the neck. (Redrawn from Sistrunk.)

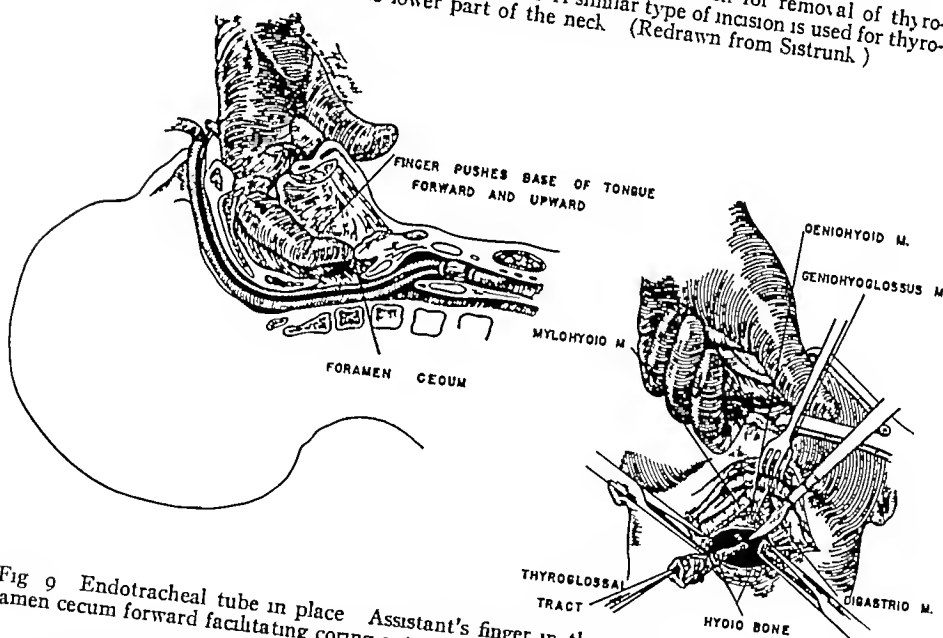


Fig 9 Endotracheal tube in place. Assistant's finger in the mouth forces base of tongue and foramen cecum forward facilitating coring out stalk of tract. (Modified and redrawn from Sistrunk.)

sors if the patient is under 4 years of age, or cut with bone cutters in older patients. Tension on the fistulous tract will pull forward the centrally freed portion of the hyoid bone (Fig 9). Frequently the tract above the hyoid is very small and pliable and care must be exercised to prevent tearing it. An assistant's finger placed in the mouth, exerting pressure against the base of the tongue, forc-

ing it forward, greatly facilitates removal of a core of tissue, including the muscles around the stalk of the tract right up to the foramen cecum. The fainthearted will usually hesitate to follow this procedure, as he fears entering the mouth or the pharynx. However, in following this technique the tract may be followed to the base of the tongue and there removed with no untoward effects. Usually a

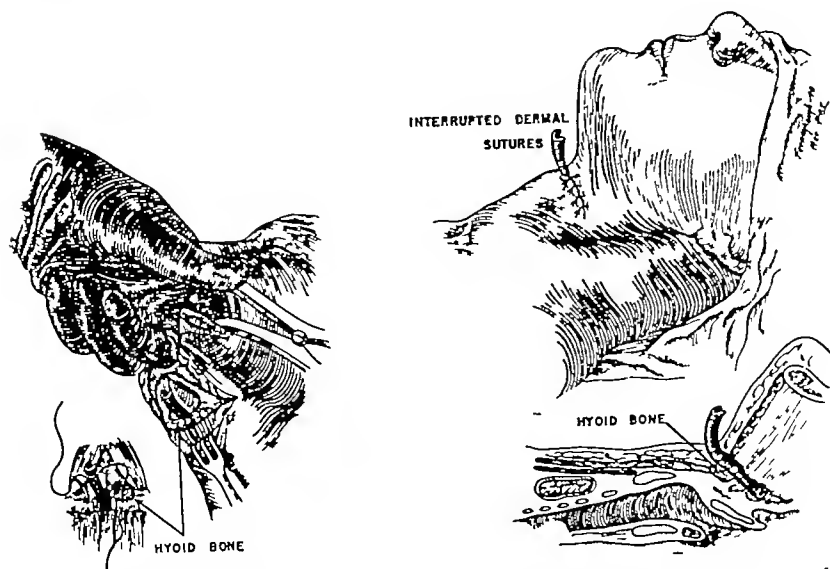


Fig 10 Method of suturing the hyoid bone and closing the wound Drain inserted (Redrawn from Sistrunk )

single pursestring suture of fine chromic catgut, carried on a round needle, will close the defect at the foramen cecum, inverting the mucosa into the mouth. The musculature of the tongue is brought together in the midline with interrupted sutures of fine silk or fine chromic catgut. The severed edges of the hyoid bone are brought together with catgut sutures placed directly through the bone, if the patient is in the younger age group; otherwise, the sutures are placed through the periosteum. It is not even necessary to approximate the edges of the hyoid. Such a defect will not result in any derangement of the action of the local muscles. A small rubber dam drain or tiny tube is placed deep in the muscles of the tongue to facilitate immediate postoperative drainage, and the skin edges are approximated with subcuticular and end-on mattress sutures of fine silk (Fig 10). Removing these skin sutures in a minimum of 4 days and a maximum of 5 days results in a fine hairline plastic scar, practically invisible after a few months, particularly if the patient is quite young.

When a sinus tract is present, the authors do not think it worthwhile to inject it with methylene blue or other dye to outline its course, as the dye frequently spills and stains the surrounding tissues. However, if the op-

erator desires to use a dye, it should be injected some 10 or 12 hours preoperatively to allow the dye to become fixed to the tissues of the sinus tract. Then, at operation, even if there is spillage into surrounding tissues, the sinus tract itself will be more deeply stained. However, any fistulous tract can be followed sufficiently without the aid of one of the dyes.

The 4 intratongue lesions in the series were all excised intraorally. None of these recurred.

#### RESULTS

Of the 105 cases studied, all were followed for a year or more. Seventy-eight, or 75 per cent, were followed for 5 years or more. The following statistics were based on the total 105 cases.

In the 28 suprahyoid lesions, it was not felt necessary to remove an area of the hyoid bone, but the lesion was followed to the foramen cecum in each case and a core of tissue was removed well around it. None of these lesions recurred, a cure rate of 100 per cent.

Of the 77 which occurred at or below the hyoid bone, 34 had an adequate section of the bone removed, 2, or 6 per cent, recurred.

In 43 of the 77 at or below the hyoid, no bone was removed and 11, or 25.6 per cent, recurred. These figures are evidence enough



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to prove the value of removal of the central portion of the hyoid bone in order to follow the tract to the foramen cecum

There were 13 recurrences in the entire series. In all but 2 of these cases, no hyoid bone was taken in the first operation. In these 2 cases, the authors feel insufficient bone was taken. In one of the cases, several small bits of hyoid were rongeured away, and in the other, the hyoid was touched with carbolic acid, both procedures to be condemned. In the reoperative cases, an adequate amount of hyoid bone was taken at the second operation. These reoperative cases have been followed from 1 to 15 years. In none were there recurrences following the second operation. In this series there were no operative deaths. One patient, mentioned before, developed hypothyroidism 4 months after operation following the removal of an intralingual cyst, the wall of which contained the only thyroid tissue in the body. As mentioned before, 6 patients presented themselves with serious acute infection and were preliminarily treated by simple incision and drainage. Eight of the cases, after pathological study, revealed aberrant thyroid tissue within the wall of the cyst. In 6 of these cases, this aberrant tissue was embryological in structure.

## CONCLUSION

Failures in this series, as well as in other reported series, are due to the inexperienced operator seldom appreciating the fact that it is necessary that thyroglossal tract abnormalities be followed to the foramen cecum at the base of the tongue, and that it is necessary in all instances to insure complete removal of all epithelial remnants, and in all lesions at the level of the hyoid bone or below to take 1 centimeter of the central portion of the hyoid bone and a block of tissue well around the

sinus or fistulous tract. There are undoubtedly some few cases in which an incomplete procedure will result in a permanent cure, but this can be due to the chance that no epithelium lies within or near the hyoid bone. Simple dissection of the cyst, combined with simple ligation of the thyroglossal pedicle, and the treatment of thyroglossal fistula by means of scraping and cauterizing, the injection of sclerosing solutions, lancing the cyst, and treating the abnormality with x-ray or radium, give unsatisfactory results, serve only to increase the incidence of recurrence, and should be discarded (23).

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# ERADICATION OF BENIGN LYTIC BONE TUMORS AND IMMEDIATE RECONSTRUCTIVE SURGERY WITH EMPHASIS ON BENIGN GIANT CELL TUMORS

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A STUDY of benign lytic lesions of bone still attracts considerable attention because of the confusion in the diagnosis and methods of treatment.

The etiology of benign giant cell tumor, localized osteitis fibrosa cystica, osteoid osteoma, and eosinophilic granuloma is not known but it appears to be directly concerned with an interference of blood supply, and trauma is a very likely contributing factor. Some writers consider these lesions as essentially inflammatory, others speak for the neoplastic theory. Codman thought that benign giant cell tumor represented a process of repair following rupture of a nutrient artery. The theory of the embryological basis for enchondromas is well known.

Bergstrand in writing on the genesis of giant cell tumor states that this condition is neither a tumor nor an inflammation but rather a process intimately associated with normal bone formation and resorption (Haggquist-Hansen theory). He states that while he does not know the genesis he regards the condition as due to local bone resorption and based his opinion on the similarity of giant cell tumor to osteitis fibrosa cystica. While the cause is not known, certain observations favor assumption of the primary cause as due to disturbed circulation.

Decalcification and resorption of collagenous materials in the bone sets free the original bone forming tissue. Bone corpuscles approach each other and by fusion and nuclear division form giant cells. These form a syncytium lining the lumina of vessels, thus differentiating a fibrous bone marrow which replaces resorbed bone substance, proliferates and displaces true bone marrow, a reversion

of bone tissue to primitive fetal type. This tendency to proliferation gradually ceases, giant cells disappear, and regression occurs. The ultimate result is a bone cyst surrounded by new bone tissue.

Eosinophilic granuloma of bone is a destructive lesion in which histiocytes form the basic component of the lesion interspersed with varying numbers of eosinophilic leucocytes. Lichtenstein and Jaffe (26) were the first to describe this condition and give it its name. Green and Farber (16) were the first to show the relationship of this condition to that of Letterer-Siwe disease and that of Hand-Schüller-Christian disease. Farber and Mallory believe that all these conditions are different expressions of the same basic disorder.

Osteoid osteoma was first described as a clinical entity by Jaffe (23) who believes that it is of neoplastic origin while other authors such as Brailsford believe it is inflammatory in origin. Ponseti and C. K. Barta describing the pathological picture bring out the fact that the typical histological appearance, the lack of inflammatory cells, and the negative smear and culture would indicate its neoplastic origin, however clinically and roentgenographically it appears to be a lesion of inflammatory origin.

Inclan believes that characteristics of giant cell tumor are more truly those of benign tumor rather than those of chronic inflammation, chronic irritation, or traumatic subcortical hemorrhage in cancellous bone.

Ernest E. Aegerter states that the giant cells found in such tumors as giant cell tumor of bone, giant cell tumor of tendons, osteogenic sarcoma, fibrous dysplasia (hyperparathyroidism), unicameral cyst, osteoid osteoma, eosinophilic granuloma and allied reticu-

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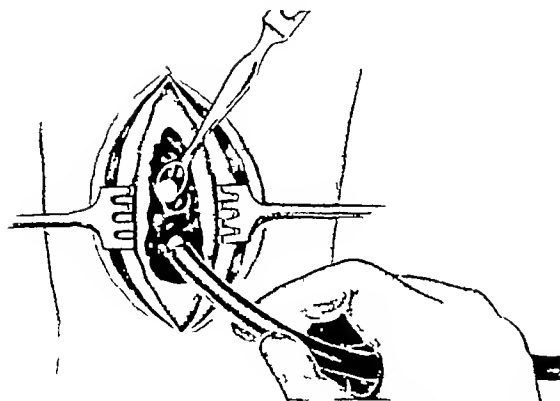


Fig 1 Curettage and suction in removal of giant cell tumor

loendothelioses, nonosteogenic fibroma and ossifying fibroma are all generically and functionally related, produced by the fusion of fibroblastic tumor cells for the purpose of phagocytosis. He states further that "the behavior of the tumor can be predicted only by the consideration of the cells of the fibrous matrix and that the giant cells give little or no clue as to whether the tumor will recur or metastasize. Fibrous matrix cells are found also in a number of bone lesions, both neoplastic and non-neoplastic. Many diagnoses of giant cell tumor of bone are based on these two criteria alone which is a mistake. The terminology would be self-explanatory and

classification simplified if fibromas of bone were called giant cell fibroma, nonosteogenic fibroma and ossifying fibroma."

The lytic lesions of fibrous dysplasia of bone, osteitis fibrosa cystica generalisata, or von Recklinghausen's disease, present a picture which may very easily be confused with metastatic carcinoma. The etiology of these lesions is definitely known as an adenoma of a parathyroid gland. The diagnosis is made from a careful history, absence of a primary lesion, hypercalciuria, hypercalcemia, hypophosphatemia, and renal calcinosis.

The purpose of this presentation is not to review the details of the various etiological theories, nor to delve at length into the pathological findings of these lesions, which are so well described in numerous writings, but rather to discuss the methods of treatment and to suggest some refinements in technique.

The diagnosis of giant cell tumor is made by the complaints of localized pain, swelling, impaired function, and a crackling or give sensation. The usual location is at the end of certain long bones, especially the distal end of the femur, the proximal end of the tibia, proximal end of the fibula, the distal end of the radius, and the proximal end of the humerus. Other bones including the vertebrae are frequently involved. The roentgenogram is often diagnostic, showing widening, rarefaction, and

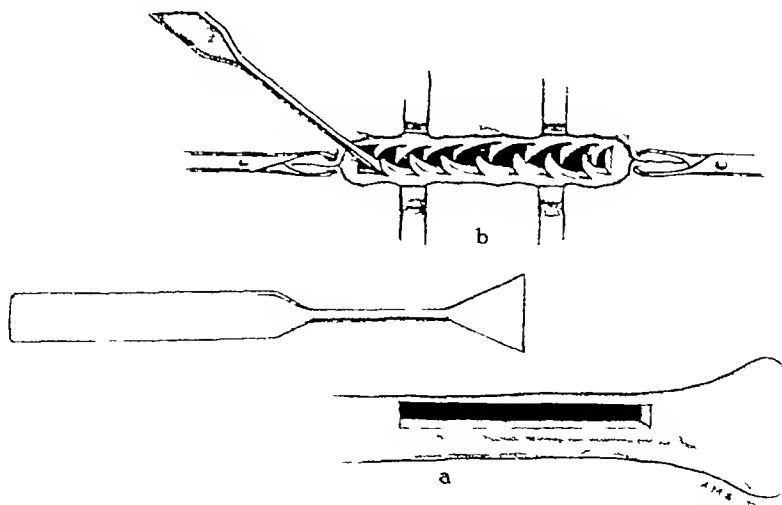




Fig 3 Case 1 A K, 10½ years of age Localized osteitis fibrosa cystica a, Before surgery, b, 5 months after surgery, curettage, aspiration, tubal grafts (struts and chips)

occasional trabeculation of the medulla, with thinning and bulging of the cortex.

Grout discusses the difficulties of roentgenological interpretation and misunderstandings which are liable to occur if too much stress is placed on roentgenographic features without reference to clinical findings and other means of investigation. He believes that it is not scientific to state that roentgenographic features alone are sufficient to establish the nature of any bone tumor. He shows series of roentgenograms of sunray appearance considered to be typical of osteogenic sarcoma which in each case showed a different pathological condition. The same situation was present with various osteolytic lesions.

Brailsford states that it is very important to correlate the clinical, roentgenological, and histological findings before radical surgery such as amputation is performed. He cites a number of cases showing roentgenograms typical of osteogenic sarcoma which proved to be benign. He also presents a case in which, although the clinical findings did not substantiate the diagnosis of a Ewing's sarcoma, the roentgenogram suggested and the biopsy revealed a highly malignant Ewing's tumor. The patient refused surgery. The lesion completely resolved and 10 years after she is still fit and well.

The treatment of benign giant cell tumors, localized osteitis fibrosa cystica, enchondroma, osteoid osteoma and eosinophilic granuloma and some others of the benign lytic bone lesions, seems to vary, depending to some extent upon the specialty of the attending physician,



Fig 4 Case 2 N O'B, 4 years of age Localized osteitis fibrosa cystica a, Before surgery, b, microscopic section showing the marrow space diffusely replaced by young connective tissue cells with a number of blood vessels, there is no evidence of malignancy, c, anteroposterior and lateral views showing gradual reossification of the involved area, 13 months after surgery

the radiologists favoring irradiation and the surgeons, resection, while a few clinicians favor both. Of the latter group, some speak for preoperative irradiation and others suggest postoperative therapy, and one surgeon gives his patients with giant cell tumors irradiation before and after surgery.

Badgley, discussing the presentation of Meyerding, states that a combination of roentgen therapy and surgery gives poorer results than either alone. He believes that radiation following operation and the employment of bone grafts may prevent creeping substitution in the grafts.

Hatcher, discussing Meyerding's presentation, says that it is possible that some benign giant cell tumors which have been reported to undergo malignant changes are examples of sarcoma induced by roentgen therapeutic ir-



Fig 5 Case 3 H B, 7 years of age Localized osteitis fibrosa cystica a, Before surgery, November 11, 1931, b, after 2,400 milligram hours radium, June 3, 1932, c, approximately 2 months after surgery, January 1933

ntation, but emphasizes that this is true in cases treated in which the indications and dosage were not so well known and controlled as they are now

Mandl does not favor preoperative irradiation

Cantril and Buschke state that roentgen therapy of giant cell tumors is a highly satisfactory procedure They state that curettage is unsatisfactory because of the frequent recurrences (30 per cent) It increases the danger of infection and may make roentgen therapy more risky and difficult They prescribe x-ray therapy in minimal dosage sufficient to destroy the tumor but not to interfere with regeneration of bone

Haggart and Hare believe it erroneous to warn against combined radiation therapy and surgery in the management of giant cell tumor

Woodard and Coley (42) after treatment of 11 giant cell tumors with irradiation have come to the conclusion that they should not be treated by irradiation

Cahan and his associates feel that irradiation

therapy is far less satisfactory than surgical treatment Irradiation therapy carries the risk of inadequate treatment of a malignant tumor in the mistaken belief that it is benign, that many of these benign lesions are radioresistant or only slightly radioresponsive, that the growth centers of children may be seriously disturbed, and that sarcoma may develop at the site of previous irradiation

They describe 11 cases in which bone sarcoma developed at a period long after irradiation of benign tumors In our rather small series of proved benign giant cell tumors, 2 patients (H D and P O'L) developed post-irradiation sarcoma The question arises whether these 2 patients may not have developed sarcoma if they had not had irradiation The biopsy sections following the original surgery in these cases had been carefully checked by several pathologists The entire tumor had been resected It is presumed therefore that there had been no error in the original diagnosis, and that the resulting sarcomas had been caused by the irradiation

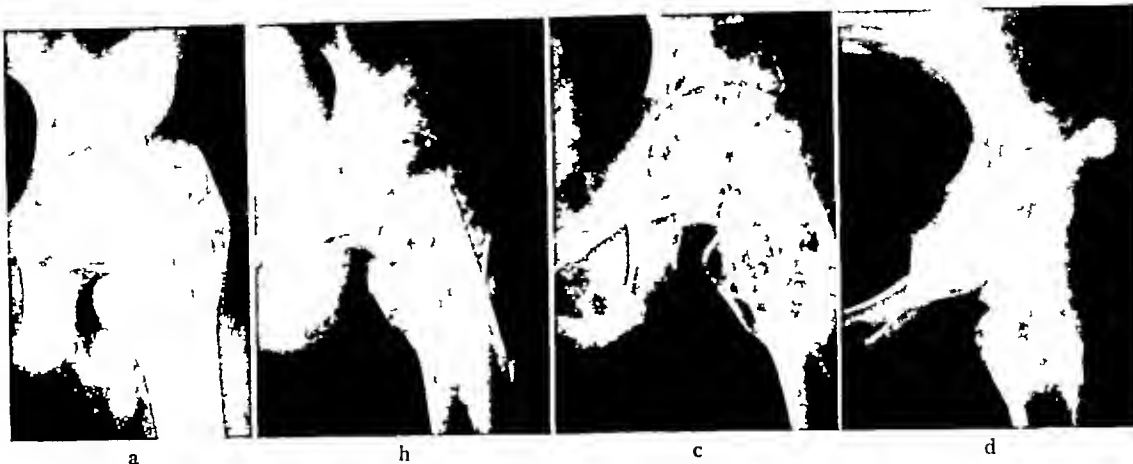


Fig 6 Case 4 P O'L, 15 years of age Xanthomatous bone cyst left femur a, March 5, 1936, on admission, b, July 7, 1936, after curettage and massive grafts and bone

chips, c, April 1, 1937, healing, film made during x ray therapy, d, April 4, 1940, 4 years postoperative, showing malignant degeneration of ilium and upper end of femur

With these divergent expert opinions, how should the local clinician or radiologist decide upon the course to pursue in a given case? The majority of these patients are originally seen by men in general practice and the diagnosis is made with the assistance of the local roentgenologist. Too few of these patients are seen early by the expert roentgenologist, general surgeon, or orthopedic surgeon. A more definite conclusion regarding the method of treatment offering the best end result with a minimum of functional loss and minimal disability may only be determined by more extensive and better illustrated literature on this subject. Good roentgenographic reproductions showing the extent of involvement at various stages of the treatment and the end results, good, bad, or indifferent should be published.

Geschickter (14), in evaluating the treatment of giant cell tumor by surgery or irradiation, chooses a middle ground. He states that surgery can be used following irradiation if the latter is properly given, while irradiation following unsuccessful surgery is usually useless. H Platt favors surgery in the treatment of benign giant cell tumors. Geschickter and Copeland (15) state that "excluding isolated giant cell tumors of the skull and vertebrae, curettage performed in carefully selected cases is unquestionably the treatment of choice." Bloodgood favored thorough curettage fol-

lowed by cauterization with pure phenol, later neutralized by 95 per cent alcohol. Some surgeons use a 50 per cent zinc chloride solution. The electric cautery or soldering iron was often substituted for the chemical cauterization.

Herendeen (20, 21) favors primary roentgen therapy without operation. He gives "growth

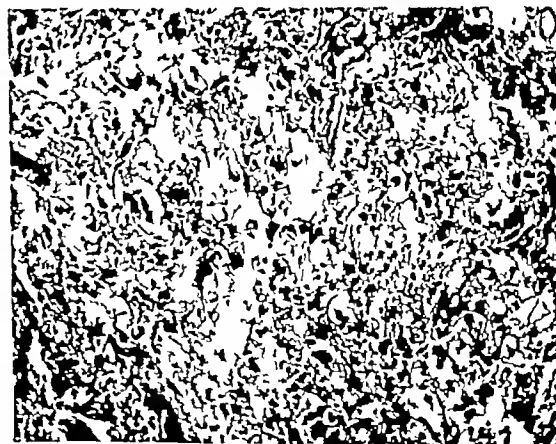


Fig 7 Same patient as in Figure 6. Photomicrograph (X145) original biopsy. Tissue from the wall of the cyst reveals a very cellular fibrillar connective tissue infiltrated with small round cells. In places there are nests of large foamy cells with a small eccentric nucleus and vacuolated cytoplasm. Sudan 3 stain reveals the cytoplasm contains lipid material. The contents of the cyst shows a similar structure with single foreign body giant cells. Single foci of new bone formation imbedded in the cellular tissue. The histological picture suggestive of xanthomatous bone cyst.

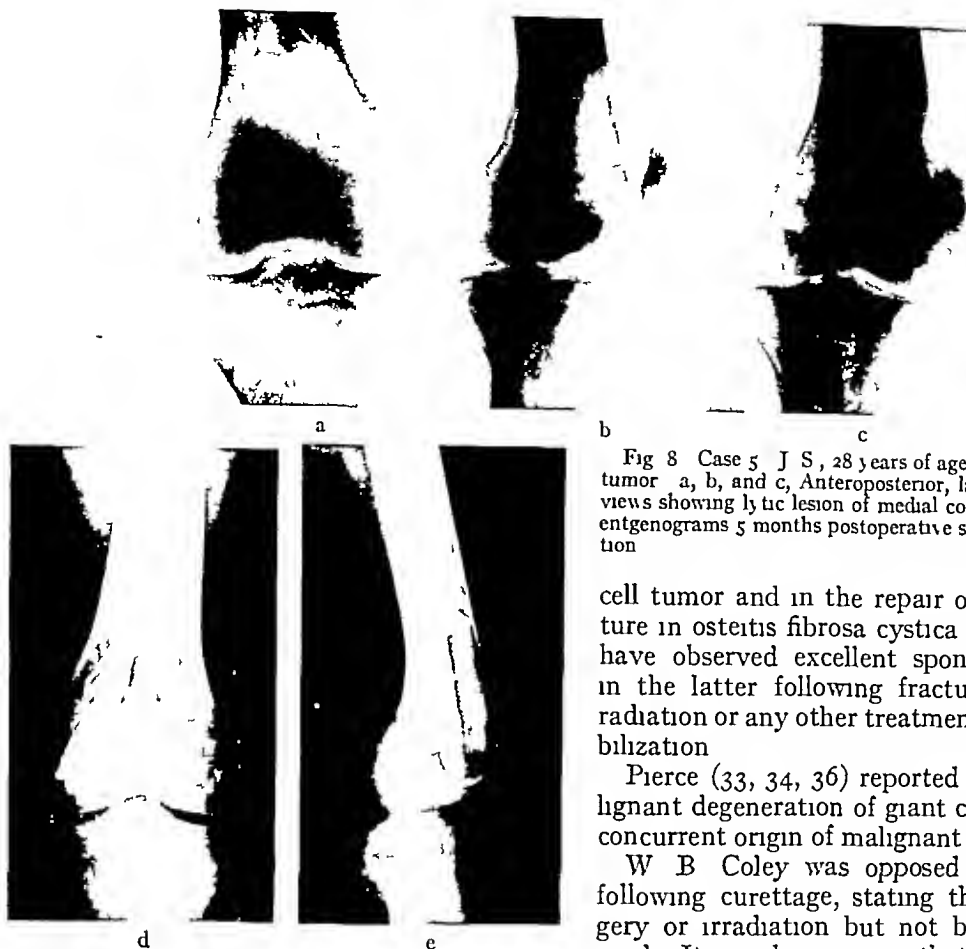


Fig 8 Case 5 J S, 28 years of age Benign giant cell tumor a, b, and c, Anteroposterior, lateral, and oblique views showing lytic lesion of medial condyle, d and e, roentgenograms 5 months postoperative showing reconstruction

cell tumor and in the repair of malacic fracture in osteitis fibrosa cystica localisata," we have observed excellent spontaneous repair in the latter following fracture without irradiation or any other treatment except immobilization

Pierce (33, 34, 36) reported 2 cases of malignant degeneration of giant cell tumor or of concurrent origin of malignant neoplasm

W B Coley was opposed to irradiation following curettage, stating that either surgery or irradiation but not both should be used It was his opinion that a higher percentage of malignant growths followed irradiation of benign lesions after surgery Coley believed that 16 per cent of benign giant cell tumors became malignant He favored surgery, cauterization, and complete closure of the wound

Simmons, in a review of the cases in the registry of the American College of Surgeons, reports 3 cases or 3.7 per cent of benign giant cell tumors changed to osteogenic sarcoma, but there is no conclusive evidence that the original diagnoses may not have been erroneous It is frequently possible for a poorly located specimen to be given to the pathologist for the original diagnostic examination The biopsy specimen may be taken from a portion of the mass which is not typical of the tumor proper *The pathologist can only report on the specimen presented to him by the surgeon*

restraint" dosages, which are followed by apparent tumor growth and later regression Pain and tenderness diminish as the reaction subsides ossification takes place, and function returns Results are not evident for months

Pierce (35) agrees with Herendeen and Pfahler He favors frequent relatively mild doses of roentgen therapy with the purpose of growth restraint It is his opinion that surgical intervention should not follow roentgen therapy short of 6 or 8 weeks In his series of cases there was a less favorable response following surgical intervention Pierce favors immediate roentgen therapy, if surgical intervention has already been accomplished, especially if there has been no cauterization at the time of operation

While Pierce speaks of the "specificity of irradiation in inducing ossification of giant



Fig 9 Case 6 D G , 39 years of age Benign giant cell tumor a, Original roentgenogram, b, after 2 months of irradiation, c and d, after resection and reconstruction, e and f, approximately 2 years postoperative, g, at right, photomicrograph (X180), giant cell tumor Note the presence of multinucleated giant cells in a rather loose stroma Hematoxylin eosin preparation

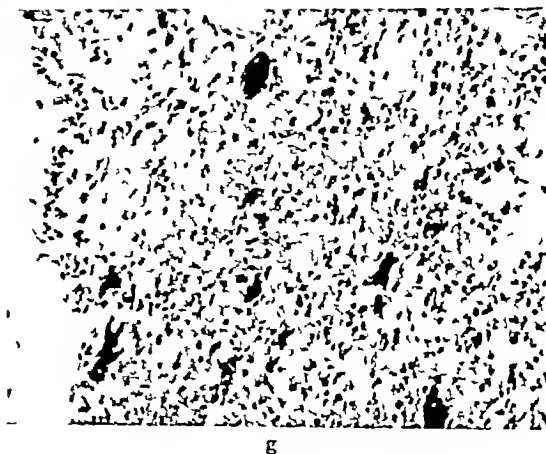






Fig 10 Case 7 E G, 15 years of age Localized osteitis fibrosa cystica neck of the left femur a, Before surgery, b, reconstruction with iliac grafts Roentgenograms 2 months postoperative

Biopsy specimens should, therefore, be taken from the depth and also from various areas of the tumor mass and preferably en bloc

Stone and Ewing reported a case of malignancy of bone occurring at least coincidentally with a giant cell tumor

Mercer reports recurrence following curettage. He evidently feels that some of the giant cell tumors undergo malignant degeneration, and that some are infected and in other cases there is failure of healing of the large cavity. He states that "deep x-ray therapy gives reasonable hope of permanent cure although in 3 or 4 weeks after treatment, the appearance is that of a rapidly growing malignant tumor. This acute phase quickly subsides and fibrosis with rapid regression of the tumor results."

Jones and Lovett describe the giant cell tumor as a collection of spindle cells with numerous multinuclear giant cells. The growth has no tendency to metastasize and can be removed locally.

While most authors have discarded the term "sarcoma" for that of benign giant cell tumor, it is regrettable that Whitman states that "in comparison with most sarcomata, giant cell sarcoma is a tumor which is clinically benign." Baetjer and Waters have a page on "giant cell sarcoma" and then state that it has a "malignant name but is entirely benign in character," and Albee under the

title, "The Treatment of Primary Malignant Changes of Bone by Radical Resection and Bone Graft Replacement," includes in his report 2 and perhaps 3 cases of benign giant cell tumor. Such repetition of errors of nomenclature confuses the students and clinicians and should be eliminated from the literature.

The writers present some cases of benign lytic bone lesions, treated by curettage, aspiration, primary excision or resection, followed by immediate reconstructive surgery. The technique described has the following advantages: (1) more definite and time saving end results, (2) immediate cessation of the destructive process, diminishing the extent of necessary reconstruction in direct proportion to the time elapsing since onset.

At operation, under tourniquet, an incision is made directly into the tumor which in benign giant cell tumor consists of a current jelly, fleshy mass containing some serosanguineous fluid. Frozen section confirms the diagnosis in the operating room and the writers proceed with the technique of resection. Depending upon the size, location, and nature of the lesion it may be eradicated by a thorough intrinsic curettage or by an extrinsic total resection.

In the intrinsic method a long window is cut over the tumor so that all sides and ends are in full view. The mass is resected grossly and then a curette is employed, at the same time constantly using a large caliber rubber suction tube attached to a strong suction apparatus (Fig 1). Substitute hose is at hand to be changed as frequently as is necessary during the operation. Each loculus is cleansed of tumor tissue with the curet and the suction apparatus. When the entire inside of the cavity can be seen thoroughly cleansed of tumor tissue, a ball electrode endotherm is used to cauterize the entire wall. It is then filled with saline solution, the large suction tube is again inserted and the walls are again curetted, and the contents thoroughly aspirated. For the bone grafts, cancellous bone is obtained from the wing of the ileum. Mowlen and Abbott and associates have shown that cancellous bone is able to withstand infection to an unusual degree, because of its loose structure it acquires an adequate blood

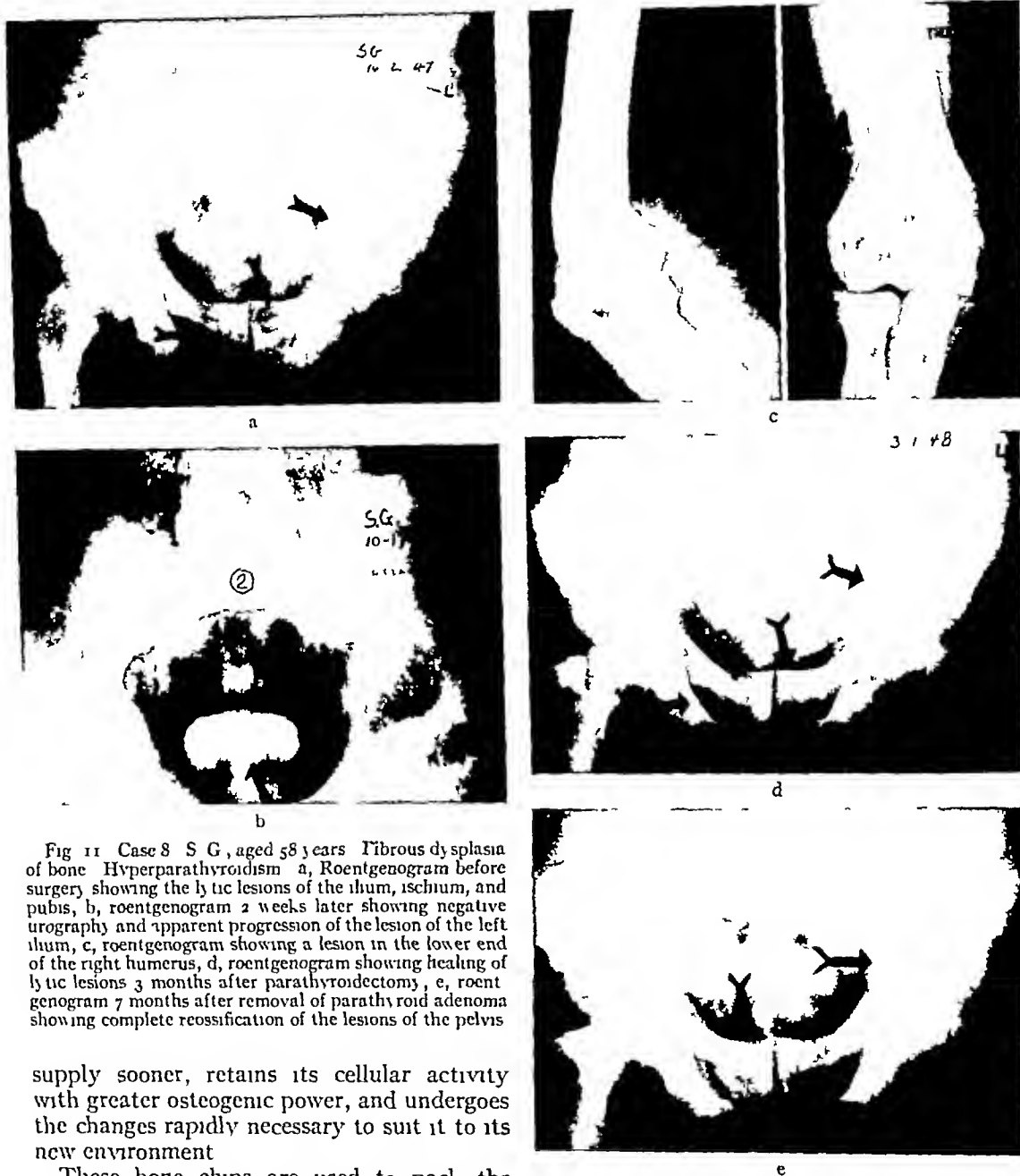


Fig 11 Case 8 S G, aged 58 years Fibrous dysplasia of bone Hyperparathyroidism a, Roentgenogram before surgery showing the lytic lesions of the ilium, ischium, and pubis, b, roentgenogram 2 weeks later showing negative urography and apparent progression of the lesion of the left ilium, c, roentgenogram showing a lesion in the lower end of the right humerus, d, roentgenogram showing healing of lytic lesions 3 months after parathyroidectomy, e, roentgenogram 7 months after removal of parathyroid adenoma showing complete reossification of the lesions of the pelvis

supply sooner, retains its cellular activity with greater osteogenic power, and undergoes the changes rapidly necessary to suit it to its new environment

These bone chips are used to pack the cavity Where structural support is necessary long cortical bone grafts are obtained from the tibia and used in strut-like fashion in the longitudinal axis of the cavity The soft tissues are sutured tightly by layers, with chromic catgut used throughout including the skin

so that dressings are unnecessary A well fitting plaster cast is applied This remains on for approximately 3 months, during which time check-up roentgenograms are made at intervals of 4 to 6 weeks When indicated, a brace is used after the removal of the cast

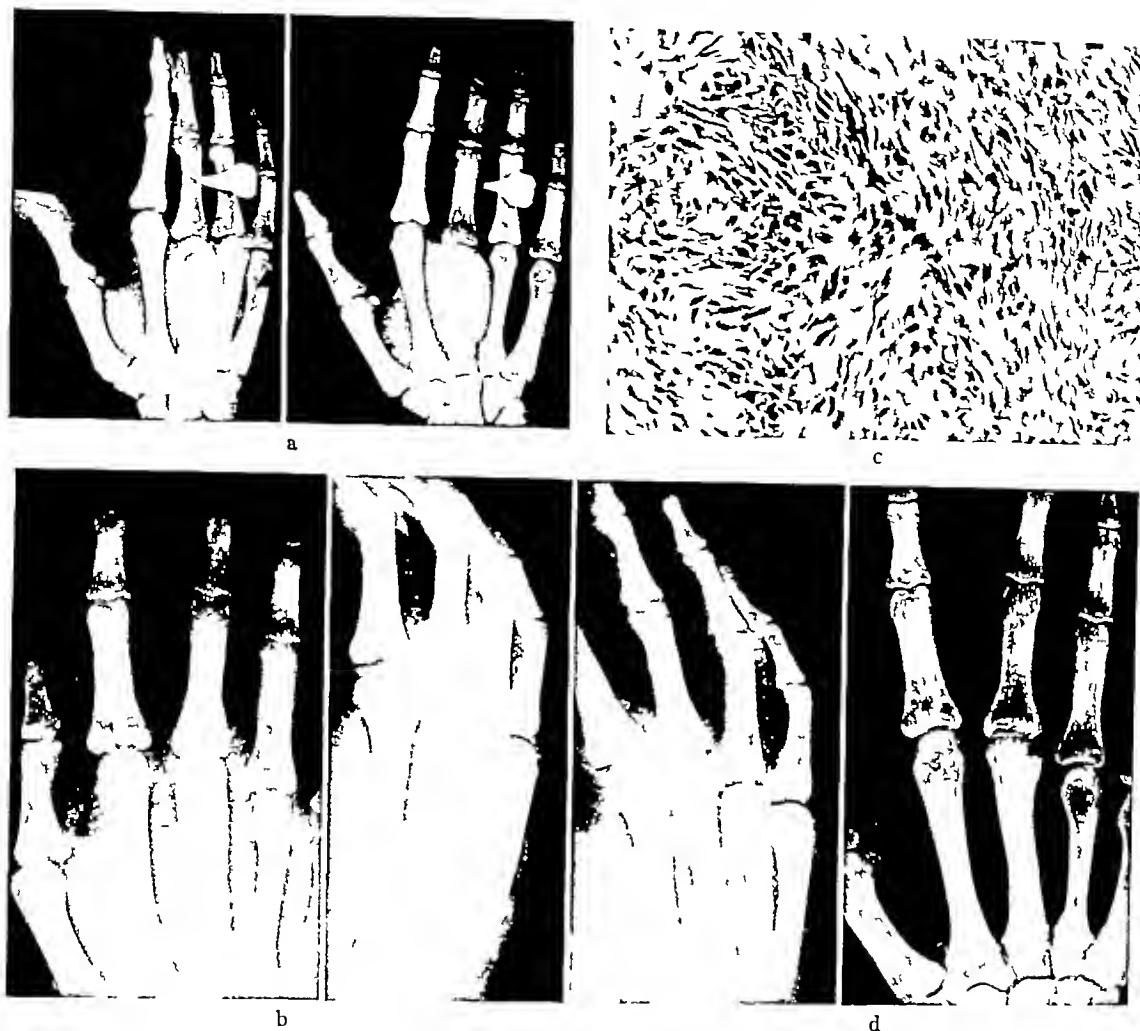


Fig 12 (Legend opposite page)

The extrinsic or total extraperiosteal resection is done in cases in which there is extreme thinning out or destruction of the cortex. Reconstruction is done by the use of thick autogenous bone grafts for structural support with numerous cancellous bone chips for its osteogenic power. Wherever applicable anatomical reconstruction should be attempted (Levinthal and Kirshbaum).

For several years, the writers have used a technique of small pedicled tooth-like grafts across the tibial channel of the donor site to hasten regeneration of bone following removal of massive grafts (Fig 2). This method also prevents depression of the scar.

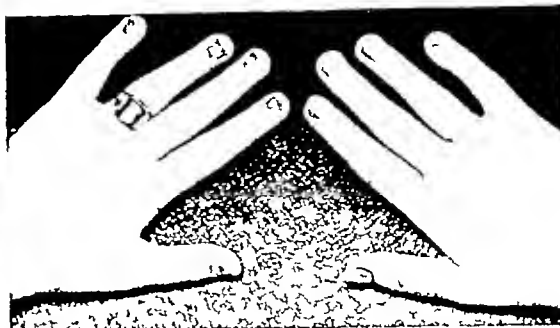
#### CASE REPORTS

**CASE 1** A K, aged 10½ years, Michael Reese Hospital. In 1933, the patient fell from a tree and fractured his left shoulder. In January 1936, the same shoulder was injured when struck by a truck. In April, 1936, the same shoulder was again injured by falling. Examination at this time revealed a fusiform tender expansion of the proximal end of the right humerus. Roentgenogram showed a multilocular cystic area expanding the upper one third of metaphysis (Fig 3, a). There was no evidence of a pathologic condition in any of the other long bones.

Operation was performed on May 19, 1936. Curettage and aspiration were done followed by the use of tibial grafts to fill the defect. The pathologist's diagnosis concurred with the clinical diagnosis of osteitis fibrosa cystica. Patient made uneventful recovery with a complete return of function (Fig 3, b).



Fig 12 Case 9 B S, 16 years of age Fibroma of the middle metacarpal bone a, Roentgenogram before operation, showing expanding lytic tumor of the middle metacarpal bone Complete destruction of the shaft including



cortex, some trabeculation There is a thin remnant of bone of fairly normal density in the subchondral region of the head of the metacarpal, and about 1 centimeter of normal appearing bone at the proximal end Note the shortening of the metacarpal, b, roentgenogram showing reconstruction of metacarpal by tibial graft Note restored length of the finger, c, photomicrograph of the tumor mass Note the dense fibrillar appearance of the lesion and in one area a spicule of bone, d, roentgenographic appearance 27 months after operation showing transformation of graft into a true metacarpal bone, e, photographs showing extension and flexion, f, photographs 27 months after operation showing restored length of right middle finger, full extension, and very moderate limitation of flexion

CASE 2 N O'B, aged 4 years, Michael Reese Hospital There was a history of right limp and pain in the right hip region of 3 months' duration The physical examination revealed tenderness about the right great trochanteric region, swelling, and limp There was no local heat or redness Roentgenograms revealed a multilocular cystic lesion of the proximal metaphysis of the right femur extending to the epiphyseal plate (Fig 4, a)

At operation on August 15, 1936, a window was opened into this cavity This was curetted, aspirated, cauterized with 50 per cent zinc chloride solution, washed and again aspirated The cavity was then filled with cancellous bone chips taken from the ilium The pathologist's report was osteitis fibrosa cystica with giant cells (Fig 4, b)

Recovery was uneventful, and the follow-up roentgenograms show gradual reossification of the involved area and reconstruction of the normal architecture of the upper end of the femur (Fig 4, c) The patient has had no residual symptoms

CASE 3 H B, aged 7 years, Michael Reese Hospital There was a history of pain and swelling of the right forearm following an injury of about a week's duration Roentgenograms showed an expanding cyst of the left ulna The patient had 2,400 milligram hours of radium on November 17 and 18, 1931 November 8, 1932, because of expansion of the cyst, operation was advised Through a small incision, the cyst wall was opened, curetted, and aspirated, and the lateral wall gently compressed with the flat surface of a small periosteal elevator On January, 1933 check-up of roentgenograms show regeneration of bone within the former cystic area

Eventually there was recovery of form and function and the patient was symptom free

CASE 4 P O'L, aged 15 years, Cook County Hospital Patient gave history of developing pain and limp in left hip about December 1934 In March of 1935 while walking her leg suddenly gave way She was admitted to the hospital on March 12, 1936 Roentgenogram taken at this time (Fig 6, a) showed a multilocular fracture of the neck of the left femur and a pathological fracture of the neck of the femur

Surgery was performed on March 23, 1936 at which time the large yellow tumor mass was curetted, aspirated, and cauterized Bone grafts obtained from the tibia and the ilium were used to fill the bone defect The microscopic diagnosis of this tumor was xanthomatous bone cyst (Fig 7)

The patient's postoperative course was smooth She received x-ray therapy as a part of her follow up treatment Roentgenograms April 1, 1937 show regeneration of bone in the pre-existing cavity with union of the fractured neck of the femur (Fig 6, c)

Four years later patient complained of pain, loss of weight, and swelling localized to left hip region Roentgenograms showed sclerosing osteogenic sarcoma verified by biopsy The patient died of pulmonary metastases about 1 year later

CASE 5 J S, aged 28 years, Michael Reese Hospital Patient gave a history of pain first developing in the region of the left knee in November, 1935 Consulted us on February 15, 1936 Examination revealed moderate tenderness over the medial condyle of the left femur and an eggshell feeling or crackling on deep pressure over that area Roentgenograms (Fig 8 a, b, c) show a lytic lesion with slight trabecu-

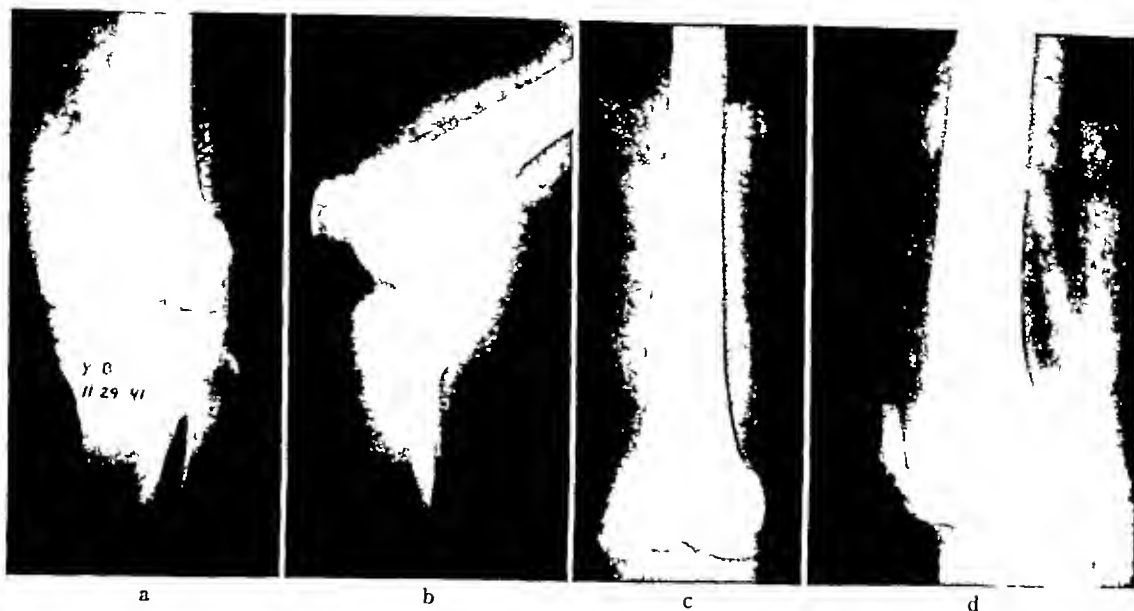


Fig 13 Case 10 Y B, aged 22 years Benign giant cell tumor of the femur a and b, Before operation, c and d after resection and reconstruction

lation involving the medial condyle of the left femur. The Wassermann and Kahn tests were negative.

On February 29, 1936, surgery was performed. The tumor was excised grossly and frozen sections showed benign giant cell tumor, highly cellular. Thorough curettage, irrigation suction, and cauterization with a ball electrode endotherm were used. The defect was filled with numerous cancellous grafts as well as cortical strut grafts obtained from the tibia. Cast was applied. The cast was removed 3 months later. Roentgenograms taken July 27, 1936 show reconstruction (Fig 8 d, e).

CASE 6 D G, aged 39 years, Michael Reese Hospital. The patient gave a history of pain in the left knee since 1931. From then until 1934 he had been treated for "rheumatism." In April 1934 he slipped while getting out of the bath tub and forcibly bent his left knee causing a loud crackling and tearing of the joint. He had a great deal of pain and disability until he was seen at a clinic on May 1934, at which place he was told he had a tumor requiring irradiation. He was also informed that he had a 3 plus Wassermann and diabetes. He was given deep x ray therapy until July 11, 1934, at which time further roentgenograms were made. The patient was then told he had a malignant tumor requiring amputation. He was admitted to the Michael Reese Hospital on July 20, 1934. The Wassermann and Kahn tests were negative and there was no glycosuria nor hyperglycemia.

On July 21, 1934, the patient was operated upon. The mass was completely excised including the medial articular surface of the condyle since the tumor involved the entire subchondral plate. The soft structures and remaining bone surfaces were care-

fully curetted and irrigated, the large tube suction apparatus being used frequently. A ball electrode endotherm was used for cauterizing. Two cavities were then made into the head of the medial articular surface of the tibia and numerous strut grafts were taken from the tibial shaft and placed across from the shaft of the femur into the tibial head (Fig 9). A spica cast was applied for 3 months followed by the use of a walking caliper brace. Brace was discarded in November 1935, at which time patient had an excellent fusion.

CASE 7 E G, aged 15 years, Michael Reese Hospital. The patient was observed in October 1941, complaining of pain, limited motion, and limp. The symptoms were all referred to the region of the left hip. Operation consisted of an anterior approach to the neck of the left femur. Curettage, aspiration, and cauterization were followed by the insertion of grafts obtained from the wing of the ilium. Roentgenograms made January 10, 1942 (Fig 10 b) show the reconstruction. Six months postoperatively the patient was symptom free.

CASE 8 S G, aged 58 years, St. John's Hospital, Santa Monica. The history is that of pain in the left groin and anterior aspect of the left thigh of 8 months' duration. On October 2, 1947, the patient presented himself in the out patient department of St. John's Hospital walking with the aid of crutches. His condition had been studied at another clinic and diagnosed as metastatic carcinoma of the bones, because of numerous lytic lesions involving the wing of the left ilium extending into the acetabular cavity, the right elbow, ischium and pubis, and the region of the left lesser trochanter. Additional lesions were noted in the left femur, both ilia, and the skull.

A complete study revealed no primary lesion. The patient had lost no weight. The routine blood count was normal. Blood chemistries showed calcium of 13.5 milligrams per cent, phosphorous 0.9 milligrams per cent, and alkaline phosphatase of 1.7 King-Armstrong units. There was hypercalciuria. The sedimentation rate was 40 millimeters in 1 hour. Recheck blood calcium was 15 milligrams per cent. On November 15, 1947, a biopsy was taken from the large lesion in the supra-acetabular region of the left hip (Fig 11 a). The pathologist, Dr Hummer, reported fibrous dysplasia, confirming the clinical diagnosis.

On December 9, 1947, the neck was explored. A benign calcified adenoma of one of the left parathyroids was removed from within the capsule of the thyroid gland. The blood chemistries immediately returned to normal values. Subsequent roentgenograms showed gradual recalcification of the lytic bone lesions (Fig 11, d, e).

On observation in the clinic in September 1948, the patient walked without crutches and with a slight limp. He had no pain and had returned to his previous occupation. The blood chemistries remained normal.

**CASE 9.** B. S., aged 16 years, Cook County Hospital. This patient was first seen in the out patient clinic on February 11, 1936. The complaint was a progressive swelling of the dorsum and palm of the right hand. This was first noticed about a year prior to her admission to the Cook County Hospital. The roentgenograms showed a lytic expanding tumor of the middle metacarpal bone with absence of the cortex along parts of the shaft. The base was uninvolved for about 1 centimeter (Fig 12, a).

Operation was performed on February 12, 1936. The entire mass was carefully resected, including the metacarpal head. The base was not resected, but was excavated to receive a metacarpal shaped, measured graft from the tibia. The pathologist reported fibroma of bone. The patient made an uneventful recovery with almost complete return of form and function. The smooth graft eventually developed the contours of a metacarpal bone, including a narrow cavity (Fig 12, d).

**CASE 10.** Y. B., aged 22 years, Michael Reese Hospital. There was a history of pain and limp in the left knee beginning several months prior to observation at Mandel Clinic. Roentgenograms made November 29, 1941 showed an expanding lesion of the medial condyle of the left femur (Fig 13, a and b). The patient was operated upon several weeks later at which time frozen section biopsy by Dr Otto Saphier confirmed the clinical diagnosis of benign giant cell tumor. Through an adequate window, the contents of the tumor mass were completely resected, curetted, aspirated, irrigated, fulgurated with the ball electrode endotherm, and packed with long tibial struts and cancellous bone grafts. A long plaster of paris spica was applied. Subsequent roentgenograms showed reconstruction of the medial condyle and proliferation of the grafts. After the

cast was removed 3 months postoperatively, a walking caliper brace was applied for 9 months. With physical therapy, the patient obtained a 90 degree range of painless motion with excellent stability.

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# TRANSVERSE INCISION FOR PYLOROMYOTOMY

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THE surgical management of infants with hypertrophic pyloric stenosis is now well standardized and highly successful. Its low mortality has been brought about by two factors. One is the introduction of the operation of dividing the muscular fibers of the pylorus longitudinally as is practiced universally at present, this operation having been developed by Frédet (6), Weber, and Rammstedt. Almost immediately following the introduction of this operative procedure the mortality figures improved. This less formidable operation brought about the results which had formerly been attained only by such a procedure as gastroenterostomy, a serious operation in the first few weeks of life. The other factor is one that developed more gradually, that is the improvement in preoperative and postoperative care. No longer are these patients operated upon as emergencies. Dehydration, acidosis, anemia, and avitaminosis are corrected prior to surgery. Postoperatively the prompt resumption of feeding, and careful attention to caloric needs and fluid balance have further improved the results. In fact, series of cases numbering 310 (Donovan, 5), 225 (Ladd, 12), 172 (Schaefer and Erbes), and 167 (Strauss) have been operated upon without a death. The mortality in complete series reported by these authors is 0.24 per cent (Donovan), 0.9 per cent (Ladd), 3.8 per cent (Schaefer and Erbes), and 2 per cent (Strauss). The average mortality figures in the reports collected and summarized by Szilagyi and McGraw, however, was 7.9 per cent. These reports covered the years 1923 to 1941 but, as in most studies, there has been a steady decrease in the mortality in more recent years due to increasing experience with the operation and improvement in the preoperative and postoperative management. Currently, immediate satisfactory results may be anticipated in 97 to 98 per cent of the operative cases with a rate for reoperation of 2 to 3 per cent and an average mortality figure of between 1 and 2 per cent (22). Nevertheless, wound disruption continues to be a serious, though infrequent, complication and has accounted for fatalities in some series. Ladd (10) ascribed 3 deaths in his series to evisceration. Two patients in another series by the same author and his associates (12) suffered dehiscence of the wound but re-suturing was successful. In the series of 84 cases from Cook County Children's Hospital studied by Oberhelman, disruption of the wound occurred twice with fatal outcome in both instances. Donovan (3) reported 3 instances in 119 cases. Schaefer and Erbes reported 4 dehiscences of which 1 was fatal. It has long been understood that very careful closure of the abdominal wall in these cases is necessary. This has been emphasized by Ladd and Gross (11) who point out that usually the abdominal wall is only  $\frac{1}{8}$  to  $\frac{3}{16}$  inch thick (3 to 5 mm). The well established type of incision is a vertical one through the right rectus muscle beginning at the costal margin and made deliberately over the liver so that the liver will form a barricade against the wedge effect of the omentum and other smaller structures when the incision is closed. The rectus muscle is either split or retracted laterally before the posterior rectus sheath and the peritoneum are opened vertically. In either case, a certain number of wound disruptions have occurred with this incision. That this vertical type of incision is not uniformly satisfactory is indicated by the variety of other incisions recommended. Thus, Robertson advocated a gridiron incision made lateral to the rectus muscle and below the costal margin. This incision, while separating structures of the abdominal wall according to their lines of cleavage and direction of fibers, has all of the advantages of the McBurney incision in that respect. However, it is located at a point where delivery of the pyloric tumor

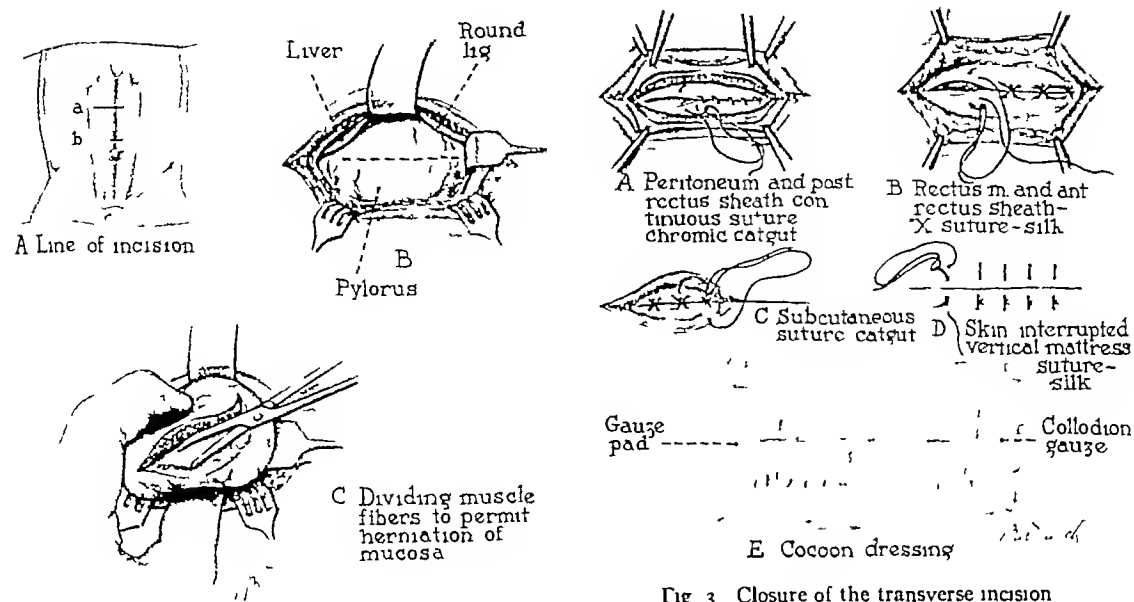


Fig 3 Closure of the transverse incision

Fig 1 Incision is made at level of previously palpated pyloric tumor. Note how pylorus fills the incision preventing extrusion of other structures

through the incision is not always easy, and many times considerable trauma to the stomach, the omentum, and perhaps to the transverse colon may result from attempts to deliver the pyloric tumor

Much has been written concerning the advantages of transverse incisions (7, 8, 16, 18), and it is generally conceded that with them (a) the tension in the area of the incision is principally parallel to the incision itself, (b) there is less wound disruption, and (c) patients are much more comfortable. The first two of these advantages have apparently prompted the use of many modifications of this type of

incision in the surgical treatment of hypertrophic pyloric stenosis. Thus Davis described an incision which is transverse through all the layers of the abdominal wall except the rectus muscle which is split vertically. Meredith described an incision vertical through all layers except the posterior rectus sheath and peritoneum which were divided transversely. The rectus muscle was split. Brunkow advocated a high right rectus transverse incision. Singleton, in discussing Robertson's paper, described the incision he favored. It is essentially the same as Meredith's, and he emphasized that with the transverse incision there was no room for evisceration of omentum and bowel. Horgan pointed out the advantages of a high transverse incision through all layers of the

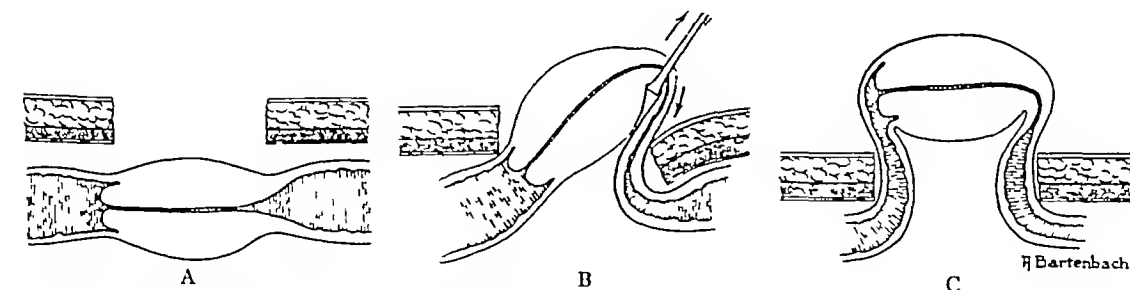


Fig 2 Diagrammatic presentation showing method of delivery of pyloric tumor through small incision. Down

ward pressure on abdominal wall makes excessive traction on pyloric attachments unnecessary



abdominal wall except the rectus muscle which is dissected from the anterior rectus sheath and retracted medially.

It is true that most of the infants with hypertrophic pyloric stenosis will do well regardless of the type of incision, their general condition being favorable to adequate wound healing. However, in the poor risk patients, many of which are operated upon under local anesthesia, the type of incision which is least liable to undergo dehiscence is desirable.

The transverse incision recommended here is approximately 4 centimeters long, divides all layers including the right rectus muscle transversely, and may be located anywhere from just below the costal margin down to the level of the umbilicus (Fig. 1A) depending upon the point at which the pyloric tumor has been palpated prior to operation. The incision need not be longer since in typical cases properly investigated, there should be very little if any doubt about the diagnosis, therefore, no need for any but regional exploration. In rare instances in which the diagnosis is uncertain, it may be verified at operation by the introduction of one finger into the abdomen.

All intra-abdominal manipulations are done with instruments, principally Babcock forceps and tissue forceps without teeth. Since the incision is made at a level which corresponds to the location of the pyloric tumor, the first structures encountered may be the edge of the liver or the anterior wall of the stomach. With the body and the fundus of the stomach collapsed, due to the presence of an inflating catheter in the stomach, it is possible to pass the wall of the stomach to the left and by doing so the pylorus can be brought to a point just underlying the incision.

It is not necessary to bring any structure except the pylorus outside the abdomen (Figs 1B, 1C). Since the average dimensions of the pyloric tumor are approximately 2 centimeters in length and about 1.5 to 2 centimeters in diameter with a wall .5 to .8 centimeter thick (22) there should be no difficulty in delivering the pyloric tumor through the transverse incision. The gastric end of the tumor is brought up first as shown in Figure 2B. In this way, a pyloric tumor even longer than the incision may be brought outside the abdominal wall

(Fig. 2C). Since the incision is usually made at some distance from the costal margin it is possible to press down on the anterior abdominal wall and thus allow the tumor to be delivered outside the abdominal wall without excessive traction on the attachments of the pyloric area. As some of the bleeding in this divulsion is thought to be due to traction on the attachments of the pyloric area with resulting interference with venous return, there may be less difficulty with hemiostasis. At this point, it may be noticed that the pyloric tumor, lying transversely and being brought up through the transverse incision, closes off practically all of the incision (Fig. 1B) and leaves no room above or below the pylorus for the herniation of omentum or small bowel such as frequently happens in the vertical incisions.

The divulsion or division of the circular fibers of the pylorus is then done in the usual manner with precautions against perforating the duodenal mucosa but with care that all fibers are divided sufficiently to a point where the normal thickness of the seromuscular layers of duodenum and the stomach is reached. A binocular loupe or other visual aid may be used, not so much to insure the division of every single muscle fiber, but rather to guard against perforation of the duodenal mucosa. Robertson believes that squeezing the duodenal end of the tumor between the left index finger and left thumb causes a change in the relationship of the muscle mass to the duodenal mucosa so that splitting the muscle mass can be accomplished with less danger of perforating the duodenal mucosa.

The closure of the wound is easy (Fig. 3). The edges of the posterior rectus sheath and peritoneum can be approximated easily even if the patient is straining. This is certainly not the case when these layers have been divided vertically. The rectus muscle is sufficiently adherent to the anterior rectus sheath to prevent marked retraction. However, approximation of the rectus muscle is indicated because it obliterates any dead space which might otherwise result and in which serum might collect. This can be accomplished by means of X sutures of fine chronic catgut or by catching the muscle edges in the fascial sutures. The closure of the rectus sheath is ac-

complished by means of interrupted X sutures of fine silk and the subcutaneous tissue and the skin are approximated with fine catgut and silk respectively

It is agreed that the cosmetic result is of minor importance. Even the vertical incision with broadening of the scar becomes proportionately less conspicuous as the child grows. However, with the transverse incision, after 2 or 3 months, it may be difficult to see the incision except upon very close inspection in good light. The incision as described herein has been used in a series of 34 personal cases with no instance of wound disruption.

#### SUMMARY

Various abdominal incisions used in the surgical treatment of congenital hypertrophic pyloric stenosis are presented. A transverse incision through all the layers of the abdominal wall including the right rectus muscle and at the level of the previously palpated pyloric tumor is described and discussed in detail. It has been entirely satisfactory in a series of 34 of the author's cases.

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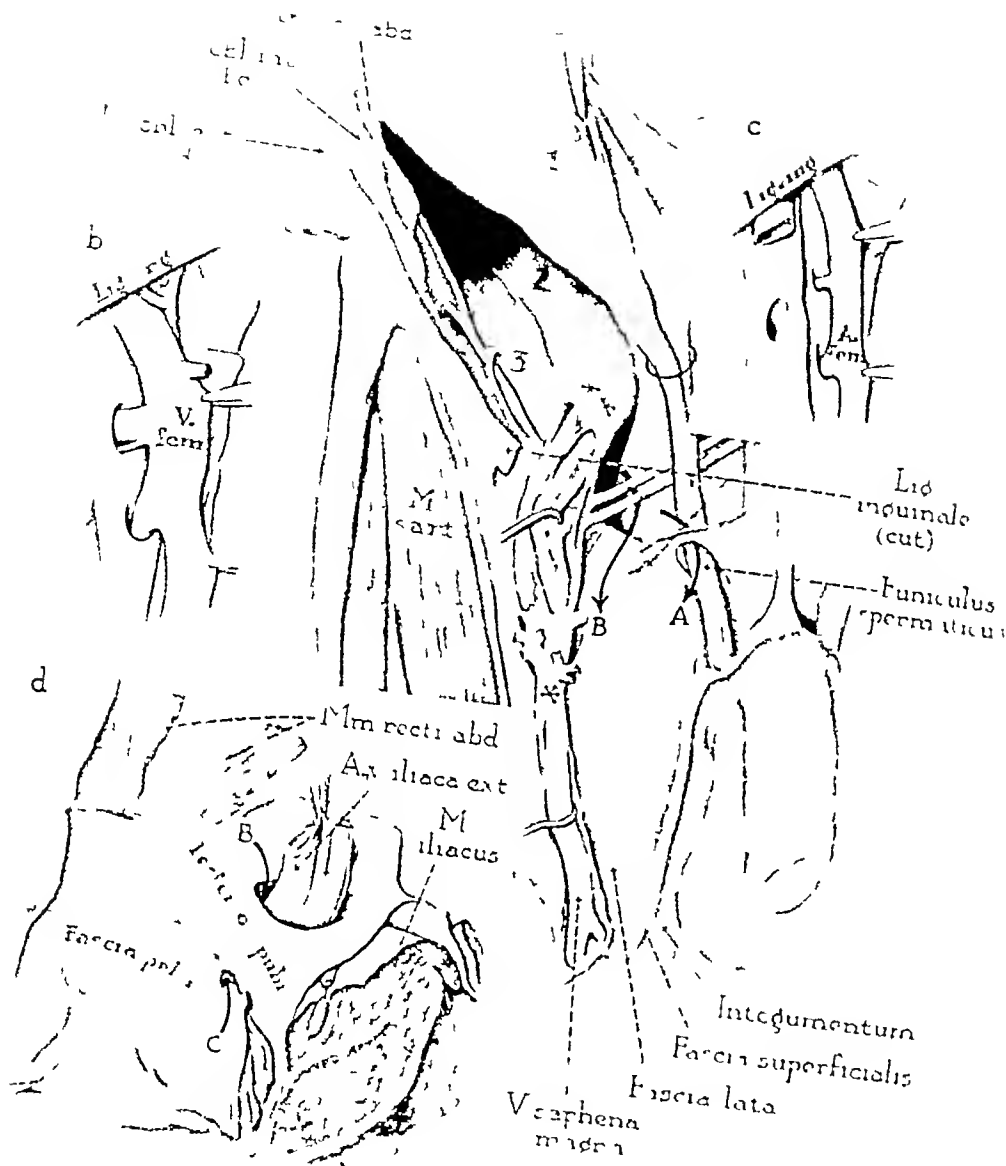


Fig. 3 (Laid on opposite page)

The Arteries of the Hernial Regions II Femoral Hernia —  
 Barry I. Arson, Arthur F. Keimann, and La Vern I. Saigart

# THE ANATOMY OF HERNIAL REGIONS

## II Femoral Hernia

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**C**ONTINUING a report upon their study of the anatomy of the important hernial regions, the authors will herein record their dissection-experience with the strata which, passing from abdomen to pelvis, converge upon the large vessels in the proximal part of the thigh and form sheaths for the femoral artery and vein

### MATERIAL AND METHODS

For the present account the authors depend chiefly upon three particularly favorable specimens, each of them a well developed adult. Two male cadavers were employed to illustrate the normal anatomical relationships of structures of the inguinal wall, pelvic cavity, and proximal thigh (Figs 2a and 2b, 3a to 3d), a female specimen was utilized for drawings of the same structures, as affected by a femoral hernia (Figs 4a and 4b, 5a and 5b, 6a to 6c). In order to record pertinent morphology of the region where a femoral hernia reaches a subcutaneous, palpable position,

variations in the fossa ovalis and its vascular contents are pictured (Figs 1a to 1f), and statistical data are presented

### OBSERVATIONS AND DISCUSSION

In contrast to the movable, and often pedunculated, indirect inguinal hernia, the mass of a femoral hernia appears to be little more than a swelling in the upper and inner angle of the femoral (Scarpa's) triangle. Here it is usually situated below and to the side of the pubic tubercle and below the inguinal ligament, however, sometimes the upper part of the mass may extend above the ligament.

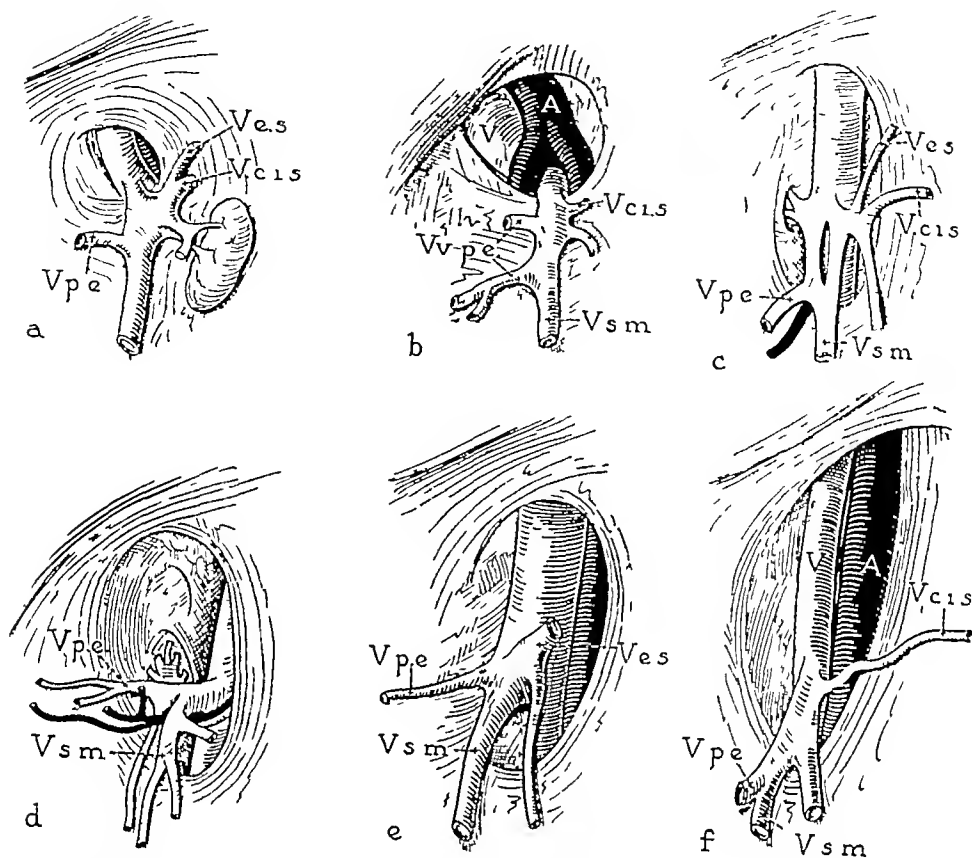
In descending from an abdominal to a femoral position, under the ligamentous edge of the external oblique and upon the superior pubic ramus, a herniating mass (intestinal or omental) pushes ahead of it the deeper layers of inguinal position to a point where, in or beyond the fossa ovalis, the hernia acquires additional coverings from the overlying layers of the thigh. Having reached subfascial level in the thigh, the hernia elevates the overlying skin

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Figs 3a to 3d. Structures related to the regions of inguinal femoral and obturator herniae. Specimen II. Fig 3a. The abdominal layers have been incised along the inguinal ligament, the peritoneum (at 1), with the coils of small intestine, has been lifted to show the preperitoneal connective tissue (at 2). The sites of inguinal and femoral herniation are indicated by arrows A and B, respectively. The site of the orifice of the abdominal inguinal ring is marked by a circle. The fascia lata has been reflected to expose the sartorius muscle, as the latter forms the latter boundary of the femoral triangle. The preperitoneal (subserous) layer (indicated by \*\*) is carried downward from the iliac vessels upon their femoral continuations (at \*), from these larger vessels arise the deep circumflex iliac and the inferior epigastric branches (unlabeled), from lateral and medial sides, respectively. Fig 3b. The femoral sheath of the opposite thigh has been opened to show the femoral vein, the vessel has been retracted in order to demonstrate the manner in which its tributaries are invested by tubular continuations of the sheath. Fig 3c. The vein has been removed to demonstrate similar relations of the corresponding artery. Fig 3d. Anterolateral portion of a pelvis, viewed from within, sagittal section to

the left of the midline. Specimen III. The viscera and subserous tissue have been removed, the external iliac vessels have been cut and lifted in order to emphasize the tubular character of the vascular lacuna. Medial to the vein is the femoral ring (at arrow B). Vessels converge upon the internal orifice of the obturator canal (arrow C). The iliacus and psoas muscles and the femoral nerve occupy the muscular lacuna.

An indirect inguinal hernia would transverse the inguinal canal in indirect course, from the abdominal orifice (encircled by the ring), through the subcutaneous fault in the fibers of the external oblique aponeurosis (at arrow A, Fig 3a, between the crura of the ring) to some point beyond the aponeurotic hiatus. Its immediate investment would be the peritoneum, which, as a vaginal process, would be progressively dilated as herniation progressed (see article I). A femoral hernia would, in a more direct course, pass beneath the inguinal ligament upon the pecten of the pubis and between the lacunar ligament medially and the femoral vein laterally (at arrows B, Fig 3a and Fig 3b). An obturator hernia would enter the internal orifice of the obturator canal (Fig 3d, at arrow C). The further course of an obturator hernia is pictured in article III.

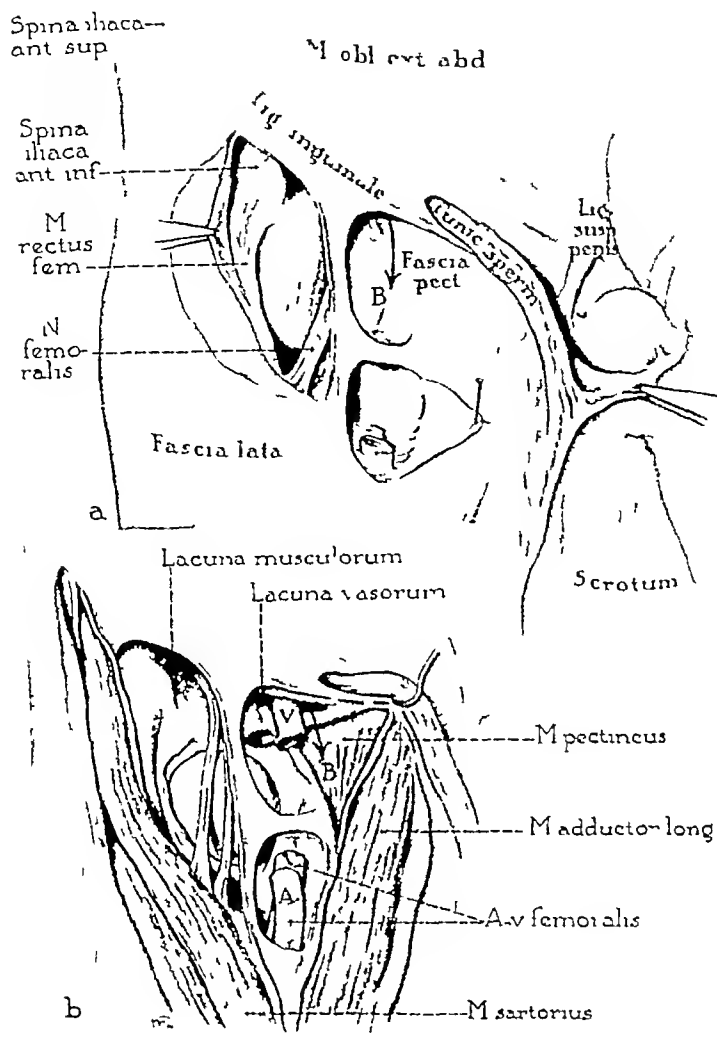


Figs 1a to 1f Variations in form, size, and contents of the fossa ovalis. Examples arranged in the order of increasing dimensions, from the smallest to the largest encountered in a series of 200 lower extremities. All are examples of the left thigh. In the specimens shown in Figures 1a and 1e, the femoral artery is but slightly exposed to the side of the femoral vein, in those depicted in Figures 1c and 1d the artery is wholly concealed beneath the falciform margin of the fossa, in those illustrated by Figures 1b and 1f it is fully exposed, in the former instance overlying the point of termination of the saphenous vein in the femoral. Abbreviations *Vcs*, Vena circumflexa ilium superficialis, *Ves*, Vena epigastrica superficialis, *Vpe*, Vena pudenda externa, *Vsm*, Vena saphena magna. The unlabeled vessel, ascending near the great saphenous vein, is the accessory saphenous vein.

Before considering these layers in detail, as evidenced in the selected case of femoral hernia (Figs 4 to 6), it may be profitable to review their disposition in relation to such a hernial protrusion, that is, as elements which guide the hernia in its descent and as structures to which the hernia becomes secondarily related.

At the termination of its migration from the abdominal cavity into the thigh, the hernia attains subcutaneous position at the fossa ovalis (saphenous opening), where the degree of its prominence depends chiefly upon the dimensions of the fossa and upon the extent

of its occupancy by blood vessels (Figs 1a to 1f). In order to reach the thigh, the hernia is obliged to pass beneath the inguinal ligament, which, through its nearness to the resistant superior pubic ramus, constitutes a temporary hindrance to its descent (Figs 2a, 2b, and 3a, at arrows *B*). The hernia emerges beneath the superior horn (cornu) of the fossa's falciform margin (compare Fig 1e), resting upon the fascial covering of the pectineus muscle (Figs 2a and 2b), in so doing, it has traversed the vascular lacuna of the subligamentous space, occupying the "space" medial to the femoral vein (Fig 2b). Space exists,



Figs 2a and 2b Two stages in the dissection of spaces and contained structures in the inguino-femoral region Specimen I Fig 2a The superficial fascia has been removed, exposing in the inguinal and proximal femoral regions, respectively, the aponeurosis of the external oblique muscle and the fascial investment (fascia lata) of the muscles of the thigh The external spermatic fascia has been removed in order to expose the spermatic cord and the crural boundaries of the subcutaneous inguinal ring The femoral vessels have been excised from the fossa ovalis (saphenous opening) The course of a femoral hernia is indicated by the arrow B, which here emerges from the femoral ring Distal to the fossa ovalis an artificial window has been cut in the fascia lata to demonstrate the further course of the femoral vessels (transected) A similar opening has been made in the fascia, lateral to the fossa ovalis into the space of the muscular lacuna, from which latter the iliopectineus muscle has been removed, but in which

the femoral nerve remains intact Fig 2b The investing sleeves of the fascia have been cut away in such a manner as to reveal the muscles and associated structures which bound the femoral triangle Marginally, the triangular space is bounded by the sartorius and adductor longus muscles, the floor is formed in part by the pectineus muscle The iliopectineus, removed from the muscular lacuna together with the subjacent portion of the articular capsule, would form the floor of the space laterally The roof is the inguinal ligament The stumps of the transected femoral vessels remain in the vascular lacuna The small orifice situated on the medial aspect of the femoral vein is the femoral ring through which a hernia would pass from the abdomen into the thigh in the direction of the arrow B, to occupy the fossa ovalis The hernia would be surrounded by the lamellae of the femoral sheath and would lie beneath the superficial fascia (see following dissections continued in specimen II)

of course, only after investing tissues, related to the blood vessels, have been removed. These tissues form coverings for the vessels, and would likewise invest a neighboring hernia, in the most medial of the three spaces of the vascular lacuna. This medial space is the femoral canal, its orifice beneath the inguinal ligament is the femoral ring.

The two investments of a femoral hernia are derived from abdominopelvic layers. The outer layer is a femoral prolongation of the fascial coverings of parietal muscles, namely, transversus abdominis and iliopsoas (Fig 3d). They are carried outward to ensheath the femoral continuations of the external iliac vessels and as the wall of the femoral canal (arrow *B* in Fig 3d). The inner coat is a derivative of the retroperitoneal (subserous) layer of the abdomen and pelvis (\*\* in Fig 3a, removed in Fig 3d).

Internal to the subserous layer, in the abdomen and pelvis, is the peritoneum (freed and lifted in Fig 3a). It would be the immediate covering of the herniating intestine or omentum.

Obviously, then, as a hernial protuberance is exposed by incision through the skin it consists of the following from without inward: the superficial fascia of the thigh, with contained vessels and nerves, the outer femoral sheath (from the internal investing fascia of the abdominal and pelvic musculature), the inner sheath (from the retroperitoneal layer), the serous coat (as a diverticular process of the peritoneum over the femoral ring), space (continuous with that of the peritoneal cavity), the hernia itself.

The several layers, their thickened portions and the orifices, or faults within them, will now be considered from without inward, in the order in which they would be encountered in dissection.

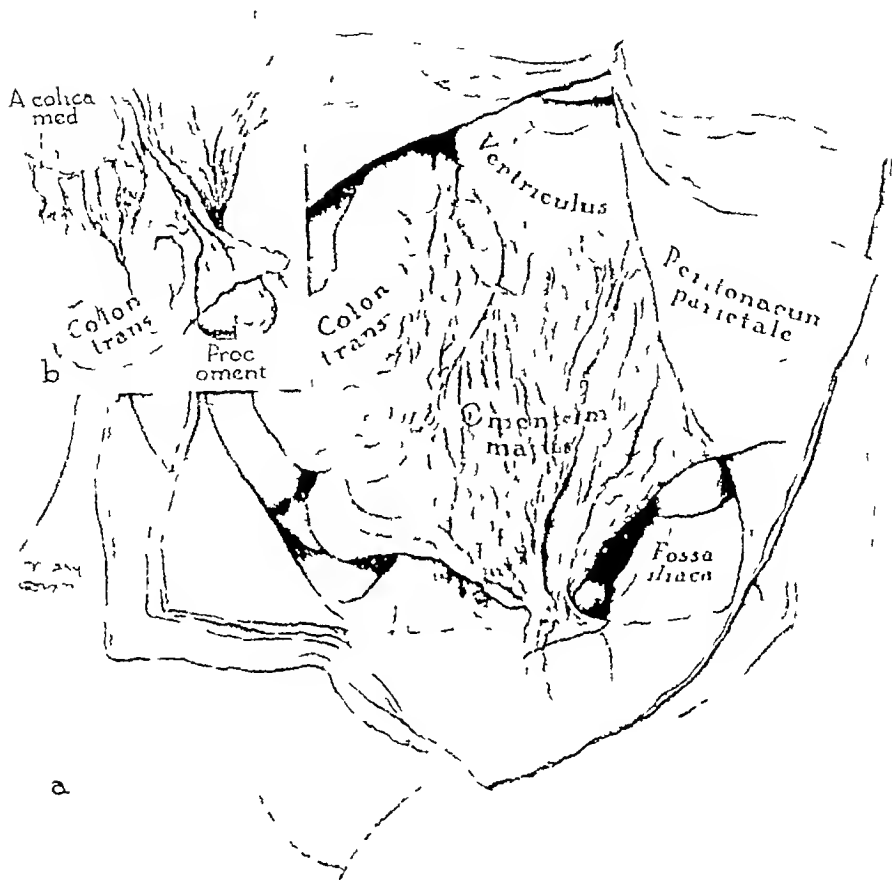
1 *Skin and superficial fascia* The outer layer of superficial fascia of the abdomen (Camper's layer) is continued downward into the thigh, over the inguinal ligament. It contains moderately large lobules of fat and vessels of small size. In the region where the hernial mass protrudes the layer of superficial fascia is thinned and the fatty tissue almost disappears.

The deep layer of superficial fascia in the inguinal region is a membranous sheet, irregularly bound down to the subjacent fascia of the external oblique muscle. This layer (Scarpa's fascia) finds a firm attachment along a line just below and parallel to the inguinal ligament and, thereby, to the fascia lata. Distal to the level of the ligament, Scarpa's layer immediately thickens to accommodate a considerable quantity of fatty tissue, superficial arteries and veins, and lymphatic vessels and glands. The thickened portion of the deep layer extends downward for a distance of a few centimeters beyond the inguinal ligament. Laterally, medially, and inferiorly, beyond the boundaries of the femoral triangle, the layer thins to become indistinguishable from a fatty pannicle. The inguinal lymph glands, the main portions of the superficial arteries and veins, emanating from and converging upon the fossa ovalis, lie chiefly within this deeper lamella.

Since the hernial mass regularly gains an external position by issuing through the upper part of the fossa ovalis, it must here encounter the deep layer of the superficial fascia. As the hernia increases in size, its shape and position are seemingly determined by the firm marginal attachments of the layer, and by its contents (see hereinafter).

2 *Fascia lata and fossa ovalis* The thick sheath (fascia lata) for the muscles of the thigh is aponeurotic rather than fascial. It is anchored to the inguinal ligament, and, indirectly, to the underlying iliopsoas muscle-fascia, since the latter gives partial origin to the inguinal ligament (Figs 1a to 1f).

The oval defect in this investing sleeve, namely, the fossa ovalis, is so placed that medially and superiorly a narrowed strip, a so called superior cornu, is formed. The cornu is carried inferomedialward, in a falciform margin, to become continuous with the pectineal fascia on the floor of the fossa, and with the lacunar extension of the inguinal ligament. In being so disposed, the free edge of the superior cornu completely hides the lacunar ligament in external view. The superior cornu in being prolonged downward as a falciform margin of the fossa, ends medially in an inferior cornu. The inferior cornu, then



Figs 4a and 4b Abdominal contents in a case of femoral hernia in a female cadaver Specimen IV Fig 4a The omentum, with the transverse colon at its distal margin, forms an apron which almost completely obscures the coils of intestine On the left side the omentum is locally fastened by a narrow band (along broken line) to the abdominal wall over the roof of the femoral canal A nodule

of the omentum occupies the femoral canal (orifice of the latter, 1 cm in diameter) Fig 4b The hernial mass, removed from the femoral canal, has been turned upward to demonstrate its form and size Prior to the time when removal was accomplished the omentum was cut (at arrows) from the area of anterior fixation to the parietal peritoneum (see Fig 4a)

sweeping upward, becomes continuous with the pectineal fascia on the floor of the fossa The pectineal part lies at a deeper level than the more lateral and superior portions Behind the femoral vessels it ascends, for attachment, to the superior ramus of the pubis, covering the pectineus muscle as it does so The difference in level between the superior cornu of the fossa and the upper attachments of pectineal fascia accounts for the depth of the vascular lacuna which, in transmitting the femoral artery and vein, contains a com-

partment for each of these vessels as well as a third space, termed the femoral canal (Figs 2a and 2b at arrows B) It is in the last-named division of the lacuna that the neck of a femoral hernia sac is encountered

Based upon a study of 200 specimens, variations in form and size of the fossa ovalis may be described and figured In outline, the fossa is occasionally almost circular (Fig 1a) Usually, however, it is oval (Fig 1d), when thus compressed laterally, the long axis may be placed vertically (Fig 1c), or ob-



liquely (Fig 1e) Occasionally the fossa is dart-shaped, with the pointed end directed downward (Fig 1f)

The relationship between the superior cornu and the inguinal ligament is inconstant. It is conventionally described as being attached above to the medial half of the inguinal ligament. When the fossa is proximally placed in the thigh, the superior horn appears to be a derivative of the inguinal ligament (Fig 1b), the ligament itself seeming to serve as one boundary of the fossa. Its independence in other instances is equally striking, an appreciable distance often intervening between the ligament and the cornu (Figs 1a, 1c to 1f)

Within the space of the fossa accessory hiatuses not infrequently occur, transmitting tributary veins from muscles to the femoral vein. These appear in simple form (Fig 1c) or as multiple orifices (Fig 1d)

In size the greatest variability is encountered. The smallest fossa in the 200 specimens is 1.6 centimeters in length, 1.7 centimeters in width, the narrowest measures 1.0 centimeter, the shortest, 1.6 centimeters. The largest fossa in the group is 8.5 centimeters in length, 3.5 centimeters in width, the widest measures 6.4 centimeters, the longest, 8.5 centimeters. Ninety per cent of the specimens (180 fossae) measure between 3.0 centimeters and 6.4 centimeters in length, 3.5 centimeters and 5.4 centimeters in width, average length is 4.6 centimeters. In width, 87 per cent (174 fossae) are between 1.5 centimeters and 3.9 centimeters, 70.5 per cent (141 fossae) are between 2.0 centimeters and 3.9 centimeters.

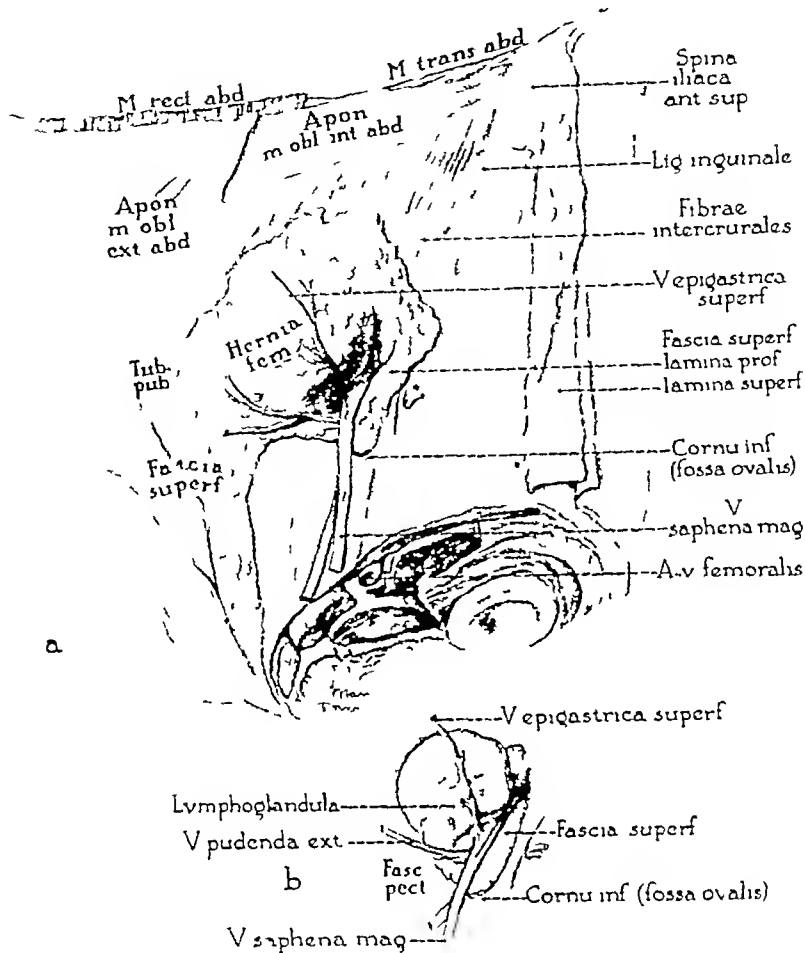
Without exception fossae are capacious orifices for the vessels which they transmit, in only one case does the circumference of the saphenous vein approach that of the fossa through which it passes, regularly a very considerable space, unoccupied by vessels, is included between the cornua of the fossa (e.g., Figs 1c to 1f), the size of contents in no way affecting the proportions of the orifice. So ample, in fact, is the space of the fossa, that the contained femoral vein is almost invariably exposed throughout its width. Moreover, in 83 per cent of 100 consecutive cases

the femoral artery, also, is wholly or partially exposed. More specifically, in 36 per cent, three-fourths to all of its breadth is in view (Fig 1e), in 30 per cent, one-half to one-fourth, in 17 per cent, not only is the artery entirely in view, but space occurs laterally, unoccupied by vessels (Fig 1b).<sup>1</sup> It might be safely assumed that capaciousness of space would render hernial migration easier.

In the hernial specimen illustrated, the fossa is elongate (Figs 5a and 5b). The neck of the hernial sac impinges medially upon the free edge of the superior cornu. Behind, it rests upon pectineal fascia. The hernia thus lies anterior to the confluence of saphenous and femoral veins in the fossa ovalis, superficial veins enter the saphenous behind and below the body sac, the external pudendal vessels course across the fossa ovalis below the sac, while the superficial epigastric artery ascends from the region of the fossa lateral thereto (Fig 5b). Superficial lymphatics which ascend from the lower extremity and from adjacent lymph glands pass into the vascular lacuna posterior to the body and neck of the sac.

3 *External femoral sheath.* At the inguino-pelvic interval, a space, the vascular lacuna, permits egress of the external iliac vessels from the pelvis into the thigh. The orifice thus produced is an elongate oval with its long axis in transverse plane. The lacunar ligament, the inguinal ligament, the iliopectineal muscle, and the superior ramus of the pubis form the resistant boundaries of the orifice. Internal to these structures the iliac fascia (transversalis fascia), are carried in a femoral direction around the margins of the orifice, to produce an infundibuliform investment for the femoral vessels. Anteriorly and medially this fascial funnel is supported from without by the lowermost aponeuroticofascial portions of the transverse abdominal and internal oblique muscles. These strata arise partly from the medial edge of the iliopectineal fascia in common with the inguinal ligament,

<sup>1</sup> The venous channels which converge upon the terminal segment of the great saphenous vein are highly variable. They have been described and figured in an article (based upon 550 specimens) by the present author and his colleagues in an earlier issue of this journal (1946 82 52-63)



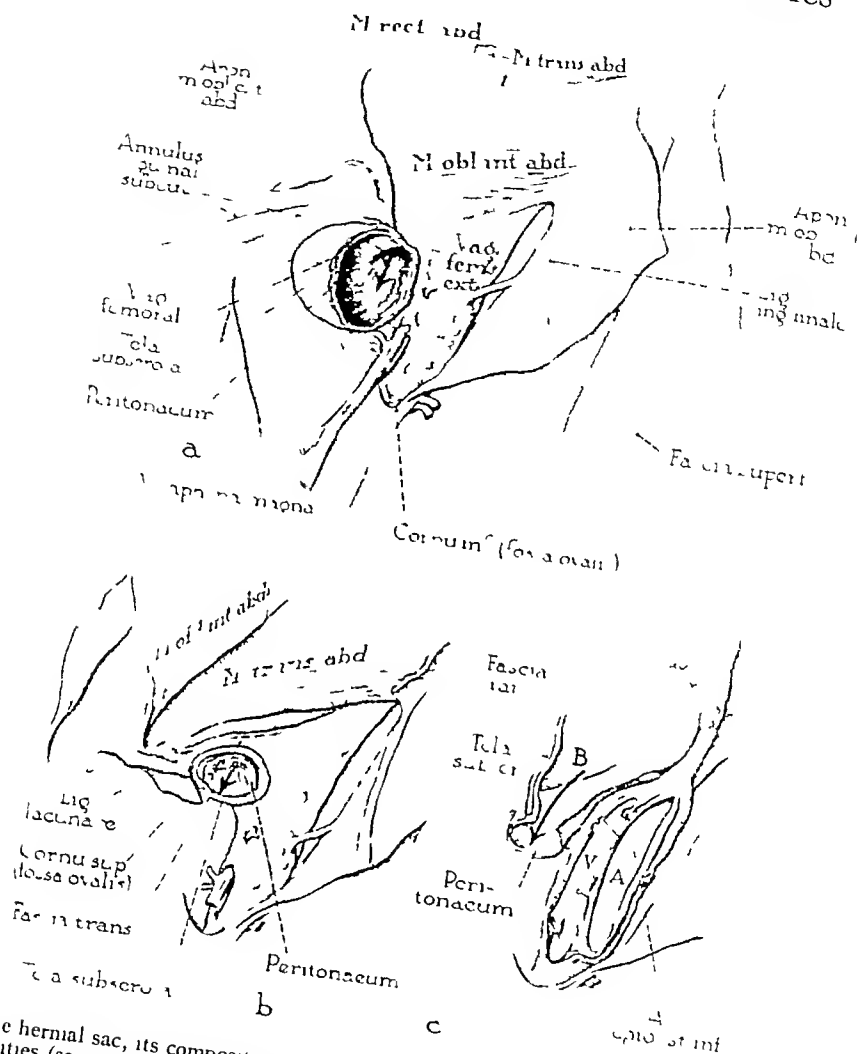
Figs 5a and 5b The femoral hernia, in relation to the external fascial and aponeurotic layers of the inguinal and proximal femoral regions (same specimen) Fig 5a The superficial fascia has been removed except in the territory of the hernia and in the pudendal area medial thereto. The aponeurosis of the external oblique muscle and the fascia lata are shown. The fossa ovalis in the latter layer is exposed (for purposes of topography) in its lower part, that is, over the inferior horn of the falciform margin. The hernia produces a circular bulging in the overlying

superficial fascia. In this fascia the superficial veins (pudendal, epigastric, circumflex iliac) descend to join the saphenous. Fig 5b The hernial sac in relation to the superficial veins and the falciform margin of the fossa ovalis. The superficial fascia has been removed from the hernial sac to reveal the latter's outline, a gland of the superficial subinguinal group, and the superficial veins. The veins form a basket-like support for the hernia, the latter being pressed upward against the inguinal ligament, not downward over the inferior cornu of the fossa.

they arch over the femoral vessels and gain a strong medial anchorage by their insertion into the pecten of the pubis behind the lacunar ligament. Thus the femoral sheath anteriorly is a fascial prolongation of the intermediate and innermost of the three muscle strata of the abdomen. Both medially and laterally at the femoral orifice the anterior part of the femoral sheath is continuous

with a posterior component which consists of the iliopectineal fascia. While the lateral wall of the funnel-shaped femoral sheath is almost vertical, the medial wall describes a moderate curve, the concavity of which is directed medialward (see esp Fig 6b). Owing to the obliquity of the medial wall, as it extends from behind the lacunar ligament to reach the medial surface of the femoral vein, there exists

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Figs 6a to 6c The hernial sac, its composition and inguofemoral continuities (same specimen) Fig 6a The aponeurosis of the external oblique muscle has been reflected with it the fascia lata has been turned aside after cutting vertically through the superior cornu of the fossa ovalis. The lateral wall of the hernial sac has been cut away. In this way the following features are demonstrated the laminar nature of the hernial sac derived in part from the femoral sheath the relation of the orifice (at arrow) to the part of the sheath which invests the femoral vessels the form and position of the sheath The sac is composed of three layers namely the fascia of the abdominal and pelvic muscles the subserous connective tissue and the peritoneum The femoral sheath is made up of the outer and intermediate of these three layers Fig 6b The orifice of the hernial sac in relation to the deep inguinal and femoral structures The sac has been transected at its neck the internal oblique muscle has been turned aside to expose the subjacent transversus abdominis As the sac passes through the femoral canal it is bounded medially by the lacunar ligament (here cut

and turned downward) laterally by the portion of the femoral sheath which transmits the femoral vein, superiorly by the lower margins of the three lateral abdominal muscles, and inferiorly by the superior ramus of the pubis (covered by the pectineus muscle and the pectineal fascia) The outer lamella of the femoral sheath is made up of the fascial coverings of the transversus and iliopsoas muscles prolonged into the thigh Its surface (here exposed) is irregular, owing to the presence of fat in the contiguous layer of connective tissue The latter, carried into the thigh as an extension of preperitoneal tissue in the pelvis, forms the internal layer of the femoral sheath and immediately surrounds the vessels (exposed in Fig 6c) The compartments of the femoral sheath, their investment contents and interrelationship The hernial sac in the medial one of the three compartments, has been opened in front its constituent layers demonstrated by carrying the incision vertically upward through the deep layers of the inguinal wall Its space (traversed by arrow B) is continuous with that of the peritoneal cavity The bi

(Legend continued on opposite page)

a small, conical space within the sheath adjacent to the femoral vein. The base of the cone lies over the pubic pecten, the opening into the space is the femoral ring.

The lower aponeurotic and fascial portions of the internal oblique and transverse abdominal muscles cover the internal surface of the lacunar ligament by inserting into the pecten of the pubis, they form the immediate boundary for the femoral ring on its medial aspect. This "internal lacunar ligament" is strengthened by a flattened, aponeurotic, lateral expansion of the rectus tendon, which is fastened, with the transversus aponeurosis, to the superior pubic (Cooper's) ligament. The rectus margin is variable, since the tendon may be wide or narrow.

In the hernial specimens, while the anterior femoral sheath remains intact over the vessels, that part of the sheath once enclosing the canal medial to the femoral vein is greatly distended to form a thin envelope for the body and neck of the hernia (Figs 6a to 6c). Since anteriorly the femoral sheath is made up of fascial continuities derived from the intermediate and deep muscular layers of the inguinal wall, the lowermost portions of these layers form an arch over the neck of the sac, strong when the layers are muscular or aponeurotic (Figs 6a and 6b), weak when they are fascial. Posteriorly the femoral ring possesses, for firmer support, a wall consisting of the pectineus muscle and its investing fascia, and the superior ramus of the pubis (Fig 6c, compare Figs 3a and 3d). Laterally the neck of the sac is related to the femoral vein (Figs 6b and 6c, compare Figs 3a and 3b), separated therefrom by a thin cushion of adipose tissue in which are lodged lymphatic vessels.

4 *Internal femoral sheath and preperitoneal connective tissue* The covering of the femoral vessels which is, as just described, derived from abdominal and pelvic fasciae, constitutes the femoral sheath of all regular, and therefore, familiar, textbook accounts. Ac-

tually, the vessels are imbedded in fatty connective tissue, which provides for them a second, or internal, femoral sheath. This matrix is directly continuous with the preperitoneal tissue layer of the abdomen, it surrounds, and passes as septal walls between, the femoral artery and vein, it fills the conical femoral canal (Figs 3a to 3c), and conveys lymphatic channels from the inguinal to the iliac lymph glands.

As seen from the abdominal aspect, the external iliac vessels course toward the lateral and intermediate portions of the vascular lacuna (Fig 6c, compare Figs 2b and 3a). The femoral canal, in the medial part of the lacuna, is normally filled with fatty preperitoneal (retroperitoneal, subserous) connective tissue. This tissue conceals the pelvic opening or "ring" of the femoral canal, but leaves a concave depression on which the femoral neum rests. This concavity is the femoral fossa. It is this point at which a hernia initially presses the peritoneum into the subperitoneal femoral ring. In specimens of femoral hernia this preperitoneal layer forms an important envelope for the hernial process (Figs 6a to 6c).

In the preperitoneal connective tissue of the lower abdominal wall the inferior epigastric vessels course obliquely from the femoral sheath to the rectus muscle (Fig 3a). However, an anomalous branch, the obturator artery, in approximately 30 per cent of cases, descends medially, in arciform course, close to the femoral ring. The umbilical artery passes upward in the lateral umbilical fold 0.5 to 1.0 centimeter medial to the femoral ring. Supposedly obliterated, this vessel sends small branches forward, beside the urinary bladder, they pass over the pubic pecten and into the femoral ring, to form an additional supply for the tissue within and about the femoral canal.

5 *Peritoneum* A slight peritoneal depression, or femoral fossa, marks the site of the femoral ring. It is critically located at the abdominopelvic junction. This small fovea in the serous layer rests below upon the rounded margin of the pubic pecten and the origin of the pectineus muscle. Medially is situated the lateral umbilical fold—a fairly tall plica

laminar sheath, which houses the femoral vessels, has been opened to demonstrate the continuity of its strata with those of the abdomen. The hernial sac is thus a diverticulum of the parietal peritoneum which, covered by subserous and fascial coats, presses outward through the vascular lacuna beneath the inguinal ligament to occupy a once "empty" compartment of the femoral sheath.

in the majority of cases Laterally lies the peritoneal elevation for the epigastric vessels, usually this fold is low The femoral fossa, therefore, lies at the inferomedial edge of the medial inguinal fossa, and is so placed as to be the apex of a broad peritoneal funnel, toward which apical point the vertical wall of the lateral umbilical fold might assist in directing a mobile viscus or a portion of the omentum The peritoneum which forms the femoral fossa, together with the subjacent preperitoneal tissue, becomes protuberant over the herniating mass (Fig 6a) External to the subserous coat is the fascial envelope derived from the transversus abdominis and iliopsoas muscles (Figs 6a to 6c, compare Fig 3a, layer marked 3) This outer coat is the femoral sheath of familiar descriptions (the inner, subserous investment customarily being disregarded) In further excursion, a portion of jejunioileum, or of omentum (Figs 4a and 4b), descending through the superficial fascia of the thigh (Figs 5a and 5b), this pannicle becomes a hernial coat as soon as the hernia reaches the fossa ovalis Thereupon, the hernia acquires relationships to superficial blood vessels, lymphatics, and cutaneous nerves regularly present in the superficial fascia of the femoral triangle and in the corresponding stratum of the inguinal region (Figs 5a and 5b, 1a to 1f) The veins which converge upon the saphenous and femoral may, apparently, be instrumental in directing the hernia cranialward, over the inguinal ligament (Fig 5a) In the specimen illustrated, the course was initially downward and forward (Figs 6b and 6c, arrows B), then somewhat upward (Figs 5a and 5b)

The solidity of the floor beneath the femoral ring is another feature of anatomical and surgical significance Outside the peritoneum and preperitoneal connective tissue lies the bony ridge of the pubic pecten From this ridge the superior surface of the pubic bone slopes slightly downward and forward, covered at the more distal portion by the peritoneal fascia and muscle It is this declinated surface which forms the actual floor of the ring and canal, and, therefore, a guide for the hernia in the first stage of its emergence

#### CONCLUSIONS

On the internal aspect, the abdominal wall presents an oval fovea corresponding in position to the femoral ring Here, as elsewhere, the peritoneum of the fovea rests upon a stratum of connective, the preperitoneal, tissue Externally, both on the abdomen and in the proximal thigh, the superficial fascia is bilaminar in character The deeper portion is locally thickened through inclusion of fat, subcutaneous vessels and lymph glands As the subserous tissue is prolonged upon the femoral continuations of the external iliac vessels, it is in turn covered by fascia derived from the parietal musculature These are, respectively, inner and outer lamellae of the femoral sheath They are carried downward through the vascular lacuna (beneath the inguinal ligament), to lie deep to the superficial fascia of the thigh where the fault in the investing fascia (fascia lata) brings them into contact The same relations are acquired by any herniating mass which, coming to occupy the most medially situated space in the femoral sheath—namely, the femoral canal—passes in succession through the femoral ring, femoral canal and fossa ovalis, to subcutaneous position

The pathway taken by a femoral hernia, then, must be at first almost directly downward into the femoral fossa, declination of the superior surface of the pubic bone carrying the process forward through the femoral ring The herniating structures meet a restraining arch of aponeurotic fibers formed by that part of the femoral sheath which is securely attached to the pubic pecten Further resistance is offered by the lacunar ligament But within the vascular lacuna the femoral vein and the investing sheath constitute a resilient lateral wall Further progress distalward brings the process into the lower reaches of the femoral canal, where it impinges upon the overlying superior cornu of the fossa ovalis After passing this point, the process is suddenly relieved of anterior constriction, and can press toward the integument in angulated course While the neck of the process must remain small in size, the distal mass of the tumor may thus increase in bulk In this situation, carrying the bilaminar femoral

sheath forward as a conjoined envelope, the hernia impinges upon the deep layer of the superficial fascia as the latter locally covers the fossa ovalis. Further descent is seemingly hindered by the basket-like arrangement of vessels related to the fossa, and by marginal fixation of the cribriform layer. The hernia consequently presses superiorly in front of the falciform margin and over the inguinal ligament.

Considering anterior hernial orifices together, the femoral canal (with the ring) represents an anatomical arrangement standing between inguinal and obturator canals in point of structural weakness.

Tendency toward hernial protrusion through the inguinal wall is greatly increased by the presence of a congenital serous sac, and by subjection to the trauma and intra-

abdominal pressure against parietes which are distensible. The femoral orifice is a narrow one, encircled in front by an aponeurotic arch, bounded by the lacunar ligament medially, and supported behind by a bony ridge. It is weakened only by the existence of potential space in the femoral ring and canal, and by resilience of the large blood vessels on its medial aspect. As will be seen, the obturator orifice, narrower still, is effectively bounded by an osseoligamentous rim, the obturator canal, the canal not only possesses peritoneal, preperitoneal, and ligamentous tissues to support it internally, but also is well barricaded externally by the layered musculature of the thigh.

In a succeeding, and final, paper in this trilogy, the anatomy of obturator hernia will be considered.

# OBSERVATIONS ON THE CLOTTING MECHANISM IN MENSTRUATION AND MENORRHAGIA

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**I**N certain diseases complicated by hemorrhage the whole blood clotting time may be prolonged and an abnormality can be detected by a protamine titration (2). Increases in the protamine titration and whole blood clotting time may occur when all other known hemostatic mechanisms are normal, although usually these changes are associated with some degree of thrombocytopenia (1). Bleeding in such individuals may be temporarily controlled, partially or completely, by the administration of adequate amounts of toluidine blue and protamine sulfate. These agents are known to inhibit heparin and heparin-like substances. The fact that such patients respond to these antiheparin agents (toluidine blue and protamine sulfate) suggests that the clotting defects may resemble that produced by the intravenous injection of commercial beef heparin (3). This comparison, however, may not be valid because certain other endogenous compounds having heparin-like action appear to be chemically different from heparin. Also, it is possible that this physicochemical change only resembles that produced by heparin, and that it is accomplished by a mechanism unrelated to heparin (3).

Menorrhagia was among the bleeding conditions investigated. This study includes coagulation data on 43 patients with menorrhagia, 23 normal female volunteers and 56 normal males.

## METHOD OF STUDY

Gynecologic examination of the menorrhagic group was performed by one of us (A K K) and, except for 2 patients who had small uterine fibroids, no gross pelvic disease was found. Biopsies on the first day of menstruation revealed no characteristic endo-

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metrial pattern. The diagnosis of menorrhagia was based on a history of prolonged profuse menstrual bleeding and anemia. The normal females consisted of volunteers carefully studied with reference to their menstrual history and blood findings. Pelvic examinations were not performed. The group constituting the normal males was composed of medical students and other hospital personnel.

Laboratory studies in both the normal and the menorrhagic groups included the protamine titration (2), whole blood clotting time (4), prothrombin time (5), gross observations for lysis of clots, clot retraction at 1, 6, and 24 hours, and, platelet count. There was no evidence of a blood dyscrasia in any of the patients. The menstrual blood was not examined.

These studies were carried out at different intervals during the menstrual cycle and on the day of heaviest menstrual flow. This usually was the second day of the menstrual bleeding.

Protamine sulfate was administered as single intramuscular injection of 50 milligrams, usually on the day of heaviest flow. Toluidine blue was given orally twice daily for 3 to 4 days in capsules containing 100 milligrams, beginning on the heaviest day of flow.

## DATA

Table I presents the results of the protamine titration, the whole blood clotting time, and the group average platelet count in the menorrhagic patients and in the normal female and male groups. The determinations on the menorrhagic group were made during menstrual periods before protamine sulfate or toluidine blue were given.

In Table II are summarized data obtained on patients in the menorrhagic group when protamine sulfate was given intramuscularly.

TABLE I — RESULTS OF THE PROTAMINE TITRATION, THE WHOLE BLOOD CLOTTING TIME AND PLATELET COUNT IN THE MENORRHAGIC AND THE NORMAL GROUP

43 Menorrhagic Patients						
No determinations	When performed	Protamine titration		Whole blood clotting time*		Average platelet counts
		In creased	Normal	In creased	Normal	
106	During profuse menstruation	80	26	6~	45	166 000
14	During normal menstruation	3	11	7	7	183 000
82	Intermenstrually	39	43	41	36	193 000
23 Normal Women						
23	During menstruation	5	18	13	10	236 000
35	Intermenstrually	11	24	14	21	211 000
56 Normal Males						
105		3	102	10	95	230 000

\*By the technique employed the normal whole blood clotting time ranged from 25 to 35 minutes (4)

or when toluidine blue was administered orally

Gross fibrinolytic activity was noted in only 1 patient. Prothrombin activity was within normal limits in all bloods studied. Prothrombin accelerator factors were not determined.

#### COMMENT

Several changes referable to the clotting mechanism have been reported for venous blood during the menstrual cycle. Among the changes noted have been a slight increase in the whole blood clotting time (7), a mild to moderate thrombocytopenia (8), and alterations in fibrinolytic activity (6). Many of the patients in our study developed some degree of thrombocytopenia and a slight to moderate increase in the whole blood clotting time during menstruation. These changes occurred also during the intermenstrual period in several members of both the normal and the menorrhagic groups, although less often and less extensively. The increased clotting times were detected only when careful techniques were employed (4).

The abnormality revealed by the protamine titration appeared to be a better index of a systemic hemostatic disturbance in these patients than was either the whole blood clotting time or the platelet count. The protamine ti-

TABLE II — BLOOD STUDIES AND CHARACTER OF MENSTRUATION IN PATIENTS WITH MENORRHAGIA GIVEN PROTAMINE SULFATE OR TOLUIDINE BLUE

Results in 32 patients given protamine†			Studies before administration of protamine			
			Protamine titration		Whole blood clotting time	
Effect*	No. of periods	No. of patients†	Increased	Normal	Increased	Normal
Good	30	25	27	3	19	11
Temporary	5	5	3	2	2	3
None	7	7	3	4	3	4
Results in 12 patients given toluidine blue††			Studies before administration of toluidine blue			
Good	7	6	4	3	5	2
Temporary	5	5	4	1	1	4
None	3	3	1	2	0	3

\*Good effect—Reversion from profuse to normal menstrual flow for remainder of period.

†Temporary effect—Bleeding slowed 6 to 18 hours; profuse bleeding resumed.

‡No effect—No detectable improvement.

†Seven patients were given protamine sulfate during 2 or more menstrual periods.

††Three patients received oral toluidine blue during 2 or more menstrual periods. Nine patients had received protamine sulfate during previous menstrual periods.

tration was increased in 80 of 106 determinations made during menorrhagic periods. It increased in only 5 of 23 determinations made during menstruation in the women whose menses were considered normal (Table I). When increases in the titration occurred in the latter group, they were less pronounced than those in menorrhagia.

The response of those patients given intramuscular protamine injections correlated fairly well with the status of their protamine titrations at the time the injections were made. Listed as "good effect" in Table II are 30 responses, 27 of which were obtained when the titration was increased. Temporary or no effect was obtained in 12 menstrual periods, of which 6 were associated with increased protamine titrations. The response to oral toluidine blue was not impressive but the number of patients so treated was too small to evaluate.

The response of many of the patients with menorrhagia to a single intramuscular injection of protamine is difficult to explain, in that the duration of intramuscular protamine action is probably less than 4 hours (4). Most



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patients who reported a reversion from profuse to normal flow remained normal for the rest of the menstrual period. These results were obtained when protamine was given intramuscularly on the second or third day of flow. This generally was coincident with an increase in the protamine titration and the onset of profuse bleeding. Temporary or poor results occurred most frequently when protamine was given on the first day of menstruation, even though in some patients the titration was increased at this time.

The mechanisms involved in menstruation and menorrhagia are not well understood and the nature of the systemic change responsible for the protamine titratable abnormality in the blood of these patients is even more obscure. Hence, these data cannot be interpreted with reference to the physiology of menstruation or coagulation. The fact that many of these patients appeared to respond to protamine sulfate is not in itself sufficient to conclude that the systemic blood disturbance in menorrhagia is the same as that produced by the injection of commercial beef heparin. Therapeutic measures in menstrual disorders often can only be evaluated in terms of subjective descriptions by the patient. The difficulty in evaluation is further complicated by the fact that not all menstrual periods in women with menorrhagia are abnormal. Hence, a much larger series of normal women and patients with menorrhagia, studied with reference to their protamine titrations and response to intramuscular protamine injections

and oral toluidine blue, will estimate the therapeutic possibilities of these agents accurately.

## SUMMARY

- 1 The presence of protamine abnormality was observed at the menstruation. This abnormality was commonly and more extensively in women with menorrhagia than those whose menstrual periods were normal.
- 2 Many patients also had a prolonged blood clotting time and a mild to moderate thrombocytopenia. Prothrombin and fibrinolysis were essentially normal. Gross evidence of fibrinolysis was observed in only 1 patient.
- 3 The blood studies and clinical course following the administration of protamine sulfate or toluidine blue in a group of 34 women with menorrhagia are presented.

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# MULTIPLE PRIMARY CANCER

## A Study of Thirty-six Patients

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IN spite of the fact that tremendous advances have been made in the fields of cancer research and the related sciences since Billroth first reported the occurrence of multiple primary malignant neoplastic disease nearly 80 years ago, the true biological significance of this condition remains obscure. Final clarification depends primarily on the correct explanation and evaluation of the various extrinsic and intrinsic factors that initiate and control malignant anaplastic cytological changes and secondarily on the statistical contributions of clinical medicine. Ewing has stated that "the study of the conditions under which cancer develops belongs to clinical medicine and pathology, while the investigation of the cell processes calls upon all of the fundamental medical sciences." With this in mind, and prompted by the fact that an increasing number of cancer patients seen in the Department of Surgery at Harper Hospital were observed to have been afflicted with a second primary malignant lesion, we made the following résumé of current thought on the subject with a report of 36 cases.

### MODE OF ORIGIN

As reliable scientific data have accumulated, the theory of unicentric origin, which holds that neoplastic processes develop exclusively from a single cytologic focus, has gradually given way to the theory of multicentric origin. The latter proposes that neoplastic transition may occur independently at two or more isolated points, either simultaneously or at variable intervals, thus producing independent multiple lesions or solitary lesions by the coalescence of adjacent foci.

In an excellent review of the subject, Slaughter discusses the following evidence favoring

the multicentric origin of both benign and malignant tumors. Examples of the former include pigmented nevi, keratotic warts, lipomas, neurofibromas (von Recklinghausen's disease), papillomas of the urinary bladder, multiple polyps of the stomach and colon, and fibromyomas of the uterus. Examples of malignant neoplastic disease of diffuse origin include the leucemias, Hodgkin's disease, and idiopathic multiple hemorrhagic sarcoma (Kaposi's disease). Multiple myeloma has also been cited as an example, but the mode of origin of this disease is subject to question. Brill Symmer's disease (giant follicular lymphadenoma) is regarded by some investigators as a precursor of lymphosarcoma.

Microscopic evidence of the multicentric origin of malignant neoplastic disease is commonly found in lesions such as intraepithelial epidermoid "carcinoma in situ" (Bowen's disease) and in the malignant degeneration of widely separated polyps of the colon. "Carcinoma in situ" has been demonstrated in skin, cervix, larynx, and other organs by Broders (28), in the breasts by Foote and Stewart (28), and by Mallory (28) in the gastric mucosa. Ewing has stated that "precancerous" or pre-invasive anaplastic cytological changes can be demonstrated in areas outside of the limits of the frankly invading carcinoma.

Although this evidence does not conclusively prove the multicentric origin of multiple neoplastic disease, or exclude the possibility of unicentric origin, it offers tangible evidence that isolated anaplastic cellular changes do occur.

### INCIDENCE

The incidence of carcinoma based on post-mortem findings at Wisconsin General Hospital (University of Wisconsin) (7), University Hospital (University of Michigan) (7), and

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TABLE I — REPORTED INCIDENCE OF MULTIPLE  
PRIMARY MALIGNANT TUMORS

Source	Rate per cent
Second Budapest Pathological Hospital (7)	0.3
University of Milan (7)	0.5
Erismann General Hospital, Leningrad (7)	1.87
Schreiner and Wehr	2.7
Hurt and Broders	3.34
Lichtman	3.50
Warren and Gates (32)	3.70
Stalker, Phillips, and Pemberton	4.52
Berson and Berger	4.60
Owen	4.70
Warren (31)	6.00
Warren and Erhenreich (27)	6.8
United States Average (32)	6.8
Combined European and United States Average (32)	1.84

the Mayo Clinic (7) averages about 30 per cent of autopsies. Warren and Gates (32) report an incidence of 13.8 per cent based on a review of 115,813 postmortem examinations. The incidence of multiple primary malignant neoplasms has been variously reported between 0.3 and 6.8 per cent of all cancer cases as shown in Table I.

## AGE AND SEX

The average age of occurrence of multiple primary malignant tumors varies, according to the literature, between 50.4 and 62.1 years. Insufficient data have accumulated to distinguish any significant correlation between age and multiplicity of lesions. Available statistics regarding the incidence in the two sexes are inconclusive, however, they seem to indicate a slightly higher incidence in males.

SUSCEPTIBILITY, IMMUNITY, AND  
HEREDITY FACTORS

Computations by Bugher based on cancer statistics of the United States during the period 1920 to 1928 indicated that the actual incidence of multiple primary neoplastic disease is greater than can be expected on the basis of chance alone. The preponderance of opinion seems to favor a tumor diathesis or susceptibility factor in a certain percentage of the population, however, Ewing, Hanlon, and Seecof (16) have suggested that the incidence is compatible with the accidental rate. Ewing states that "the validity of assuming the existence of

a predisposition to cancer based on current available statistics is subject to doubt. So many events of widely separated significance have been included in the reports of multiple malignancies that no definite conclusions can be drawn. Multiple malignancy is an accidental coincidence of the biological factors in the incidence of tumors. Clinical studies indicate that there is, among human beings, a general susceptibility to tumors, but as a rule, the susceptibility is negligible and the disease is not developed until the real affective causes of the disease are brought into play." In the statistics available, approximately 26 to 29 per cent of patients with multiple primary malignant tumors have a family history of cancer.

Until further evidence has accumulated, no definite conclusions can be drawn concerning the significance of the immunity, susceptibility, or heredity factors.

## COMBINATIONS

The potential combinations of primary malignant tumors are numerous, but Slaughter has shown in his analysis of 1,868 cases that there is a striking tendency for them to occur in the same organ or in paired organs (54.3 per cent). This observation has also been made by Lichtman and Stalker, Phillips, and Pemberton. Ewing reported that bilateral primary carcinoma of the breasts occurs in 1.5 per cent of the cases. According to the literature, multiple primary neoplasms occur most frequently in the skin or in combinations with the skin. This group constitutes more than 50 per cent of the cases in many of the earlier reports. As Slaughter points out, the fact that the skin is the system most frequently involved is not surprising, when one considers the relative size of this organ and the frequency with which it is exposed to external chemical and physical carcinogenic stimuli. Schreiner and Wehr observed that basal cell carcinoma is found more frequently than squamous cell carcinoma in multiple primary tumors involving the skin.

The next most commonly involved system is the gastrointestinal tract, followed by the genitourinary system. According to Slaughter's work, the order of frequency of involve-

ment of the several divisions of the gastrointestinal tract is colon, first, combinations of colon and stomach, second, and stomach, third, which, as he points out, is somewhat of a surprise as gastric carcinoma is not generally thought of as being multiple

As would be expected, the highest incidence in the paired organs occurs in the breasts, ovaries, testicles, and kidneys in that order

Multiple primary tumors involving two different systems occur most frequently in the gastrointestinal and genitourinary systems. Second in frequency are tumors involving the breasts and genitourinary tract

Multiple sarcomas are relatively rare, however, combinations of carcinoma and sarcoma are not infrequent

Certain combinations, particularly those involving the same tissue or same organ, are frequently difficult to prove because of the problem of excluding metastasis. Examples of these are multiple primary lesions confined to the ovaries, breasts, skin, colon, and combinations involving the ovaries and gastrointestinal tract (Kruckenberg). Teratomas also give rise to doubt in certain cases

#### THE SIGNIFICANCE OF THE ENDOCRINE SYSTEM IN MULTIPLE PRIMARY NEOPLASMS OF PAIRED ORGANS

The existence of a relationship between the estrogenic hormones and carcinoma of the breast is generally accepted, however, the exact significance of this relationship is not clearly understood. It is well known that surgical castration following primary carcinoma of the breast frequently alters the course of the disease in patients in the premenopausal state

Dockerty (4) states that granulosa cell and theca cell tumors occasionally produce adenocarcinoma of the breast and uterus as the result of a hormonal disturbance

Slaughter has suggested that if carcinoma of the breast is a systemic disease predicated on an endocrine background, then the bilateral occurrence of breast cancer could be readily explained. Likewise, bilateral carcinoma of the ovaries and testicles could be explained on a similar basis rather than on the basis of chance alone

#### CRITERIA FOR DIFFERENTIATING PRIMARY MALIGNANT NEOPLASTIC DISEASE

Billroth (32) proposed the following criteria which have generally been discarded because they were too strict: (1) the tumors must have a different histological appearance, (2) they must arise in different locations, and (3) they must each produce their own metastasis. The third postulate would obviously rule out many cases which are beyond reasonable doubt

Goetze (15) revised Billroth's criteria slightly and proposed that (1) each tumor must present the microscopic and macroscopic picture of the usual tumors involved, (2) the possibility of metastasis must be excluded with certainty, and (3) diagnosis must be confirmed by the character of the individual metastasis. As in Billroth's criteria, the third postulate falsely eliminates many true malignant primary neoplasms

Dissatisfied with these, Warren and Gates (32) liberalized their criteria as follows: (1) each tumor must present a definite picture of malignancy, (2) each tumor must be distinct, and (3) the probability of one tumor being a metastasis of the other must be excluded

Many reported cases have been disregarded in the statistical reviews in the literature because they did not conform to the criteria of the author concerned. Many others occurring in the same or paired organ or in the same or adjacent systems have been subject to question

#### DISCUSSION OF STATISTICAL DATA

Early in the course of this investigation it was realized that the number of cases acceptable for this report would not be as large as expected because of the difficulty in proving that the second neoplasm concerned was an independent primary tumor rather than an extension of the original growth

More than 60 per cent of the cases originally reviewed were discarded for one reason or another. The chief cause for elimination was due to the fact that clinical diagnosis of one or the other of the tumors had not been conclusively confirmed by histopathologic proof. Other cases were discarded when it was revealed by their histories that the original primary lesion had been diagnosed and treated

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TABLE II — PATIENTS WITH FAMILY HISTORY OF CANCER

Case No	Case diagnosis	Family history
19	Carcinoma of breast and ovary	Mother died carcinoma of stomach
22	Carcinoma of breast and cervix	Mother died carcinoma of stomach
11	Carcinoma of sigmoid colon	Mother died carcinoma of unknown site
9	Carcinoma of breast and stomach	Mother has carcinoma of breast
5	Carcinoma of rectum and colon	Father died carcinoma of bladder
32	Sarcoma of nose and carcinoma of breast	Mother had carcinoma of uterus Grandfather died carcinoma of stomach Two aunts died carcinoma of unknown site
25	Carcinoma of breast and uterus	Father died carcinoma of prostate Brother died carcinoma of bowel Four sisters died carcinoma of breast
27	Carcinoma of breast and uterus	Brother died carcinoma of hip Brother died carcinoma of liver

TABLE III — MULTIPLE NEOPLASMS OF THE GASTROINTESTINAL TRACT

Case No	Age years	Sex	Diagnosis	Interval	Diagnosis
4	47	F	Adenocarcinoma of sigmoid colon	4 yr 7 mo	Adenocarcinoma of transverse colon
5	50	M	Adenocarcinoma of rectum	8 yr 6 mo	Adenocarcinoma of transverse colon
6	40	F	Adenocarcinoma of transverse colon	6 yr 9 mo	Adenocarcinoma of sigmoid colon
7	50	F	Adenocarcinoma of cecum	10 yr	Adenocarcinoma of sigmoid colon

The age at the time of diagnosis of the first primary lesion varied from 28 to 78 years, and averaged 52.0 years. The age at the time of onset of symptoms of the second primary also varied between 28 and 78 years, and averaged 54.9 years. The interval between the onset of symptoms and the time of diagnosis of each neoplasm was so short in the majority of cases that this factor was considered negligible in computing the time intervals between lesions. The interval between the time of diagnosis of the first primary and the onset of symptoms of the second primary lesion ranged from 0 to 14 years, and averaged 3.22 years.

A reliable family history was obtained in 30 of the 36 cases, and of this number, 8, or 26 per cent, had a positive history of malignant disease, as noted in Table II.

It is of interest to note that in Case 25 there was a high incidence of carcinoma of the breast in the family. In this small series, however, it is impossible to draw any conclusions regarding a familial susceptibility factor.

The cases herein reported have been grouped according to the systems and system combinations concerned. In the 4 cases in which the gastrointestinal system alone was involved, the tumors were confined to the colon and rectum and there was no evidence of multiple polyposis in any case (Table III). Several cases of synchronous multiple lesions of the large bowel were reviewed, but were discarded on the basis that metastasis could not be ruled out. The interval between the occurrence of the two lesions in this series is worthy of note, the average being 7 years and 4 months. Malignant lesions of the upper gastrointestinal

at some other institution. Still others were discarded because the lesions concerned were confined to paired organs (as the breasts, ovaries, and kidneys) and the possibility of metastasis could not be ruled out. In spite of the fact that a large percentage of the cases reviewed did not fulfill the requirements of the criteria used, it was felt that many of them represented true cases of multiple malignant primary tumors.

We have included in this report only those cases (1) which have been proved to be malignant tumors microscopically, (2) which presented the gross and microscopic characteristics of the usual primary neoplasms found in the organs involved, and (3) in which the possibility of the second tumor being a metastatic lesion has been excluded to our satisfaction.

Thirty-six cases were finally selected from the Harper Hospital records of the last 20 years. In this group, there were 71 primary lesions, including 63 carcinomas, 5 sarcomas, 2 malignant teratomas, 1 malignant endothelioma, and 2 cases of myelogenous leukemia. Thirty-two of the patients were female and 4 were male, which represents a higher proportional incidence in women than previously noted in the literature.

TABLE IV—MULTIPLE NEOPLASMS OF THE GENITOURINARY TRACT

Case No	Age years	Sex	Diagnosis	Interval	Diagnosis
1	51	F	Sarcoma of ovary	3 yr 9 mo	Adenocarcinoma of uterine fundus
2	49	F	Sarcoma of ovary	2 yr 11 mo	Squamous carcinoma of uterine cervix
3	52	F	Adenocarcinoma of ovary	8 mo	Squamous carcinoma of uterine cervix

tract, which have frequently been reported in the literature, are conspicuously absent in this series. In only 1 of the cases reported was there a family history of cancer.

Three of the patients were found to have multiple neoplasms confined to the genitourinary system, as shown in Table IV. It is of interest to note that all of these are combinations of ovarian and uterine tumors in which the ovary became involved first. As previously indicated, this group may not represent the correct percentage involvement of this system because of the fact that multiple primary lesions confined to the ovaries were disregarded. None of these patients had a positive family history of malignant neoplastic disease.

The 6 cases of multiple primary neoplasms involving the breasts and gastrointestinal tract, shown in Table V, are of considerable interest. Fifty per cent, or 3 cases, are combinations of the rectosigmoid colon and ovaries in which the initial lesion occurred in the bowel. The possibility of Kruckenberg tumors and direct extensions of the initial lesion were ruled out to our satisfaction in these 3 cases, however, it is realized that they may be a subject of controversy. Several cases with similar combinations were discarded because these possibilities could not be reasonably excluded.

As previously noted in Table III, the time interval between the initial and subsequent primary lesions confined to the large bowel averaged 7 years and 4 months. In contrast to this, it is of interest to note that when the second primary lesion involved the ovary, the time interval was reduced to 7 months. Accordingly, the survival rates were markedly reduced.

TABLE V—MULTIPLE NEOPLASMS OF THE GASTROINTESTINAL AND GENITOURINARY SYSTEMS

Case No	Age years	Sex	Diagnosis	Interval	Diagnosis
11	44	F	Adenocarcinoma of rectosigmoid	2 mo	Adenocarcinoma of ovary
12	56	F	Adenocarcinoma of uterine fundus	7 yr 2 mo	Adenocarcinoma of cecum
13	59	F	Hypernephroma of kidney	5 mo	Adenocarcinoma of sigmoid colon
14	28	F	Adenocarcinoma of rectum	1 mo	Adenocarcinoma of ovary
15	41	F	Adenocarcinoma of uterine fundus	14 yr	Adenocarcinoma of colon
16	59	F	Adenocarcinoma of sigmoid colon	1 yr 6 mo	Papillary carcinoma of ovary

In our experience, this combination seems to have a much poorer prognosis for survival than other combinations. As previously noted, this observation seems clinically significant, regardless of whether the ovarian neoplasms are primary or metastatic, in that it raises the question of the advisability of castrating all female patients with carcinoma of the gastrointestinal tract at the time of initial resection.

For example, in Case 14, a 28 year old white female was found to have grossly normal ovaries at the time of operation for a fairly early carcinoma of the rectum (Miles operation). Because of the patient's age and desire to have another child, and the lack of evidence of metastasis or local extension of the neoplasm, the ovaries were not removed. Approximately 2 months later, this patient returned with a rapidly enlarging abdominal tumor which proved to be a papillary cystadenocarcinoma of the ovary. Eighteen months later the patient expired as the result of a generalized abdominal carcinomatosis. It seems reasonable to assume that her life would have been extended if the ovaries had been removed at the initial operation.

Eleven, or 30 per cent, of the cases included in this report were combinations of breast and reproductive organs, as indicated in Table VI. The average time interval between lesions in this group was 17 years. The ovaries were involved in 3 cases and the uterus (cervix) in

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TABLE VI — MULTIPLE NEOPLASMS OF THE BREAST AND GENITAL ORGANS

Case No	Age years	Sex	Diagnosis	Interval	Diagnosis
17	44	F	Teratoma of ovary	None	Adenocarcinoma of breast
18	66	F	Carcinoma of breast	None	Carcinoma of uterus
19	44	F	Carcinoma of breast	4 yr 4 mo	Carcinoma of ovary
20	48	F	Sclerous carcinoma of breast	1 yr	Adenocarcinoma of uterine fundus
21	61	F	Adenocarcinoma of uterine fundus	None	Sclerous carcinoma of breast
22	47	F	Carcinoma of breast	2 yr	Carcinoma of cervix
23	45	F	Primary duct carcinoma of breast	1 yr 6 mo	Teratoma of ovary
24	54	F	Adenocarcinoma of breast	7 mo	Carcinoma of cervix
25	56	F	Carcinoma of breast	4 yr 6 mo	Carcinoma of uterus
26	39	F	Carcinoma of breast	1 yr 9 mo	Carcinoma of uterus
27	44	F	Carcinoma of breast	4 yr 4 mo	Squamous carcinoma of cervix

TABLE VII — MULTIPLE NEOPLASMS OF THE BREAST AND GASTROINTESTINAL TRACT

Case No	Age years	Sex	Diagnosis	Interval	Diagnosis
8	44	F	Adenocarcinoma of transverse colon	4 yr	Sclerous carcinoma of breast
9	49	F	Sclerous carcinoma of breast	6 yr	Sclerous carcinoma of stomach
10	78	F	Sclerous carcinoma of breast	None	Adenocarcinoma of rectum

in contrast to the early statistical reviews which reported an incidence of more than 50 per cent

In Case 36 the patient had three primary neoplasms. The first was an adenocarcinoma of the jejunum, followed 8 years later by a carcinoma of the kidney and a squamous cell carcinoma of the larynx. This patient is also reported to have a carcinoma of the bladder and a carcinoma of the prostate, but histopathologic evidence had not been obtained at this writing.

The time interval between lesions in this group, for the most part, was relatively short.

## DISCUSSION

The contributions of clinical medicine to this subject have been limited for several reasons. Foremost is the failure of the medical profession as a whole to report all significant clinical observations and statistical data. Conclusions regarding the incidence of cancer must be based on the relatively small percentage of cases that are reported in the scientific literature and the vital statistics surveys of the few countries publishing reliable reports. The number of cases of primary and multiple malignant disease that remain undiagnosed and unreported is highly speculative. Probably a large majority of these cases are never seen by the medical profession, particularly those in the less civilized parts of the world. Many others no doubt die of accident or intercurrent disease before the second primary malignant tumor manifests itself clinically. Still other cases are undiagnosed at autopsy because of the impracticability of serially sectioning all tissues.

Other limitations to the accuracy of statistics include the diversity of opinion re-

the remaining 8. Two of the tumors involving the ovaries were teratomas.

Of this group, adequate histories were available in only 10 cases which revealed that 6 of the patients had passed the menopause at an average age of 50 years and the remaining 4 were between the ages of 44 and 47 years. Eighty per cent of this group were parous. Menstrual histories were essentially normal in all cases but 1.

In this small group, there is nothing to indicate endocrine imbalance, and the group as a whole falls well within the limits of normal with regard to menstrual history and fertility.

Table VII includes 3 cases in which one of the primary lesions occurred in the breast and the other in the gastrointestinal tract. Noteworthy only is the fact that all of the breast lesions were of the sclerous variety.

The final category of multiple neoplasms is composed of miscellaneous combinations of lesions involving unrelated organs and systems. Table VIII indicates the nature and locations of these lesions.

Neoplasms involving the skin constitute only 8.3 per cent of this total series, which is

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## TABLE VIII—MULTIPLE NEOPLASMS OF MISCELLANEOUS SYSTEMS

Case No	Age years	Sex	Diagnosis	Interval	Diagnosis
28	56	M	Squamous carcinoma of the tongue	None	Lymphosarcoma
29	60	F	Sarcoma of nasal septum	1 yr	Adenocarcinoma of descending colon
30	65	F	Epithelioma of cheek	None	Epithelioma of scalp
31	74	F	Adenocarcinoma of sigmoid colon	None	Myelogenous leukemia
32	65	M	Adenocarcinoma of jejunum	8 yr 6 mo	Myelogenous leukemia
33	55	F	Endothelioma of palate	None	Adenocarcinoma of thyroid
34	40	F	Sarcoma of nose	None	Scirrhus carcinoma of breast
35	47	F	Squamous carcinoma of scalp	None	Adenocarcinoma of uterine fundus
36	57	M	Adenocarcinoma of jejunum	8 yr	Carcinoma of larynx

garding the classification of malignant tumors in general and the absence of a set of criteria that will differentiate true multiple primary neoplastic disease from extension or metastasis beyond any question of doubt. Until such criteria have been proposed, tumors having similar histopathologic patterns or occurring in the same system or paired organs will always be subjects of controversy.

The incidence of multiple primary malignant neoplastic disease based on the law of chance has been variously estimated in the neighborhood of 3 per cent. The consensus of opinion seems to favor the theory that the actual incidence is greater than can be accounted for on the basis of chance alone. If this is correct, it seems reasonable to assume that this condition is either an inevitable sequence in the course of uninterrupted neoplastic genesis or that susceptibility, resistance, and heredity factors exist.

The apparent and actual incidence of multiple primary malignant tumors should gradually rise further above the incidence expected on the basis of chance alone because of the following reasons:

- 1 Progressive improvement in methods for accumulating accurate cancer statistics from all sources should bring more cases to light.
- 2 Progressive education of the laity, as well as the medical profession, should increase vigilance for the disease and result in earlier diagnosis and treatment.
- 3 Progressive increase in the number of individuals living in the "cancer age" group should result in an increase in the incidence of multiple primary cancer as well as of initial cases.

- 4 Progressive increase in the cure and survival rates resulting from improved methods of cancer detection and cancer therapy should permit the occurrence of additional primary tumors in the same individual.

As the actual incidence of cases increases, the clinical significance of multiple primary neoplasms becomes increasingly important from several standpoints. First, the importance of a thorough periodic examination of all cancer patients for the development of subsequent primary lesions as well as metastasis cannot be overemphasized. Secondly, in view

of our present knowledge of multiple primary neoplasms and the frequent involvement of the ovaries by a second primary or metastatic lesion following carcinoma of the uterus or gastrointestinal tract, the surgeon must always consider the advisability of castration at the time of surgery for the initial cancer. Furthermore, the problem of castration of premenopausal women with primary carcinoma of the breast, as a method of controlling the development of subsequent primary lesions as well as metastatic lesions, is worthy of consideration.

### SUMMARY

A survey of 36 cases of multiple primary malignant neoplasms, based on records obtained from the Department of Surgery at Harper Hospital, revealed an average age in incidence of 52.0 years for the appearance of the initial primary tumor, and an average time interval between primary tumors of 3.22 years. There were 32 females and 4 males in this series, a ratio of 8 to 1.

Calculation of the incidence rate in systems and organs reveals that 17 patients, or 47 per cent, had a primary lesion in the gastrointestinal tract, 15 patients, or 41 per cent, had involvement of a breast, and 9 patients, or 25 per cent, had a primary lesion in one ovary.



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The time interval between lesions was greatest in those confined to the gastrointestinal system, and shortest in those involving the ovaries and gastrointestinal system. In this series, there was a family history of cancer in 26 per cent of the cases in which reliable histories were available.

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# EDITORIAL

## SURGERY Gynecology and Obstetrics

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### FRACTURES ABOUT THE ELBOW IN CHILDREN

FRACTURES involving or adjacent to the elbow joint are important, they occur frequently, and excellent functional results are often difficult to obtain. Accurate reduction is required to restore the carrying angle, flexion, extension, pronation, and supination.

Supracondylar fractures are the most common about the elbow. Volkmann's contracture follows supracondylar fracture more often than any other injury. The anatomy about the elbow joint contributes to impairment in circulation. The distal fragment is usually displaced posteriorly, stretching the terminal portion of the brachial artery over the brachial fragment. At the elbow the brachial artery passes through a closed space bounded posteriorly by the humerus, and laterally and medially by the intermuscular septa which are continuous with the deep fascia that forms the anterior boundary. The occurrence of edema in this space may impair the circulation.

Considering these anatomical facts, circulatory impairment following supracondylar fracture is relatively rare. When it does occur, every effort must be made to restore adequate circulation by correction of the gross displacement of the fracture, elevation, parasymphetic block and, in rare cases, surgery. There are few more distressing conditions seen in the practice of orthopedic surgery than a severe Volkmann's ischemic paralysis.

Nerve lesions are rare, when they do occur the radial nerve is the most often involved, the median second, the ulnar almost never. The radial nerve is subject to injury as it passes over the anterior margin of the proximal fragment in the interval between the brachialis and brachioradialis muscles. Usually the radial nerve paralysis is temporary. The roentgenograms should be studied to differentiate between supracondylar fracture, condylar fracture, and posterior dislocation of the elbow.

Reduction should be accomplished as soon as possible. General anesthesia is used. Traction is placed on the forearm with the elbow extended and any medial or lateral displacement of the distal fragment corrected by manipulation. While moderate traction is continued, the distal fragment is pushed forward, the proximal fragment is pushed forward, the elbow flexed so that the palm of the hand points toward the sternoclavicular joint. This position places the forearm medial to the arm when the elbow is flexed, therefore, when the elbow is extended the carrying angle will be preserved. The forearm should not be flexed above 45 degrees. If the radial pulse is not palpable at this point, the elbow should be extended sufficiently to allow palpation of

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pulse The forearm is held in this position by adhesive strapping When this method is used the circulation must be watched with great care following the manipulation At the end of 3 or 4 weeks sufficient callus is usually present to allow removal of the adhesive The child is encouraged to increase the motion in the elbow by active use Passive motion should not be used Forceful manipulation or passive stretching of the elbow to produce extension, either by physiotherapist or the relatives is to be condemned as is also the carrying of bricks, books, etc Active use of the elbow and active use alone should be employed to increase the motion in the joint

*Condylar fractures* It is important to differentiate between supracondylar and condylar fractures The former can be treated by conservative means in nearly all instances while the latter require early open reduction and adequate internal fixation to insure satisfactory reduction and to prevent disturbances in growth and arthritic changes Due to the presence of the carrying angle, fractures of the lateral condyle are much more common than fractures of the medial condyle Fracture or epiphyseal separation of the medial epicondyle is more common than fracture of the medial condyle but not as common as fracture of the lateral condyle

In either fracture of the medial or lateral condyle, separation and rotation of the fragment is usually seen The lateral condyle is displaced and rotated by the pull of the extensor muscles, the medial by the flexor muscles In the roentgenograms the fragments always appear smaller than they actually are as complete ossification of the condyle has not occurred The condylar fragment is small and difficult to manipulate, as it is practically impossible to grasp and replace it accurately Even if one is successful in securing an accurate reduction, the pull of the muscles will

distract the fragment despite any form of external fixation

When these fractures are treated by manipulation nonunion occurs As the fracture line passes through the growth centers of the lower end of the humerus, disturbance in growth will occur If the lateral condyle is fractured, as the child grows the medial side of the humerus will grow faster than the lateral, thus creating a gradually increasing cubitus valgus deformity If the medial condyle is fractured the lateral portion of the lower end of the humerus will grow faster than the medial side and there will be gradual decrease of the carrying angle with the development of a gunstock deformity Irregularity of the lower end of the humerus causes a posttraumatic arthrosis of the elbow With nonunion of the lateral condyle and increase in the carrying angle, delayed ulnar palsy may be seen during adult life

To prevent these complications, early operation and internal fixation should be employed The condylar fragment should be rotated into its anatomic position In many instances the major portion of the fracture line is covered with cartilage and only a small central area of bone is noted in both fragments Cartilage heals poorly, consequently, to obtain union it is necessary to oppose the osseous tissue Internal fixation is imperative to maintain the position of the fragments, without it separation will occur as a result of the muscle pull The fragment can best be held by means of a small rustless steel nail If there is a tendency for the condyle to rotate, a second nail may be necessary The end of the nail should be palpable beneath the skin At the end of 6 weeks, usually under local anesthesia, the nail is removed

This method has the theoretical disadvantage of passing a foreign body across the epiphyseal line We have not noted blocking of

## EDITORIAL

the epiphysis or impairment of growth as a result of the nail

Posterior dislocation of the elbow in children is often associated with fracture or epiphyseal separation of the medial epicondyle. At the time when the dislocation is reduced the medial epicondyle may be caught in the joint.

The above accounts for 90 per cent of the fractures about the elbow in children (supracondylar 65 per cent, condylar 25 per cent, in our series). Fracture of the neck of the radius, fracture of the ulna with dislocation

of the head of the radius, fracture of the olecranon and T condylar fractures accounted for the remaining 10 per cent. These are usually treated by methods similar to those employed in adults, except that in fracture of the neck or head of the radius, the head of the radius should not be removed in a growing child as cubitus valgus will result. Also fractures of the ulna with dislocation of the head of the radius can often be treated conservatively in a child while these fractures usually require operative therapy in an adult.

HAROLD B. BOYD



JOHN PAUL JONES  
1734-1792

*Dr. John Paul Jones, 1734-1792*

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## THE BOOK SHELF

### DEATH COMES FOR THE ADMIRAL

ESTHER H VINCENT, Evanston, Illinois

JOHN PAUL JONES started life in a wee cottage in Galloway, in that same western Scotland that nourished Wallace and Bruce, Bonnie Prince Charlie, and Bobbie Burns. His parents, John Paul and Jean Macduff, Low and High Scotch, respectively, handed down to their little son the poetic romanticism of the Lowlanders and the physical vigor and "derring-do" of the Highlanders. John Paul, Senior, had come from Fife, where his father was a gardener-innkeeper, and had taken service as a landscape architect on the estate of William Craik, Laird of Kirkcudbright. Craik was the natural son of the eminent surgeon, James Craik, and had achieved a favorable reputation throughout Britain as an inventive agriculturalist.

In their cottage on a granite headland of the Solway Firth, John and Jean Paul produced seven children, four boys and three girls. The two youngest boys, however, died in infancy, and the eldest girl died before she was twenty. The eldest son, William, was adopted by a Virginia planter, William Jones, who took a liking to the lad, while on a visit to his home-folks in Scotland. That left to the family John Paul, Junior, and the two little girls, Mary and Janet.

The future founder of the United States Navy was born on the sixth of July, 1747, the year after the famous battle of Culloden, while the strains of "Scots wha hae with Wallace bled" still echoed over the heather. Efforts have been made to assign him to other than his gardener father—to the Earl of Selkirk on St Mary's Isle, to Mr Craik, and to Uncle George Paul. But the probability is that he was quite unromantically legitimate.

His scanty childhood included a meager education at the parish school, and an extensive education at the seashore. His toy frigates had

given way to fishing yawls, and his boy companions to bronzed sailors before he was twelve. At that age he was apprenticed to a ship owner, and made his first voyage to the new world. While still in Virginia, he had his indentures returned to him, his ship-owning firm having changed hands, and he went back to Scotland on a British man-of-war. Then as third mate on a "slaver," he plowed the steaming waves to Africa, and at the age of nineteen, found himself chief mate on a Jamaica-Guinea brigantine. In this nefarious trade, sailors died almost as fast as their human cargo, and epidemics were frequent. Young John wrote home about his "several very severe fevers," and at length gave up his job. Stranded in Jamaica, he joined a troupe of actors and toured the West Indies, thus developing his native histrionic ability and achieving skill in speech and stage presence.

Tired of island-jumping, he sailed on a ship bound for Britain. Early in the voyage, both the captain and the first mate died of fever, this sort of thing being quite characteristic of tropical malaria before the days of quinine and mosquito crusades. John Paul took command, and, on arrival in port, was made master at the age of twenty-one. By this time, his father was dead, and, after arranging family affairs, John again went down to the sea in ships.

Now occurred the unfortunate Mungo Maxwell incident. Maxwell, a fellow Scotsman, was ship's carpenter on a voyage to Tobago. So shiftless and lazy was he, that Captain Paul thought to cure him with the cat-o'-nine-tails. Maxwell seemed none the worse for his whipping, but, when, some time later, he died on another ship, John Paul was accused of his murder. The evidence proved that Maxwell's death was due solely to fever, but the affair put the young captain in a very miserable as well as a precarious situation.

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His difficulties were not lessened by his own attacks of malarial fever, and by the strain on his constitution occasioned by the summer heat of the tropics. In Tobago, his "isle of misfortune," there later took place another affair of serious import. During a mutiny at sea a rebellious sailor impaled himself on Captain Paul's sword. The twenty-six year old commander was so upset over his two unfortunate experiences with violence, that he disappeared from history for two years. Speculation has suggested that he took refuge in piracy, but there is no worthy evidence as to this, and knowledge of his character contradicts it.

In 1774, John Paul turned up again in Fredericksburg, Virginia, and there found brother William mortally ill. After the funeral, John took over the administration of William's estate, and showed some signs of wanting to become a planter, himself. His glamor-boy personality won for him a rather dazzling social success, and the presence in the neighborhood of a certain Dorothea Dandridge (afterward married to Patrick Henry) was an added incentive to permanent retirement from the sea. But the American Revolution was brewing, and John Paul, who had now added Jones to his name, walked with brisk step from the pillared porches of Virginia to the quarter-deck of a fighting ship.

John Paul Jones was the sort of man who always commands attention. His keen, wild look, heritage of his Highland mother, augmented his charm. Of medium height, he was slender, admirably proportioned, and with classical features. His hair and eyebrows were black, his eyes brilliantly dark. He had a military grace of motion and a remarkable facility of movement. His sweet Scotch baritone fell most agreeably on the ear, and his power of conversation was extraordinary. His dress was invariably good, his personal habits pleasant. His life as a sea captain had produced a certain air of withdrawal, of seeming arrogance, which put lesser men in their places. Since many of these "lesser men" did not like to be put in their places, Paul Jones acquired a good many enemies, some of them in the seats of the mighty.

He reached Philadelphia at the bidding of the Congressional Marine Committee in 1775, and was placed in a group of experienced persons to consider how to make a navy. Now began his life of vexatious delays and bitter disappointments for which all his naval victories and all the adulation of two continents could hardly compensate. Personal jealousies and petty minds continually got in his way. Along with him in

Paris celebrated the conquest with wild delight. The King made Jones a Chevalier, and the Duchess of Chartres greeted him with royal triumph as he laid the English Captain's sword at her feet. News of treachery and conspiracy home led Jones to return, a "wrathful Achilles of the sea." Congress was suffering from its usu-

the budding United States Navy were "political skippers," soon to be dismissed or to fall into harmless byways. But Jones was the first to hoist the Stars and Stripes as the ensign of the Republic, and was named by Congress to command the *Alfred*, crack frigate of the weak, little American line.

Burgoyne's surrender to Gates at Saratoga was the turning point of the Revolution, and it was Jones who was chosen to carry the news to France in the *Ranger*, the first Yankee frigate to cross the Atlantic. His arrival brought him a new friend in the canny Benjamin Franklin, then Minister to France. It also brought a new friend to the United States, for France now left the harbor of neutrality for the seas of intervention. Jones' association with French admirals, statesmen, nobles and plain citizens added to his own reputation and to that of his country. A series of daring raids on the coast of England, including an incursion to burn the shipping at Whitehaven (across the Solway from his birthplace), gave Britain a frightening experience. In April 1778, the *Ranger* captured the *Drake*, presenting the very new United States with its first victory over a ship of war. But the *Ranger's* commander had the very devil of a time with French and American red-tapism, bungling officials of both nations, treacherous and jealous subordinates, and had the utmost difficulty getting his prize money and meeting his crew pay rolls. All this produced a terrific mental strain on the struggling commander.

But there were interludes of glory and romance in Paris. Flirtatious letters from aristocratic French ladies give proof that one should not write love letters to famous men who keep an orderly correspondence file. Jones received a sword of gold and a medal of merit from Louis XVI, and a purse of 50,000 dollars from his great and good friend, Adelaide de Bourbon, Duchess of Chartres. Given command of an old tub of an East Indiaman, *Le Duras*, he changed its name to *Le Bonhomme Richard* in honor of Franklin's "Poor Richard," and set out with three other vessels on the adventure that ended with moonlit victory over the English *Scraps*, and made famous the phrase, "I have not yet begun to fight."

## VINCENT DEATH COMES FOR THE ADMIRAL

al reaction to excessive hero worship, but the notous passage of the *Alliance* under command of the psychopathic Landais did much to vindicate Jones' honor. Nevertheless, the Scotch-American hero continued to experience disappointment and frustration. Sailing to the Caribbean in vain expectation of a meeting with Spanish and French admirals, Jones had to cope with a long summer of tropical heat and bad food. Already sick with thwarted hopes, he fell easy prey to the marsh fevers of Porto Cabello. Relief came only with autumn and cold water therapy. However, intermittent fever plagued him all his days.

On his return to the States at War's end, he sought recuperation at Pennsylvania's Bethlehem, a favorite health resort for army and navy officers. His name still may be seen in the archives of the hospital kept by the Moravian Brethren. He was only thirty-six years old, but was like a tired and sick old man. Owing to financial reticence on the part of both the United States and France, Paul Jones had to rely on his interest in the whale-oil trade for economic security. But he continued to serve his country generously in spite of inadequate gratitude.

Sent abroad as a special envoy to adjudicate and collect delicate international claims, he proceeded to Paris. Here he had personal interests, also, in connection with the ladies. The most serious love affair of his life was conducted on the fringe of the royal court with a mysterious Mme T——, said to have been a natural daughter of Louis XV, an apparently very lovable woman, who disappeared in the mists of the Reign of Terror. Jones went on to Copenhagen to play his part in the tragicomedy of the Danish indemnity affair. Landais had holed up American ships in Bergen, then a Danish port, and Denmark had handed them over to Britain. The journey north was accompanied by great physical exposure, and on arrival Jones was forced to spend several days in bed. Hitherto blessed with a Napoleonic imperviousness to small ills, he had finally reached the point where he "couldn't take it."

Paul Jones was now ranking officer in the non-existent American navy, but, being unemployed for the time, he was open to offers from foreign countries. Catherine of Russia had heard of the handsome naval hero and requested his services. Jones accepted, with French minister Jefferson's blessing, and set out for Unholy Russia. Since direct passage was prevented by ice, Jones made a dangerous detour to Estonia in a small, open boat, manned by a few frightened Swedish sailors.

Badly battered, he landed at Revel after several days and nights of constant struggle with cold, wind, waves, and ice. He reached St Petersburg in April of 1788, and promptly went to bed with a pulmonary upset. This exposure, added to that already suffered on the journey to Denmark, was a deep shock to his already weakened constitution. Exposure to the wily Catherine and to her treacherous Prince Marshall, Potemkin, was a further shock to the trusting Caledonian.

After a period of flattery and adulation at Court, Jones made the thousand mile journey across the bleak Russian steppes to the pretentious but disease-ridden military post of St Elizabeth. Both Catherine and Potemkin were potentially dangerous to their new naval advisor, but it was to the interest of both of them that he be given a chance to make use of his talents. His was an uncanny knack of being able to succeed with poor material in both men and ships. And his "I have not yet begun to fight" spirit served him well. Though tired and half-sick, and caught in a net of intrigue, the doughty Russian Vice-Admiral won an astonishing victory over the Turks on the Black Sea. That the inept Prince of Nassau won the glory was characteristic of Russian imperial gratitude.

Three days in an open galley near the Ukrainian port of Kherson was too much for the already feverish naval hero. Hurt and bewildered, he spent two weeks in bed with bronchial pneumonia.

On his return to St Petersburg, further misery awaited the helpless man in the infamous and senseless Russo-German-girl-scandal, with which courtesan Catherine, in Puritan mockery, tortured her handsome Admiral.

Having wasted his health and his talents in sixteen months of Russian service, Paul Jones asked for and was granted a two year leave of absence. His "retreat from Russia" was made in good order with a "hail the conquering hero" reception in Vienna. May of 1790 found him esconced in a pleasant little house and garden of his own on the Rue de Tournon hard by the Luxembourg. France, already experiencing labor pains preceding the birth of her Revolution, got but little help from the exhausted man. Yellow and emaciated, lonely and sad, the Admiral confined himself to the seasoned joys of a few groups of old admirers. Latterly, he spent his days lying in the garden hammock or sitting in a favorite easy chair in his room. Affectionate respect was his from both the old and the new order in France, and the Revolution touched him but lightly. Social activity became increasing



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difficult for him, owing to frequent and exhausting coughing episodes and to encroaching dropsy. Repeated exposure to cold, stormy weather had affected his respiratory system. The intermittent fevers which had injured his kidneys. The frustrating days had attended him ever since his less spirit. Like a ship, sturdy and well built, with strong, beautiful lines, the Admiral was now being broken up prematurely on the rocks of misfortune. Disappointment with light, repeated strokes tortured both body and soul. His spirit had always been strained by a sort of split personality—a clash of the energetic seacaptain (the extravert) with the intensive but unexpressed poet (the introvert).

When Madame Arbergne, his housekeeper, entered his room at about nine o'clock on the evening of July 18, 1792, Death had preceded her. The Admiral lay face downward across the middle of his couch, with his feet on the floor. His arms were outstretched, one hand clutching the counterpane, the other clasping his beautiful watch, gift of the friendly Duchess of Chartres. Gouverneur Morris, then American ambassador to France, had witnessed his will just three hours before, at the end of a quietly happy afternoon spent with friends in the garden. The attending physician was the great anatomist, Vicq d'Azyr, Marie Antoinette's doctor, and permanent secretary of the Paris Academy of Medicine.

The French Assembly, then sitting, passed a unanimous resolution honoring the memory of Paul Jones, "Admiral of the USA" and decreed that twelve of its members should assist at the funeral. Some even proposed that he be buried in the Panthéon with the illustrious dead of France. But Admiral Jones' body was laid in a cemetery for foreign Protestants, having been put into a leaden coffin, "that, in case the United States should claim his remains, they might be more easily removed." A letter found in the French National Archives of 1792 states that "M. Simoneau has furnished the cost of interment of Admiral Paul Jones, of which the bill amounts to 462 francs."

If he had lived a week longer, Jones would have become an Admiral of France with authority to reorganize the French Navy. Had he lived three weeks longer, he would have received from George Washington orders to take charge of the complicated American interests in European waters, especially those connected with the Barbary pirates. For one hundred and thirteen years, the body of America's first naval hero lay forgotten in the

little cemetery of St. Louis, which became successively a garden, a dumping ground, the site of a laundry, and of several other squalid buildings. Two unsuccessful attempts to locate the grave were made, but it was not until 1905 that Ambassador Horace Porter, by a long and pains-taking examination of cemetery records, city maps, and documents, was able to trace the burial place. Five shafts were sunk with galleries in all directions. The intervening spaces were probed by long iron rods. Five leaden coffins were found, of which the third was superior in solidity and workmanship. It contained a well-preserved male body packed in hay, straw, and what had probably been alcohol. Clothed in a winding sheet and linen shirt, the body had its long hair gathered into a monogrammed cap. The flesh was still intact.

Identity was proved by (1) the striking resemblance of the features to the medal made by Dupré, voted by Congress in 1787, (2) anthropologic agreement of measurements with those of the bust of Jones made by Houdon, (3) length of the body, color of the hair, peculiar formation of the ear, and condition of the teeth, (4) the cap marked with the initial "J" made with the loop so rounded as to form a "P" when inverted, (5) the autopsy showing that the subject had had pneumonia and interstitial nephritis.

Dr. Capitan made the autopsy, opening the body from the back in order not to change the appearance of the corpse. He found the viscera much contracted but well preserved. The lungs showed pleural adhesions, especially in the upper lobe. When cut open, they showed a brownish parenchyma. The surface and interior pulmonary tissue presented small white hard masses, three to four millimeters in diameter, somewhat like calcified tubercles. These were particularly prevalent at the level of the diaphragmatic edge of the lower lobe. The heart was grossly normal, but with some flat concretions *sous-endocardiques*, similar to those of the lungs. The liver was a yellow-brown. The healthy gall bladder contained a pale yellow-brown pasty bile. The stomach was very small and contracted. The spleen seemed large in comparison with the other viscera. Both kidneys were small, hard, and contracted. The intestines were contracted and empty. The head was not opened.

Histologic studies revealed a normal heart, with muscle fiber streaks. The seemingly normal liver did not show the cellular lesions expected from the known symptoms of jaundice. The white granulations in the lungs appeared to be tyrosin crystals, products of the decomposition

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of azotized substances. No tubercle bacilli could be demonstrated, but there were found small rounded masses, partly calcified, corresponding to patches of bronchopneumonia. The kidney sections showed chronic interstitial nephritis, with thickened vessel walls invaded by sclerosis. Some glomeruli had changed into fibrous tissue in the shape of small spheres.

From the July 19, 1905 edition of the Paris *Le Temps* comes the following

"We know that the celebrated sailor had manifested some very grave pulmonary symptoms toward the close of his life, and that they were localized in the left lung. Further, that sometime before his death, he had had dropsy of the lower extremities, descending to the feet and ascending to the abdomen, indicating also a renal affection. The autopsy of the cadaver showed the organs impregnated with an alcoholic liquid, contracted, brownish, but so well preserved that Prof. Cornil was able to make histological sections, identical with those of the viscera obtained in an autopsy of our own times. The microscopic examination showed with the greatest exactness, that the liver was normal, that there existed in the left kidney especially, foci of the glomeruli, indicating an advanced interstitial nephritis. These histological lesions accord thus perfectly, we see, with the clinical signs presented toward the end of his life by Jones. It is remarkable that this is the first time that the identification of a cadaver has been realized, by means of these diverse methods, a century after the death of the subject."

The body was brought to Annapolis with due ceremony, and commemorative exercises were held in the Naval Academy's Bancroft Hall on April 24, 1906. There the body rested ignominiously for seven years on a couple of wooden saw horses behind a stairway. On January 26, 1913, one hundred and twenty one years after death, the Admiral's body was finally placed in the crypt of the new Naval Chapel. Cut into the marble of the mausoleum are the names of seven of his ships, including the *Ranger* and the *Bonhomme Richard*.

Napoleon, musing gloomily over Trafalgar, was heard to ask, "How old was Paul Jones when he died?" "Forty-five" was the answer. "He did not fulfill his destiny. Had he lived to this time, France might have had an admiral."

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## REVIEWS OF NEW BOOKS

FROM the large volume of material at the Memorial Hospital and the author's wide experience with tumors of bone, Dr Coley<sup>1</sup> has compiled an informative book which should lead to earlier diagnosis and better treatment. The author stresses primarily the clinical, diagnostic, and therapeutic aspects of the diseases described. The value of the text might have been enhanced by a more complete correlation of the pathologic aspects of bone tumors with their clinical and therapeutic aspects.

The book *Neoplasms of Bone* is organized into sections, and most sections may be profitably read with little reference to the rest of the book. Each section has its own bibliography appended which adds to the completeness of the subject material. Such a division of material into self-contained sections has led to minor overlap of the sections on surgical and constitutional therapy and part of the section on radiation therapy.

The illustrations, including roentgenograms, photographs, photomicrographs, drawings, and statistical tables, in general are numerous and excellent. Illustrative cases are abundantly cited, frequently in detail. The index is large and well chosen.

The author's classification of bone tumors is a modification of the revised classification of the Bone Sarcoma Registry of The American College of Surgeons. Bone tumors are defined as new growths arising in bone or derived from cells which are components of skeletal tissue. They are divided into benign and malignant types and are classified for the most part according to the cell or tissue of which they are composed, as chondroma and chondrosarcoma. However, the term osteogenic sarcoma, instead of being limited to bone forming sarcoma, is sometimes used later in the text in Ewing's original sense to indicate sarcoma arising in bone, consequently the unsatisfactory terms osteogenic fibrosarcoma and osteolytic osteogenic sarcoma. Again in Chapter 23, the term Ewing's sarcoma is used in the original sense to indicate a specific lesion, endothelioma of bone, and next to osteogenic sarcoma is considered the most common primary tumor of bone. But there is now a large body of evidence that true endothelioma of bone is a comparatively rare lesion and that the great majority of tumors which Ewing described under this head are other types of cancer, as mesenchymal cell sarcoma, reticulum cell sarcoma, neuroblastoma, round cell fibrosarcoma, and other little differentiated sarcomas.

The various theories of cancer etiology are briefly described. The differential diagnosis of bone lesions and a diagnostic survey of such lesions is well done.

NEOPLASMS OF BONE AND RELATED CONDITIONS. THEIR ETIOLOGY, PATHOGENESIS, DIAGNOSIS AND TREATMENT. By Bradley L. Coley, M.D. New York: Paul B. Hoeber, Inc. 1949.

This includes a discussion of the indications and contraindications of surgical and aspiration biopsy and the technique of each. Relatively few clinics rely upon aspiration biopsy in bone sarcoma to the extent which the author advocates.

There is an excellent chapter by Woodard on blood chemistry in the diagnosis of diseases of bone. It includes a table summarizing the chemical findings in typical cases of bone neoplasms and in non neoplastic diseases. Especially interesting are the studies correlating alkaline and acid phosphatase levels to primary and metastatic bone tumors.

The benign tumors and tumor-like lesions of bone are covered with considerable detail. However, the discussion of such non-neoplastic lesions as solitary bone cyst, fibrous dysplasia of bone, chondrodermatoid cyst, fibrous dysplasia congenita and so-called non-osteogenic fibroma under benign tumors may serve to link them too closely with the latter. The chapters on chondroma, chondroblastoma, and giant cell tumor are particularly good. The importance of precursors of malignant tumors, is duly considered.

The primary and metastatic tumors of bone are dealt with concisely. The author expresses the desirability of classifying osteogenic sarcoma into 3 groups—osteogenic sarcoma, chondrosarcoma, and fibrosarcoma—to avoid the confusion of further subdivision, but this runs counter to strict classification according to tissue type. A thorough analysis of 283 cases of osteogenic sarcoma seen and treated at Memorial Hospital is presented. Ewing's tumor, reticulum cell sarcoma, angiosarcoma, and multiple myeloma are similarly analyzed according to clinical features, sex, age incidence, location, treatment, and survival rate. The types and effectiveness of treatment are discussed with each tumor group and again, in more detail, in the special chapters and under surgical and radiation therapy. Of considerable importance is the stress the author gives to the development of osteogenic sarcoma following irradiation. He advises against the use of irradiation therapy for benign lesions for this reason. Amputations are well discussed, including end-results, and treatment of selected cases of bone sarcoma by resection and bone transplantation is properly advocated.

Sections on tumors involving bone by extension, metastatic tumors involving bone (numerically greater than primary bone tumors), tumors of bone in special localities, and lesions of the skeletal system that may simulate neoplasms of bone add to the completeness of the book. Of the latter group the most important under consideration are myositis ossificans, which is all too often confused with osteogenic sarcoma, and Paget's disease in which sarcoma frequently develops.

## REVIEWS OF NEW BOOKS

This book should be popular with both practitioners and medical students alike

DALLAS B. PREMISTER.

THERE is nothing finer in medical literature than the sincere appreciation of the achievements and contributions of those who built the foundations on which modern medical practice is based. When, as has often happened, the builders have had to work alone, and with too little understanding and sympathy from their contemporaries the important part they played may easily be forgotten. For that reason in particular we are under obligation to those who have recorded the story of the pioneers in medicine and surgery and made us aware of our indebtedness to men whose teachings and ideas we constantly apply, perhaps with little thought of their source or little appreciation of our obligation.

In a small and exceedingly interesting volume of 250 pages H. Winnett Orr has told the story of Hugh Owen Thomas, of his nephew, Sir Robert Jones, and of the American orthopedic surgeon, John Ridlon, who made American surgeons aware of Thomas and of his fundamental contributions to surgery. A very thoughtful and scholarly chapter by Arthur Steindler on Ridlon and his share in molding orthopedic surgery and an extensive bibliography add to the completeness and to the value of Dr. Orr's contribution.

Two factors in Thomas' contribution to surgical practice stand out with particular clarity: his constant and persistent emphasis on rest, "enforced, interrupted and prolonged," and the skill with which he devised methods of providing that rest. That Thomas was a general practitioner and that his application of surgical principles was carried into every phase of his practice is often forgotten by those who think of him only as the originator of the Thomas splint. Orr recalls that Sir Arthur Keith in his interesting essay on Thomas stressed his application of the principle of rest in the treatment of intestinal obstruction rather than in the field with which we invariably associate his name. That important principle of complete rest in the treatment of fractured bones and joint disease is concisely expressed in two quotations from Thomas' small volume, *Diseases of the Hip, Knee, and Ankle Joints*, quoted in Dr. Orr's preface (p. ix).

"I assert that a fractured thigh, if treated by extension only, would be accompanied by vastly more muscular irritability than if the same case was placed in a modern appliance with retention, in which the limb was retained and fixed immovably."

"Efficient and enforced rest in joint disease as well as in fractures, is the infallible remedy for quieting the irritated muscles, not extension."

ON THE CONTRIBUTIONS OF HUGH OWEN THOMAS OF LIVERPOOL, SIR ROBERT JONES OF LIVERPOOL AND LONDON, JOHN RIDLON M.D. OF NEW YORK AND CHICAGO TO MODERN ORTHOPEDIC SURGERY. By H. Winnett Orr M.D. with a supplement on Ridlon and his share in moulding orthopedic surgery by Arthur Steindler M.D. Springfield Ill. Charles C. Thomas, 1949

It is interesting to quote beside Thomas' words the author's own comments, on page 25

"We do not seem to have arrived at this 'rest' point of view for the acutely inflamed fractures and compound fracture wounds. There is still the attempt to diminish the amount of apparatus, to provide more joints and mobility, to make our patients ambulatory, and to render less efficient rather than more so the kind of control which Thomas described long ago as rest, 'enforced, uninterrupted and prolonged.'"

It is this basic principle and the most effective method of securing it to which Orr constantly returns in this study of the three men.

The "Surgery" of Hugh Owen Thomas at 11 Nelson Street in Liverpool in which his nephew, Sir Robert Jones, was associated and in which Jones and his pupils continued their work in later years has often been referred to. Close to the consulting rooms was the brace shop with its smithy, its saddler, and skilled workers. Here it was that Thomas and his aids fashioned the splints and braces that enabled him to provide for his patients the rest upon which he was so insistent. So complete was the equipment and so skilfully designed the splints which he devised, that in Sir Frederick Watson's words, "No matter from what distance a patient comes, no matter whether the affection be spinal caries, hip disease, or fractured thigh, he is always able to return home in an hour or so, most accurately fitted with a simple and appropriate splint."

The work of Jones and of Ridlon is better known to the present generation of American surgeons than that of Thomas. Jones "made acceptable to the profession" the principles which Thomas insisted upon so uncompromisingly. His tact, his diplomacy, and his genius for friendship enabled him to reach a wide and influential audience and to place the specialty of orthopedic surgery in Great Britain upon a firm foundation. Ridlon also, was a powerful influence in American orthopedic surgery during the 40 years that followed the formation of the American Orthopedic Association in 1887. As Dr. Steindler says

"John Ridlon may be said to represent the connecting link between the American tradition and the rising British influence of such masters as Hugh Owen Thomas and Sir Robert Jones. When he died in 1936 at the age of 84 he left an inspiring memory to his pupils. So sound had been his teachings, so careful, so deliberate, so conservative, and so thoughtful had been his approach to the difficult subjects or problems of our profession, that I do not think anyone of us really believes his methods antiquated nor would any of us hesitate to take counsel with him in any situation if he were alive today."

Everyone interested in orthopedic surgery can gain helpful stimulus and direction by reviewing anew under Dr. Orr's guidance the contributions of these three distinguished surgeons to the treatment of injuries and diseases of bones and joints.

SUMNER L. KOCH

## SURGERY, GYNECOLOGY AND OBSTETRICS

THE elaborate two volume contribution *Lehrbuch der Geburtshilfe*<sup>1</sup> is written by one of the leading German obstetricians and gynecologists. In the first volume the author discusses the physiology of pregnancy, labor, the puerperium, and lactation, and he discusses multiple births, the healthy newborn infant, and prenatal care. In the second volume he takes up the pathology of pregnancy, dystocia in labor, the pathology of the puerperium, and disturbances of the newborn.

Very little literature is quoted either in the text or at the end of any chapter. This was done intentionally because Martius maintains that physicians who are interested in the literature should consult the large systems of obstetrics. There are 539 illustrations in the first volume and 486 illustrations in the second volume, a total of 1,025 illustrations. Nearly all are highly instructive and many are in color. However, most of the reproductions of x-ray pictures are so poor that they are almost useless. Throughout both volumes, the author reveals his extensive experience as an obstetrician and as a teacher. His attitude is conservative and in line with that of most obstetricians throughout the world. One minor criticism is that the description and illustration of the Credé maneuver for delivery of the placenta should have been omitted, because this procedure can do great harm. Martius himself emphasizes that this maneuver is "not entirely without danger." Another point of disagreement is the use of oxytocic drugs in cases of placenta previa treated conservatively. Even in a multipara with a marginal placenta previa the use of oxytocics may result in rupture of the lower uterine segment. Aside from these and other minor criticisms the book can be highly recommended to physicians who read German. Martius was assisted by Drs W Bickenbach and K Nordmeyer, and all three deserve great credit for having written these books. The publishers also are to be commended because the paper is good, the type is very clear and all the illustrations except those of the roentgenograms have been reproduced admirably.

J P GREENHILL.

THE book *Die geburtshilflichen Operationen, Ihre Ausführung und Anwendung*<sup>2</sup> is the sixth edition to appear since 1934. In it the author discusses the structure of the birth canal and the baby, the mechanism of labor, forceps delivery, breech delivery, version and extraction, embryotomy, repair of lacerations, episiotomy, cervical incisions, pubiotomy, hydrostatic bags, abdominal cesarean section, delivery of twins, treatment of prolapse of the cord and arms, treatment of placenta previa, manual removal of the placenta, uterine tamponade, treat-

<sup>1</sup>LEHRBUCH DER GEBURTSHILFE. By Prof Dr Med. Heinrich Martius. Assisted by Prof Dr Med. Werner Bickenbach Prof Dr Med. Kurt Nordmeyer and Katho Droyen. Vol 1 Physiologie. Vol 2 Pathologie. Stuttgart Georg Thieme, 1948.  
<sup>2</sup>DIE GEBURTSHILFlichen OPERATIONEN IHRE AUSFÜHRUNG UND ANWENDUNG. Ein Lehrbuch fuer Studierende und Gebrauchsueber AERZTE. By Prof Dr Med Heinrich Martius. 6th ed. Stuttgart Georg Thieme Verlag 1948.

ment of abortion, curettage, induction of labor, and sterilization.

There are several minor points with which the reviewer disagrees. The metal hook for the delivery of a breech in a living baby should not be described or illustrated. Likewise the Credé maneuver for expelling the placenta should be condemned and the uterine pack should be given up for controlling bleeding from an atonic uterus. Twenty of the 287 pages and 27 of the 281 illustrations are devoted to destructive operations on the child. This is a disproportionate amount of space and number of illustrations for operations which are now fortunately seldom performed. The only form of tubal sterilization described is the Madlener, though it is our belief that the Pomeroy procedure yields better results. Aside from these few minor criticisms Martius has written an excellent book which will prove helpful to anyone who reads German. The fact that this is the sixth edition is ample proof that the book has been of great assistance to German students and physicians. The publishers have prepared this book exceedingly well as they have Martius' companion two volume book, *Lehrbuch der Geburtshilfe*.

J P GREENHILL.

THE authors present in the monograph *Cardiac Catheterization in Congenital Heart Disease*<sup>3</sup> a brief statement of the methods employed and the information to be gained by cardiac catheterization in infants and children.

The first part of the book outlines the technique employed for the physiologic studies, shows x-ray observations during catheterization, blood pressure tracings within the heart and great vessels, and formulas for calculation of systemic and pulmonary blood flow and of blood shunts.

The second part of the book reports 17 illustrative cases in which clinical data and catheterization have been co-ordinated in the diagnosis of various types of congenital cardiac malformations.

It is an excellent book which will be read with interest and profit by those who wish to familiarize themselves with this highly specialized diagnostic procedure.

STANLEY GIBSON

THE second edition of *Operating Room Technique*<sup>4</sup> by Edythe Louise Alexander is a comprehensive presentation of the problems involved in carrying on the surgical work of the hospital. The material is carefully organized and presented in detail. It is generously illustrated and includes a description of the anatomy involved, operative areas, surgical preparation of the skin, incisions, positions, and sterilization of material to be used in operative procedures.

<sup>3</sup>CARDIAC CATHETERIZATION IN CONGENITAL HEART DISEASE. A CLINICAL AND PHYSIOLOGICAL STUDY IN INFANTS AND CHILDREN. By Andre Cournaud, M.D., Janet S. Baldwin M.D. and Aaron Himmelstein M.D. New York: The Commonwealth Fund, 1949.  
<sup>4</sup>OPERATING ROOM TECHNIQUE. By Edythe Louise Alexander. 2d ed. St. Louis: The C. V. Mosby Co., 1949.

## REVIEWS OF NEW BOOKS

A chapter on the history of asepsis adds much to the interest of this subject. The author constantly emphasizes the fact that the welfare of the patient is the first consideration, and stresses the necessity of careful planning, co-operation, and teamwork. This volume can be profitably used as a guide and reference for operating room personnel.

HAZEL M. JOHNSON

THE author of *Plaster of Paris Technique* discusses the various forms of plaster used in surgery, giving in detail instructions for handmade plaster bandages. He includes the principles used in the care of the plaster and the application of the various types of plaster casts and a discussion of the errors and difficulties in plaster technique.

A chapter is devoted to the technique of pattern plaster and is well illustrated. The spine, the upper and the lower extremities are dealt with separately in sections. Several chapters are devoted to the use of plaster of paris in war surgery and one chapter is devoted to follow-up care. Approximately one-third of the book is text, the remainder consists of illustrations which are grouped at the end of each chapter. There has long been a need for a satisfactory text on plaster of paris technique. This book, however, only partially answers the purpose. The brevity of the text combined with the lack of correlation with the illustrations greatly reduces the effectiveness of the book.

ERWIN J. CUMMINS, JR.

THE standard *Textbook of Bacteriology*, first written by Hiss and Zinsser in 1910, has been repeatedly brought up to date through 8 editions, first by Zinsser and then by Bayne-Jones. The present group of authors, in preparing the ninth edition, have tried "to keep inviolate the basic biologic approach to bacteriology and at the same time to emphasize the public health significance and the practical clinical importance of certain of the biological characteristics of the organisms."

In preparing this review for *SURGERY, GYNECOLOGY AND OBSTETRICS* the writer has had in mind the value which this book might have for the surgeon, the gynecologist, and the obstetrician. Certainly the widening of the scope in these three fields of medicine has depended largely on the development and growth of the science of bacteriology. Zinsser himself believed in the close association of his laboratory with the clinical departments, and the present authors, as noted above, clearly expressed their intention of stressing the "practical clinical importance" of the knowledge of bacteria to all departments concerned with infection.

The book is divided into 77 chapters covering a historical review and sections on general bacteriology

*PLASTER OF PARIS TECHNIQUE* By E. O. Geckeler, M.D. F.A.C.S. 4th ed. Baltimore: The Williams & Wilkins Co. 1948.  
*ZINSSER'S TEXTBOOK OF BACTERIOLOGY* Revised by David T. Smith, M.D., Donald S. Martin, M.D. M.P.H. Norman F. Conant, Ph.D., Joseph W. Beard, M.D. Grant Taylor, M.D. Henry I. Kohn, Ph.D. and Mary A. Poston, M.A. 9th ed. New York: Appleton Century Crofts, Inc. 1948.

and immunology. Then the various pathogenic groups are described with special emphasis on the spirochete, the pleuropneumonia group, the rickettsiae, the viruses, and the mycoses. In these chapters reference is made to the clinical manifestations of these organisms. However, the surgeon, gynecologist, and obstetrician would like to see more detailed discussion of the relationship of bacteriology to the operating and delivery rooms, the minutiae of the processes of sterilization and sterile technique, the methods of minimizing the contamination of the "sterile field," and a consideration of carriers of bacteria among operating and delivery personnel. They would also like to see a discussion of the clinical activity of the streptococcus, staphylococcus, pneumococcus, gonococcus, the tubercle bacillus, the aerobic gram-negative rods, the gas gangrene clostridia and the other anaerobic organisms in their clinical fields of interest. These are only lightly touched upon. Furthermore, hardly any reference is made to the work which has been accomplished before, during, and after World War II in the many laboratories of surgical bacteriology. It is hoped that in future editions these practical points will be more fully covered.

FRANK LAMONT MELENEY

THE fourth edition of *Fractures and Dislocations* is divided into two sections. The first section deals with fractures, 7 chapters being devoted to general consideration and principles of care. Fractures of the various bones or groups of bones are dealt with individually in the remaining chapters of the first section.

Part 2 deals with dislocations and is similarly organized. The author recognizes the usefulness of more than one method for the treatment of certain fractures but continues to recommend the one method of which he considers the simplest and most reliable for the best functional results. The text material is well organized and well written. Illustrations are excellent, conveniently placed, and referred to frequently in the text. The new developments in traumatic surgery which occurred since the third edition are included in the appropriate chapters. The book effectively fulfills its purpose for the general practitioner.

ERWIN J. CUMMINS, JR.

THE technique of retropubic prostatectomy is presented in a monograph of 95 pages entitled *L'Adenomectomie prostatique retro-pubienne* by R. Couvelaire. Many of the problems which are encountered in the performance of this operation are considered, and effective technical methods for their solution are presented. Although the author's technique differs in many minor respects from the excellent method of Terence Millin, the originator of the operation in its present form, the book is well written and concise.

*FRACTURES AND DISLOCATIONS FOR PRACTITIONERS*. By Edwin O. Geckeler, M.D. F.A.C.S. 4th ed. Baltimore: The Williams & Wilkins Co., 1948.  
*L'ADENOMECTOMIE PROSTATIQUE RETRO-PUBIENNE* By R. Couvelaire. Paris: Editions Bernard Bacchet, 1948.

## SURGERY, GYNECOLOGY AND OBSTETRICS

This otherwise excellent volume, which is in the form of an atlas and well printed upon glossy paper of good quality, suffers from the poor quality of its illustrations. The numerous photographs are often out of focus and poorly finished, and they frequently fail to demonstrate significant anatomic landmarks. The drawings are also very sketchy and of inferior quality.

FREDERICK A. LLOYD

THE textbook of surgery for the eye physician *Surgery of the Eye*<sup>1</sup> by a master eye surgeon is a concise and complete treatment of the subject in 392 pages. The details of each step in the surgical procedures are given and aided by the use of many illustrations and diagrams. The contents include first the general considerations for the eye surgeon, preparation of the patient, and a detailed description of the use of local anesthetics. Postoperative treatment includes the use of typhoid-paratyphoid in large doses to which great credit is given. With the varied antibiotics now available such frequent use of foreign proteins in such large doses should be carefully considered.

The operative procedures carefully described include paracentesis, intracapsular and extracapsular extraction of the lens with the management of complications. All of the standard operations for glaucoma are given with the management of complications. Other chapters include the operations on the retina, sclera, cornea, conjunctiva, lids, and sockets including the plastic procedures. The treatment of intraocular foreign bodies is outlined in detail. Surgery for ptosis is considered according to the shortening or advancement of the levator muscle, utilizing the occipito frontalis or the superior rectus muscles. The surgery on the extraocular muscles gives the technique of Todd, Jameson, and Reese which was described by White and later by Berens. The surgery on the inferior oblique at its insertion is not mentioned nor is the more recent surgery on the superior oblique. The book concludes with the description of operations on the tear apparatus. It is an excellent book and all eye surgeons would be better for reading it or referring to it before the usual or any unusual procedures that they are called upon to do.

BEULAH CUSEMAN

WITHOUT a doubt *Cancer Metastases*<sup>2</sup> by Hans Walthers is one of the finest books of its kind. The author, a roentgenologist, had often encountered cases in which tumor metastases were demonstrable in the bones, the lungs, and in other areas, while the seat of the primary tumor remained unknown. The desire to show a relationship between the location of the original tumor and the seat of the metastases led to a careful study over a 15 year period of the material of the Pathologic Institute at Zurich.

<sup>1</sup>SURGERY OF THE EYE By Meyer Wiener M.D. 2d ed. New York: Grune & Stratton 1949.  
<sup>2</sup>KREBSMETASTASEN By Dr. Med. Hans E. Walthers. Basel: Benno Schwabe & Co. 1948. (Imported by Grune & Stratton Inc. New York.)

The author has come to the conclusion, and brings abundant proof of the fact, that the spread of tumor metastases always follows the established vascular and lymphatic pathways, and obeys the laws of circulatory physiology. Retrograde transport by reversal of the lymph flow, spread from organ to organ by way of lymphatic channels, and other bizarre explanations for the apparently paradoxical spread of some metastases are vigorously denied. The concept of micrometastases in the lungs, which subsequently lead to a dissemination through the arterial circulation, is a very interesting one, and not only serves to explain many of the pathways of tumor metastases, but also readily lends itself to microscopic proof. The author has established certain rules for hematogenous metastases and divides them into four main types.

This volume throughout gives evidence of great scholarship and a painstaking evaluation of clinical and pathological material. It is printed upon glossy paper of good quality with clear, easily readable type. The illustrations are beautiful and the photography is excellent. The photomicrographs are especially noteworthy and demonstrate a superb histologic technique. This book is a classic in its field and should serve as a standard reference for the clinician as well as the pathologist.

FREDERICK A. LLOYD

THE *Handbook of Surgery*<sup>3</sup> written by McKie and Mackenzie is a fine compendium consisting of 41 chapters in 764 pages covering the field of general surgery. Written by teachers of wide experience who obviously know the requirements and limits of a handbook, it is concise but not at the cost of being inadequate. Designed to be of greater value to the senior undergraduate who is interested in a comprehensive review of the essential and important aspects of surgery it has much to offer to both the surgeon and the general practitioner. The chapters follow the pattern of first, a brief discussion of development, anatomy and physiology, followed by symptoms, pathology, clinical examination, treatment, then complications and their treatment. Some chapters have the valuable addition of a section of interpretations of roentgenographic and other clinical laboratory findings, and of a discussion of common errors of interpretation. While any description or discussion of operative techniques is wisely avoided the common generally accepted surgical procedure is named. The orthopedic division, Chapters 30 through 41, is unusually well presented in a book of this design and scope. The book is new and up to date, but also follows the time proved fundamental principles of surgery. It is a worth while addition to the surgery texts.

RUSSELL T. BOMF

<sup>3</sup>HANDBOOK OF SURGERY By Eric C. McKie M.B. Ch.B. FRCS (Edin.) F.I.C.S. and Ian Mackenzie M.B. Ch.B. FRCS (Edin.) Foreword by the late Sir John Fraser Bart. M.C. M.D. Ch.M. FRCS (Edin.) 2d ed. Baltimore: The Williams & Williams Co. 1949.



# REVIEWS OF NEW BOOKS

THE author, the professor of surgery at the University of Kiel, reviews in the 190 page monograph entitled *Pathologische Physiologie der frischen, geschlossenen Hirnverletzung, insbesondere der Hirnerschuetterung*<sup>1</sup> the literature on closed cerebral injuries and his own experiences with such injuries. He found that the majority of the patients who died of cerebral concussion had severe circulatory and vascular changes in the internal organs and especially the lungs. He describes a "centrogenic" pulmonary hemorrhage which he found to be caused by lesions in the hypothalamic region. Carefully evaluated animal experiments also revealed the same changes. Similar circulatory changes and hemorrhages in the heart, the liver, the kidneys, the pancreas, the spleen, and the lungs could be produced by small puncture lesions in the hypothalamic nuclei, and he concluded that the hypothalamic nuclei were the seat of a sympathetic and parasympathetic center which regulated peripheral circulation. Lesions of this center produced the peripheral circulatory changes which resulted in death.

He studied the various clinical changes which followed closed craniocerebral injuries and correlated them with experimental findings. Blood pressure, blood picture, blood distribution, respiration, body temperature, protein and carbohydrate metabolism, electrolyte and fluid balance, basal metabolic rate showed reversible postconcussion changes which were thought to be the result of stimulation of the sympathetic and parasympathetic center or of its pathways in the brain stem.

Posttraumatic symptoms and findings are also discussed, they include chapters on headaches, vertigo, oculomotor disturbances, temperature and blood pressure changes, and changes in bladder, sexual, vasomotor and metabolic function. Chronic posttraumatic disturbances were present in 30 per cent of the cases. They depended to a large extent on the pretraumatic personality of the patient himself.

Another chapter deals with the morphologic and functional findings of the injured brain and especially the etiology and pathology of cerebral swelling and edema causing posttraumatic increased intracranial pressure. Cerebral contusion, petechial and massive intracerebral hemorrhages are also mentioned. Spinal fluid, encephalographic and ventriculographic findings are discussed and their common relation to the development of cerebral edema arising on the second and third posttraumatic day is demonstrated. Arteriograms showed contraction of the cerebral vessels in concussion while they usually showed widened and poorly filled vessels in cases of contusion.

In his last chapter, the author discusses the prognosis and the treatment of fresh craniocerebral injuries. The indication and effect of dehydration, osmotherapy, spinal or ventricular puncture and surgical intervention are briefly presented. His best

results were obtained by bed rest, dehydration and osmotherapy.

GEORGE PERRET

IN the third edition of a paper bound monograph, *Technique de la chirurgie du sympathique et de ses infiltrations*<sup>2</sup>, Doctors O Lambret, P Razemon, and P Decoux have presented an interesting discussion of techniques for various forms of sympathectomy and for use of novocain block. It should afford valuable reading for those interested in this field of surgery. Not included in the book are several of the newer procedures recently developed and often employed. However, included in it are interesting and apparently accurate drawings of the relationships of the sympathetic nerves and their ganglionated paravertebral chains to surrounding structures. It should prove interesting reading for those familiar with the French language and familiar with standard techniques for sympathectomy and the indications for use of block or excision of the ganglia and sympathetic chains.

KEITH S GRIMSON

THE text *Pulmonary Tuberculosis*<sup>3</sup> was first presented in 1939. The second edition has been completely revised, enlarged, and modernized. The task of revision has been the lot of W Pagel since Laurence O'Shaughnessy met death while in military service in 1940, and Gregory Kayne succumbed to illness in 1945. Dr Pagel has felt the loss of his stimulating partners, but has met the situation with the aid of carefully selected coauthors (F A H Simmonds, N Macdonald, and L Fatti). These men, in a splendid co operative venture, have dedicated their edition to their lamented confreres.

The pathological, clinical, and surgical aspects of pulmonary tuberculosis, including current concepts of antibiotic therapy, are presented. An extensive bibliography and usually a chapter summary is found at the end of each section. This group of Middlesex England physicians has compacted into this 720 page volume most of the essential information regarding pulmonary tuberculosis. The disease is thoroughly though concisely presented, controversial points are discussed with an open mind. Anyone interested in the field of tuberculosis will find this book of value.

EUGENE L WALSH

GOOD books in English on ocular histology and pathology for reference and study have been sadly lacking in the past. The few that have been available are either out of date or very incomplete. The result is that the subject of ocular pathology has been neglected by a large number of practitioners and students of ophthalmology.

<sup>1</sup>TECHNIQUE DE LA CHIRURGIE DU SYMPATHIQUE ET DE SES INFILTRATIONS. By O Lambret, P Razemon and P Decoux 3d rev ed. Paris G Dion & Cie 1948.  
<sup>2</sup>PULMONARY TUBERCULOSIS. PATHOLOGY, DIAGNOSIS, MANAGEMENT AND PREVENTION. By G G Kayne, W Pagel, and L O'Shaughnessy. 2d ed. rev. and partly rewritten by Walter Pagel, MD, F A H Simmonds, MA, MD, DPH, N Macdonald, MB, MRCP (Ed.) and L Fatti, FRCS. London, New York and Toronto Geoffrey Cumberlege Oxford University Press, 1948.

<sup>1</sup>PATHOLOGISCHE PHYSIOLOGIE DER FRISCHEN GESCHLOSSENEN HIRNVERLETZUNG. INSBESONDERE DER HIRNERSCHUETTERUNG. KLINISCHE ANATOMISCHE UND EXPERIMENTELLE BEFUNDE. By R Wanke. Stuttgart Georg Thieme, 1948.



## SURGERY, GYNECOLOGY AND OBSTETRICS

Thanks to Professor Sommers, who is well qualified by many years of experience in working with and teaching the subject of ocular pathology, there is now available a satisfactory treatise on the subject.

His book *Histology and Histopathology of the Eye and its Adnexa*<sup>1</sup> is divided into three parts. Part 1 has to do with normal histology, embryology, and senescence, Part 2 with general pathology (from an ocular viewpoint), and Part 3 with histopathology of the eye. This covers very well the various structures of the eyeball and adnexa. In addition, there are valuable chapters on ocular developmental abnormalities, glaucoma, myopia, injuries, and the pathologic conditions that arise as the result of surgery.

<sup>1</sup>HISTOLOGY AND HISTOPATHOLOGY OF THE EYE AND ITS ADNEXA By I G Sommers M D New York Grune & Stratton 1949

At the end of each chapter, under the heading "Reading of Source Material" there are remarks on the pertinent discussion by many authors, taken from their writings. This is one of the most interesting and valuable parts of the book. It contains a wealth of information and should act as a stimulus for further study by the reader.

The book is well printed and illustrated. Perhaps more illustrations could have been used to advance the subject is complex and difficult and the reading of it makes for tough going at times. The ophthalmologist will be well repaid in the development of his understanding of his clinical problems for the effort that is required in a careful study of Sommer's excellent and exhaustive work.

DERRICK VAIL.

## BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

- OPERATIVE TECHNIC IN SPECIALTY SURGERY Edited by Warren H Cole, M D, F A C S Introduction by Allen O Whipple New York Appleton Century Crofts, Inc., 1949
- DISEASES OF THE AORTA, DIAGNOSIS AND TREATMENT By Nathaniel E Reich, M D, F A C P New York The Macmillan Co., 1949
- CHILD BIRTH, YOUR QUESTIONS ANSWERED By Carl Henry Davis, M D, and Donita Ferguson New York Harper & Brothers, 1949
- A MANUAL OF PHYSICAL THERAPY By Richard Kovács, M D 4th rev ed Philadelphia Lea & Febiger, 1949
- ELECTROTHERAPY AND LIGHT THERAPY, WITH ESSENTIALS OF HYDROTHERAPY AND MECHANOTHERAPY By Richard Kovács, M D 6th rev ed Philadelphia Lea & Febiger, 1949
- MODERN SURGICAL TECHNIC By Max Thorek, M D, LL D, Sc D, F I C S, F B C S, D C M With a foreword by Fred W Rankin, B A, M A, M D, LL D, Sc D, F A C S 2d ed Vols 1, 2, 3, 4, and index Philadelphia, London, Montreal J B Lippincott Co., 1949
- AN INTRODUCTION TO CLINICAL SURGERY, SURGICAL WHEREFORES AND THEREFORES By Charles F M Saint, C B E, M D, M S, F R C S (Eng), Hon F R A C S, Hon F G S S Cape Town and Johannesburg Published for The Post Graduate Press by Juta & Co, Ltd, 1949
- BONE AND JOINT RADIOLOGY By Emerik Markovits, M D New York The Macmillan Co., 1949
- DIE DISTROPHIE By Professor Dr Med Heinrich Berning Stuttgart Georg Thieme Verlag, New York Grune & Stratton, Inc., 1949
- GRUNDLAGEN DER FUNKTIONELLEN UROLOGISCHEN ROENTGENDIAGNOSTIK By Dr Med Habil Walter Pfeifer Stuttgart Georg Thieme Verlag, New York Grune & Stratton, Inc., 1949
- GOLDEN JUBILEE WORLD TRIBUTE TO DR SIDNEY V HAAS New York The Committee for the Golden Jubilee Tribute to Sidney V Haas 1949
- ANNALS OF ROENTGENOLOGY, A SERIES OF MONOGRAPHS ATLAS, ROENTGEN DIAGNOSIS OF DISEASES OF THE SKULL Vol 19 By Max Ritvo, M D New York Paul B Hoeber, Inc., Medical Book Department of Harper & Brothers, 1949
- ABRAHAM LEVINSON ANNIVERSARY VOLUME, STUDIES IN PEDIATRICS AND MEDICAL HISTORY Edited by Dr Solomon R Kagan, and Dr Isaac A Abt, Dr Reuben Friedman, and Prof Max Neuburger New York Froben Press, Inc., 1949
- THE THOMAS VICARY LECTURE 1948, THE PORTRAITURE OF WILLIAM HARVEY By Geoffrey Keynes, M A, M D (Cantab), F R C S (Eng) London The Royal College of Surgeons of England, Lincoln Inn Fields, 1949
- CHIRURGIA D'URGENZA By Stefano Teneff Toronto Edizioni Minerva Medica, 1949
- A SHORT PRACTICE OF SURGERY By Hamilton Bailey, and R J McNeill Love. Illustrations by L C D Hermitte, 8th ed Baltimore The Williams & Wilkins Co., 1949
- ATLAS OF SURGICAL OPERATIONS By Elliott C Cutler, and Robert M Zollinger Illustrated by Mildred B Codding, A.B., M A 2d ed New York The Macmillan Co., 1949
- FUNCTIONAL LOCALIZATION IN RELATION TO FRONTAL LOBOTOMY By John F Fulton, O B E, M D, D Sc, LL D (Birm) Being The William Withering Memorial Lectures Delivered at The Birmingham Medical School, 1948 New York and London Oxford University Press, 1949
- A TEXTBOOK OF SURGERY By American Authors Edited by Frederick Christopher, B S, M D, F A C S 5th ed Philadelphia and London W B Saunders Co., 1949
- CIRUGIA DE LA GLANDULA TIROIDES, ANATOMIA QUIRURGICA DEL CUELLO EL NERVIO LARINGEO SUPERIOR Y SU RELACION CON LA FISIOLOGIA LARINGEA LAS APONEUROSIS CERVICALES By Diego E Zavaleta Buenos Aires Ediciones Impaghone, 1949
- MINUTES OF THE SEVENTH STREPTOMYCIN CONFERENCE Held on April 21, 22, 23, and 24, 1949, Cosmopolitan Hotel, Denver, Colorado Prepared and edited by Veterans Administration, Area Office, Washington, D C

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# SURGERY GYNECOLOGY AND OBSTETRICS

*Supplement*

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# INTERNATIONAL ABSTRACTS OF SURGERY

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## COLLECTIVE REVIEWS

### CARCINOMA OF THE CERVIX 1948 SURVEY OF ITS TREATMENT IN THE UNITED STATES AND CANADA

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**M**EDICINE, like other arts and sciences, is not static. It is forever in a state of flux, adapting scientific discoveries to its use, learning from experience, relying heavily on trial and error, maintaining the good, discarding the bad, and always on the lookout for something better. Seemingly established therapeutic procedures may become controversial, may be modified or discarded, or their superior worth may be substantiated. Sometimes the pendulum swings back and forth. And so, methods of therapy in one decade may or may not resemble those used in the preceding or subsequent decade. It is well for the informed physician to know the treatment most favored at a given time, and it is of interest and of possible value to predict what it will be next.

The first chosen treatment of carcinoma of the cervix in the era of modern medicine was radical surgery, as typified by the abdominal panhysterectomies introduced by Wertheim in the latter part of the nineteenth century. The discovery of radium in 1898 was to change this, for early in the twentieth century irradiation therapy was introduced (21) in the treatment of carcinoma of the cervix, and was to prove superior to the surgery of that time. For what seemed good and sufficient reasons, surgery was subsequently almost abandoned in favor of irradiation.

A review by Hoge (22) of the literature relating to the therapy of cancer of the cervix in the early

1930's supported this view because the great majority of the authors favored irradiation. Crossen had stated that the operation for carcinoma of the cervix was obsolete. Shaw (42, 43), one of England's most distinguished gynecologists and formerly a strong advocate of surgery, had published his advocacy of radium. Among those who had stated or implied that they preferred irradiation to surgery were Eymery, Laborde and Wickham, Dietel, Regaud (34, 35), Jansen, Schinz, Cutler (9, 10), Findley (15, 16), Pfahler, Doderlein and Voltz (48), Keene and Kimbrough, Burnam (4, 5), Simpson (44, 45), Lacassagne, Coutard, Healy (19, 20), Schmitz (39, 40), and Ward (49, 50). However, some writers expressed a preference for surgery in operable cases, among these were Bonney (1, 2) and Faure. Others favored a combination of surgery and irradiation. Among these were Reiprich, Duncan, Schlink and Chapman, Blakley (33), Gellhorn (17, 18), and others. For some time thereafter the trend toward irradiation in the treatment of carcinoma of the cervix seemed to continue. In 1937, Novak wrote, "The old question of surgery versus radium has been replaced by the question of whether there is now any place at all for radical surgery. The prevailing popularity of radiotherapy is fully justified by the fact that it gives final results just as good as those of even expert surgery."

Recently, however, the medical literature and forums show a reawakening of interest in the surgical treatment of this condition, an interest stimulated, no doubt, by recent advances in the

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adjuncts to surgery which tend to decrease the morbidity and mortality in radical surgical procedures. Also, it has been discovered that the results of irradiation are far less than ideal.

Meigs, in 1939, (29) expressed satisfaction with the results of treatment of carcinoma of the cervix with x-rays and radium, but in 1945 (28) he stated that the Wertheim operation in properly selected cases may improve the results, and more recently he has found reason to add iliac lymphadenectomy by an extraperitoneal approach to irradiation in the treatment of certain cases (30). Taussig had previously introduced the method of adding transperitoneal iliac lymphadenectomy and bilateral salpingo-oophorectomy to irradiation in the treatment of stage II cases. Brunschwig, an advocate of the surgical treatment of carcinoma of the cervix, has reported the excision of all the pelvic viscera in a series of cases of advanced stages of this disease.

However, Buschke and Cantril conclude that attainable improvement in irradiation therapy will save more patients than a return to surgery, and Carter and his associates (47), reporting on radical panhysterectomy and radical pelvic lymphadenectomy in selected cases, state that the majority of patients with carcinoma of the cervix will continue to be treated with accepted techniques of irradiation therapy.

#### SURVEY

With these thoughts in mind, it was decided that it would be certainly of interest and possibly of value to determine the present status of the treatment of carcinoma of the cervix in the United States and Canada. To this end, beginning in May of 1948, questionnaires were sent to the heads of the departments of gynecology, or of gynecology and obstetrics, in the accredited 4 year medical schools in the United States and Canada. There were 70 such schools in the United States and 9 in Canada. At the end of 1948, the time of this writing, all but 2 of the schools, that is, 77, or 97.5 per cent, had replied. An analysis of these replies now follows.

#### "ROUTINE" TREATMENT OF CARCINOMA OF THE CERVIX

Each school was asked to indicate if the "routine treatment of carcinoma of the cervix" was by irradiation alone, surgery alone, a combination of the two, or by some other method.

This statement was made without reference to the stage of the disease. The use of the word "routine" was unfortunate and is regretted. A few schools justly pointed out that no routine was

used but that each case was judged separately. A study of the answers shows that 48, or 62.3 per cent, of the schools in answering this section indicated that irradiation alone *without noted exceptions* was their method of treatment of carcinoma of the cervix. An additional 19 employed irradiation alone except in stage I, in stage I cases they used irradiation alone and other methods also. Seven more schools used irradiation alone except in stage I and II cases, in these stages irradiation alone or other methods also were used. One school reported exceptions in all stages to the use of irradiation alone. Two schools did not answer this section, but a study of their answers in the other sections in the questionnaire showed that one of them used irradiation alone except in alternate cases in stage I, and the other used irradiation alone except in stages I and II. In most of these instances in which exceptions were noted, irradiation was nevertheless the treatment in the majority of cases.

More accurate and detailed information is obtainable from the study of the treatment given according to the stages of the disease. This study is reported in subsequent paragraphs of this review.

#### STAGE CLASSIFICATION

As the stage of the disease may be regarded as an important factor in determining the type of treatment, it was decided to determine what classification of stages was used at each school.

Seventy-six schools answered this section. Fifty-seven, or 75 per cent, indicated that they used the League of Nations (27) classification exclusively, one school used both the League of Nations and the American College of Surgeons classifications. Eight, or 10.5 per cent, reported using the Schmitz (41) classification exclusively. Four schools used both the League of Nations and the Schmitz classifications. Six schools used other miscellaneous classifications. No school reported the use of the American College of Surgeons classification alone.

In an analysis of the foregoing it is seen that 82 per cent of the schools used the League of Nations classification exclusively or in combination with other classifications, and 16 per cent used the Schmitz classification exclusively or in combination with the League of Nations classification.

Having determined the classification of stages used by each school, the schools were questioned regarding the treatment used in each stage and were asked to indicate for each stage whether the treatment "in general" was irradiation alone, surgery alone, combined irradiation and surgery,

# HOGE CARCINOMA OF THE CERVIX

or some other method Here, the word "routine" was not used The replies are analyzed in the following sections In these sections, for the sake of uniform comparison, all stages reported are in terms of the League of Nations definitions (27), appropriate translations having been made in the returns to accomplish this

## STAGE I

Fifty-one schools, or 66 per cent, indicated irradiation alone as the treatment in general of stage I carcinoma of the cervix Thirteen of these stated that in occasional selected cases surgery alone, or combined surgery and irradiation, is used Fifteen schools, or 19.5 per cent, indicated only the combined method (irradiation and surgery) as the treatment in general Two schools checked both surgery alone and the combined method as the treatment in general Four schools checked both irradiation alone and the combined method as the treatment in general Two schools indicated irradiation alone or surgery as the treatment in general Two schools checked irradiation alone, surgery alone, and the combined method as the treatment in general

A summary of the treatment of stage I carcinoma of the cervix shows that for the usual treatment irradiation alone was reported by 66 per cent of the schools, the combined treatment was reported by 19.5 per cent, and surgery alone was reported by one school The remaining schools checked more than one method as the treatment in general, and all of these included irradiation among the methods Of all the schools reporting, 27, or 35 per cent, indicated that surgery was used either alone or in combination with irradiation in some of the cases

## STAGE II

Sixty-two schools, or 80.5 per cent, indicated only the use of irradiation alone in the treatment of this stage To these should be added 8 schools, which, though listing other methods also, indicated that, through preference or otherwise, the majority of stage II cases were treated by irradiation alone This brings the total number of schools using irradiation alone in all or the majority of stage II cases to 70, or 90.9 per cent Three schools indicated the use of the combined treatment only (irradiation and surgery) for stage II cases To these should be added 4 schools which preferred the combined treatment in the majority of cases but sometimes used irradiation only Thus, 7 schools, or 9.1 per cent, reported using the combined treatment exclusively, by preference, or in the majority of cases No school

indicated surgery alone as its usual or preferred treatment in this stage In brief, in this section the score was irradiation alone 90.9 per cent, combined irradiation and surgery 9.1 per cent, and surgery alone 0

## STAGE III

Seventy-three schools, or 94.8 per cent, reported only the use of irradiation alone as the treatment in stage III The remaining 4 schools used irradiation alone as the usual method, but under some circumstances used other methods One of these schools reported that it was at present studying "the results of irradiation plus regional lymphatic-bearing tissue excision" Another of these schools reported using the combined method or surgery alone in about 5 per cent of the cases A third school stated, "if regression (after irradiation) is excellent it (the patient) may be subjected to surgery" The fourth school used combined irradiation and surgery as "second choice" to irradiation alone

In short, 100 per cent of the schools reported the use of irradiation as the customary treatment in stage III, and 4, or 5.2 per cent, reported the additional use of surgery under some circumstances One school reported the use of surgery alone in a small percentage of cases No school gave the use of combined irradiation and operation or surgery alone as the usual treatment

## STAGE IV

All 77 schools indicated that irradiation alone was their treatment of stage IV carcinoma of the cervix However, 3 schools, or 4 per cent, stated that although they used irradiation alone chiefly, sometimes they used combined irradiation and surgery Two schools implied that, although irradiation was used if the patients were treated, some were not treated at all

The type of irradiation was not asked for in connection with this section but 3 of the schools using irradiation alone indicated that only x-rays were used

One of the schools, occasionally using combined irradiation and surgery, indicated that the surgery was "regional lymphatic-bearing tissue excision" and was used to study its value, another used the combined treatment as "second choice depending on involvement," and the third school occasionally used the actual cautery prior to the insertion of radium

In brief, it is seen that all schools used irradiation as the treatment of stage IV carcinoma of the cervix, 3 schools indicated that sometimes some type of surgery was combined with irradiation

TABLE I—SUMMARY OF THE USUAL TREATMENT OF CARCINOMA OF THE CERVIX ACCORDING TO STAGES<sup>1</sup> BY 77 MEDICAL SCHOOLS IN THE UNITED STATES AND CANADA IN 1948

Usual method used	Percentage of schools			
	Stage I	Stage II	Stage III	Stage IV
Irradiation alone	66 <sup>1</sup>	90.9 <sup>2</sup>	100 <sup>3</sup>	100 <sup>3</sup>
Combination alone	19.5	9.1	0	0
Surgery alone	1.3	0	0	0
Multiple methods	13			

<sup>1</sup>League of Nations definitions.

<sup>2</sup>Exceptions were made as follows: stage I to irradiation alone 13 schools; stage II to irradiation alone 8 schools; stage II to combination alone, 4 schools; stage III to irradiation alone 4 schools; stage IV to irradiation alone 3 schools.

No school indicated the use of surgery alone in any stage IV case.

#### INTRAEPIDERMAL CARCINOMA

The statements in this review apply only to invasive carcinoma of the cervix. A separate section in the questionnaire dealt with the treatment of intraepithelial carcinoma (carcinoma *in situ*). It will be the subject of a separate report.

#### SUMMARY

1 The literature on the treatment of carcinoma of the cervix is partly reviewed.

2 The 79 accredited 4 year medical schools of the United States and Canada were polled regarding their treatment of this condition. Replies were received from 77 of them.

3 Eighty-two per cent of the schools used the League of Nations classification of stages exclusively (75%) or in combination with other classifications. Sixteen per cent used the Schmitz classification exclusively (10.5%) or in combination with other classifications. The League of Nations classification is used in this review.

4 In the usual treatment of stage I carcinoma of the cervix 66 per cent of the schools used irradiation alone, 19.5 per cent used the combined method (irradiation and surgery) alone, 1.3 per cent (1 school) used surgery alone, and 13 per cent listed multiple methods. In stage II the usual treatment was reported as follows: irradiation alone was used by 90.9 per cent of the schools, and the combination alone was used by 9.1 per cent. In stages III and IV irradiation alone was reported by all schools as the usual treatment.

5 Many notations were made by the schools indicating that exceptions to the usual method of treatment are made in some cases. Most of these exceptions were in the direction of surgery.

Factors present in individual cases which favor, or are believed to favor, surgery are early stages of the disease, a low degree of malignancy, evidence of radioresistance, and conditions which tend to make the patient a good operative risk.

#### CONCLUSIONS

Irradiation is still the most important and widely used method of treatment of carcinoma of the cervix in each and all of its stages. However, surgery is being used to an increasing extent in the early stages of the disease, especially in combination with irradiation. Surgery alone is little used except in highly selected early cases, or for study. Its use has been stimulated by improvement in the adjuncts to surgery.

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## OVARIAN TUMORS IN PREGNANCY

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THE first important reference to ovarian tumors in pregnancy was made by Ephraim McDowell on October 24, 1823 when he proved that the ovarian cyst can be removed with survival of the patient. The literature of the modern era of obstetrical surgery opens 23 years later in England, when Burd removed an ovarian tumor in a patient who was 3 months pregnant, the patient recovered but unfortunately aborted. Shortly thereafter, Marion Sims inadvertently removed a large ovarian tumor in a woman 3 months pregnant who went uneventfully to term and was delivered of a living child.

Since that incident the problem of ovarian tumors complicating pregnancy has frequently engaged the attention of medical authors, so that in 1903 and 1906 McKerron (63, 64) was able to collect 1920 cases from his own work and the literature. Among the cases with sufficient data for study, he observed a maternal mortality of 21 per cent for 720 cases, with a concomitant fetal mortality of over 50 per cent. However, few of his patients had early surgery, and he found that 25 per cent of the tumors lay in the pelvis and were undiagnosed until they obstructed labor. Heberg found that only 18 of 52 cases were diagnosed prior to laparotomy. McKerron's table (63) of the incidence of abortion for each month of gestation in the face of intervention follows:

Remy reported that 17 per cent of 321 patients aborted if they were not operated upon because of incarceration of the tumor or uterus in the pelvis, torsion of the tumor upon its pedicle, adhesions, pressure from the tumor mass, or because of infection.

The incidence of this complication is difficult of tabulation for the obvious reason that it is

TABLE I — INCIDENCE OF ABORTION

Month of gestation	Per cent of abortion
1	18.5
2	8.8
3	5.3
4	6.2
5	22.2
6	20.0
7	57.1
8	

frequently not diagnosed. Rosenthal observed 3 cases in 1400 pregnancies. McKerron quotes Flaischlen as seeing 5 in 17,832 pregnancies, Lohlein 2 in 1,300 pregnancies, and Tarnier 1 case in 1,738 pregnancies. Lynch observed the condition once in 500 cases, and in his article he stresses the importance of careful pelvic examination of the pregnant patient at her first visit to the office. Matthews had 12 cases in 8,500 deliveries, while Falls found 1 case per 650 pregnancies.

The size of the tumors varies widely in different reports, but for obvious reasons the later series show smaller tumors than the earlier ones. Miller and Willson, studying 934 ovarian tumors, found them to be small (under 5 cm) in 49.3 per cent, medium (5 cm to 10 cm) in 25.8 per cent, and large (over 10 cm) in 24.0 per cent. Of the small ones, 80 per cent resolved or ruptured spontaneously without surgery, so these authors concluded that the small tumors, unless hard in consistency, are simple, usually asymptomatic, and largely evanescent. In view of the luteal body changes, the same observation will be frequently made in carefully observed early cases of pregnancy.

The studies of various authors show a wide range of incidence of the different types of tumors.

Goodall quotes Norris (68) and Spencer (99) as finding 68 per cent and 66 per cent, respectively, of their cases presenting cystomas and 23 per cent and 29 per cent, respectively, presenting dermoids. Conversely, he quotes Pfannenstiel as stating that dermoids and pseudomucinous cysts comprise the majority of ovarian tumors complicating pregnancy, and he cites the figures of Stuebler and Brandess as dermoids 58.3 per cent, pseudomucinous cysts 16.7 per cent, simple cystomas 16.7 per cent, and papillary cystomas 8.3 per cent. McKerron's (63) figures are simple and multilocular cysts 68 per cent, dermoid cysts 23 per cent, malignant neoplasms 5 per cent, and solid adenomas and fibromas 2 per cent.

As to the method to be employed in the care of ovarian tumors occurring in pregnancy, the literature becomes steadily more unanimous with the passage of time. The earliest case reports (McKerron, 63) show a high maternal and fetal mortality along with a high rate of interruption of pregnancy resulting from surgery. Flatau, in 1905, demonstrated abortion in 17.2 per cent of 284 patients subjected to surgery, whereas Berkeley and Bonney state that if surgery is adopted there is an abortion rate of 26.6 per cent and a gross fetal mortality of 33.3 per cent. They further contend that if surgery is not employed there is a gross fetal mortality of 21.6 per cent and an abortion rate of 12.5 per cent. Barrett, in 1913, studied the cases of 114 patients of whom 76 were subjected to surgery with 3 maternal deaths, and 64 of the surviving 73 carried their children to viability. Graefe said that from 14 to 20 per cent of the patients with ovarian tumors abort if untreated, as illustrated by McDonald's patient who went into premature labor at 7½ months of gestation and came to surgery 21 days later with a large dermoid cyst which had undergone torsion.

Early in the literature there appeared case reports of cysts in pregnancy drained by colpotomy, as in Gaudino's report of 10 cases, in which 3 patients were subjected to vaginal puncture. This procedure has been abandoned, and as early as 1920 Spencer (99) advocated the removal of the tumors as early as possible unless they occurred in the last trimester of pregnancy. The case reports of Litzenberg, Theron, Eiss, Caverly, Lynch, McCullough, Stein, H. T. Holmes, Ingraham (46, 47), Braddock, Mathieu and Holman, Massey and Helwig all show that early diagnosis of the condition and active treatment are essential to good results. The necessity of early diagnosis and active treatment, and the danger of temporizing are illustrated by the case of Davis, in which the patient was rehospitalized 1 week after dismissal

following a vaginal hysterotomy at 4 months, and required the resection of 25 cm of gangrenous ileum along with a gangrenous dermoid cyst measuring 12 by 16 cm. The patient survived only as a result of the technical surgical skill available.

The case report of R. W. Holmes is of interest as a scientific curiosity. He records the case of a patient upon whom he performed a cesarean section and a bilateral salpingectomy, in association with the removal of bilateral ovarian tumors, each described as the size of a grapefruit. Subsequently, this same patient was delivered of 2 other living children by cesarean section.

The later case reports of Trout and Kuder, Seibels, MacKenzie, Nucci, Capone, Moscoso, and Falk and Bunkin show that opinions generally favor the removal of any cyst large enough to be significant in the nonpregnant woman, as well as excision of all solid and all bilateral tumors. There is almost unanimous agreement that surgery should be performed prior to the last trimester of pregnancy, and if diagnosis is made in the last trimester that surgery should be done as an emergency measure in the event of torsion, compression, rupture, degeneration, or infection of the complicating tumor. If, in the late case, no surgical emergency demands intervention, the tumor should be removed at the time of cesarean section if there is obstruction by the tumor or if it is of such size or is so located as to make severe injury of the tumor probable at the time of vaginal delivery. If it appears that delivery can be performed vaginally with safety, arrangements should be made for excision of the tumor in the puerperium. This is necessary because more than 20 per cent of ovarian tumors undergo torsion in the puerperium.

In their studies of the hormone content of ovarian cysts removed during pregnancy, Watts and Adair usually, but not always, found gonadotropin, however, estrogen was by no means found constantly nor was it in high concentration when present. They rationalize this observation by the fact that the tumors (30) were removed early in pregnancy before the high estrogen levels were obtained.

In the past, ovarian surgery in pregnancy was approached with much trepidation because of the fear of abortion if the corpus luteum was disturbed. It now appears that the human female reacts differently to ablation of the corpus luteum in pregnancy than do experimental animals. Also, we may work with more freedom than formerly, because of our possession of potent endocrine preparations of corpus luteum extracts, or their

# HAMILTON, HIGGINS OVARIAN TUMORS IN PREGNANCY

synthetic equivalents Pratt (84), in 1927, reported 2 patients in whom the corpus luteum was ablated in the first month of pregnancy and both patients went to full term and delivery. The following year, Oastler had the same result in a woman whose only remaining ovary was removed for torsion of a cyst at 7 weeks of gestation. Three years later Douglass recorded 3 similar occurrences, while Gardner cited the case of a woman from whom he removed at 6 weeks of gestation an ovarian cyst. This cyst was the size of a grapefruit and contained the corpus luteum, and a satisfactory outcome followed its removal. Hoenig and Warner attended a woman with only one ovary which they excised at 5 months of gestation because of a 10 cm cyst upon it. She, also, did not abort. Novak (71) states that the human female does not require the existence of a corpus luteum to carry her pregnancy to term, and Seegar and Delfs demonstrate that bilateral oophorectomy occasions no drop in the pregnandiol excretion of the pregnant human female. *Ergo*, pregnancy can be maintained by the progestin elaborated by the placenta. The most amazing case report is a later one by Pratt (85), in which he states that he performed an uterine suspension upon a sterile woman on the twenty-first day after the onset of her menstrual period and at operation removed the fresh corpus luteum for study. The patient missed the following menstrual period and went uneventfully to successful delivery at term. With the foregoing evidence before us and with the availability of pharmacologically potent progestin products, there is little excuse for failure to excise ovarian cysts in the first half of pregnancy, if we make the diagnosis of their presence.

The relationship of endometriosis to pregnancy has engaged the thoughts of many authors, and as early as 1930 Keene and Kimbrough showed that there is a sterility incidence of 40.9 per cent in patients with endometriosis. These authors urged conservative surgery, however, as they found that 28 per cent of the patients had subsequent pregnancies if their surgery was not radical. Scott states that the normal marital fertility rate is 88 per cent, which is contrasted to the sterility incidence as found by the following authors: Counsellor—32.1 per cent, Dreyfuss—35 per cent, Payne—40 per cent, Haydon—53 per cent, and Jenkinson and Brown—34 per cent.

With the high rate of infertility associated with endometriosis it is not remarkable that the literature contains so few case reports of endometriosis complicating pregnancy. In 1944, Scott was able to find but 7 cases reported, to which he added

his 2 cases. We find 17 cases at present, to which our series of cases adds 2, making a total of 19 cases. The following men have reported cases as listed: Sampson—1, Shaanning—1, Winestine—1, Lee—1, Aschheim—1, Novak (70)—3, Porter—1, von Franke—1, Wilson—1, McKenzie—1, Scott—2, and Pratt and Higgins—3. Aside from the discrete endometrial cysts which were removed because they were simply present as a tumor, there were others which gave symptoms from frank rupture or leakage due to their being markedly adherent with an attendant tug on their attachment by the upward growth of the pregnancy. Winestine noted the decidual reaction in the endometrial tissue of the tumor, which reaction was also commented upon by Novak (72). In both of our cases, the decidual reaction was quite pronounced in the tumor tissue.

Dermoid cysts are some of the most common tumors complicating pregnancy and unless they have been damaged by torsion, compression, or infection usually lend themselves to surgery without a great deal of technical difficulty. Again the importance of early surgery is obvious.

The bilateral dermoid cyst in pregnancy, however, offers features of unusual interest. Here, again, is a group of cases in which bilateral oophorectomy is practiced in pregnancy, and in which the studies of Andrews *et al*, Bowles (9, 10), and others show that the optimum time for surgery is early in the pregnancy, and that there are fewer abortions if the surgery is performed in the first 16 weeks of gestation. Andrews and the following workers and their number of cases assembled 43 cases in the literature, to which they added their personal case of bilateral dermoid cysts in pregnancy. Since these 44 case reports were studied, there have appeared the writings of King—1, Southward—1, Doyle and Daversa—1, Goodwin—1, Bowles (9, 10)—5, Ellis—1, Falk and Bunkin—2, and Berlind—1. These 13 cases added to the 44 cases previously reported make a total of 57 cases in the literature.

Waldstein operated upon his patient quite early, and then ran hormone assays throughout the remainder of the pregnancy. The values which he found did not vary from those in similar studies on normal pregnant women. It should be stressed that in the event the diagnosis of bilateral dermoid cysts is not made in time for early operation, elective cesarean section should be performed with simultaneous excision of the ovarian tumors.

We were able to find but 5 case reports of Brenner tumor associated with pregnancy. Siegel



removed a large Brenner tumor of the right ovary following closure of the uterine incision in a low cervical cesarean section with an uneventful convalescence. Novak (74) reported 3 cases, 1 was excised at 4 months' gestation with a good result, 1 was found in the hysterectomy specimen of a bilateral salpingo-oophorectomy and hysterectomy, and 1 was diagnosed by the decidual tissue found in the curettings of a patient subjected to laparotomy for a Brenner tumor. The fifth case was reported by Rogers who removed a 15 cm Brenner tumor at 12 weeks of gestation, followed by a normally continuing pregnancy and delivery.

Dysgerminoma in conjunction with pregnancy appears in the literature in 11 case reports. Schneider, von Szathmary (104), Schomaker, Dockerty, and Vesell each recorded 1 case of dysgerminoma removed early in pregnancy with a successful termination of the pregnancy at or near term. Nyst reports a case of dysgerminoma blocking the pelvis, which was removed at the time of cesarean section, and Stabler cites an identical case, as do Schneider and Vesell. Cunningham and McGrath were less fortunate in their case, their patient was given a cesarean section at term for dystocia from bilateral dysgerminomas which were simultaneously excised. She died of metastases 2 months postpartum. Abernathy's patient had a stillborn child when cesarean section was performed after 48 hours of labor for dystocia from obstruction by a dysgerminoma. The tumor was removed 3 months postpartum. Von Szathmary (104) also had a case in which the tumor was removed in the puerperium. Again, when surgical intervention occurred early, the complication was benign, but when the tumor was diagnosed and treated late the fetal and maternal mortality and morbidity rose.

As would be expected, there is a paucity of reports of the rarer tumors complicating pregnancy. Moore had a case in which a leiomyoma of the ovary was removed at 2½ months of gestation and the patient continued to delivery at term. This author was able to find 2 similar cases recorded, 1 by Brachetta-Brian and 1 by Olshausen. Brentnall's patient developed masculinization during the pregnancy, but her tumor obstructed the pelvis, so it was removed at the time of cesarean section. The patient's masculinization rapidly disappeared in the puerperium, but the baby was a hermaphrodite.

Bomze and Kirshbaum present the history of a 37 year old gravida-9 para-7 who had Meigs' syndrome complicated by toxemia of pregnancy. She aborted a dead fetus at 6 months of gestation, and was subjected to removal of a large solid tumor on

the third postpartum day. She died on the second postoperative day.

Spencer and Hollenbeck delivered a patient of a premature infant at 7 months of gestation and on the eleventh postpartum day removed a granulosa cell tumor measuring 22 by 17 by 11 cm. The authors' patient had a much smaller tumor (8 by 11 cm) which was removed at 16 weeks of gestation and the patient progressed uneventfully to term and delivered a healthy child normally.

In malignancy of the ovary complicating pregnancy one must again resort to the dictum that one cannot prove or disprove the malignancy of a lesion until it is subjected to microscopic study. Hence, one should subject the tumor to early surgery. Hagstrom found a patient with Krukenberg tumors which were operated upon at 5 months of gestation. Subsequently, the patient's condition deteriorated steadily and the pregnancy was terminated by a bag induction. The patient survived delivery for 6 hours. Campbell (15) cites a case in which a large ovarian carcinoma was removed with successful outcome of the pregnancy.

Bossert collected 14 cases of malignant ovarian neoplasms occurring in pregnancy, in addition to his personal case of bilateral serous papillary adenocarcinoma of the ovary at 10 weeks of gestation. His patient was subjected to bilateral salpingo-oophorectomy and hysterectomy with postoperative irradiation therapy and alive and well when the report was written 3 months later. Of the 14 cases, 6 were sarcoma and 8 were carcinoma, with 4 maternal deaths due to malignancy, 4 cases were unreportable, and 6 patients were alive and well when last seen. Bossert refers to 39 cases of von Szathmary (105), of which 7 were sarcoma and 32 were carcinoma. Of the author's series, 3 cases showed malignant ovarian neoplasms, 2 of which were papillary cystadenocarcinomas operated upon at 14 weeks and 12 weeks of gestation with uneventful pregnancies and term deliveries, the third was a solid carcinoma of the left ovary discovered during labor and operated upon on the fifth postpartum day with death 8 months later from metastases.

#### CASE REPORTS

**CASE 1** A 34 year old para-1 gravida-2, operated upon at 15 weeks of gestation with removal of a 10 cm dermoid cyst of the left ovary. There was delivery at term of a male child.

**CASE 2** A 34 year old para-3 gravida-6, operated upon at 14 weeks of gestation with removal of a 7 cm luteal cyst of the left ovary. Delivery of a male child occurred at term.

**CASE 3** A 30 year old para-0 gravida 1, operated upon at 12 weeks of gestation with removal of a 10

by 7 cm papillary cystadenocarcinoma on the left side, with no breaking through of the capsule. The right ovary was surgically absent. Delivery of a female child occurred at term. When examined 2 months ago, the patient was living and well, 18 months after operation.

CASE 4 A 19 year old para-o gravida-1, operated upon at 8 weeks of gestation with removal of a 20 by 12 cm simple cyst on the right side. Delivery of a male child occurred at term.

CASE 5 A 22 year old para-o gravida-1, operated upon at 13 weeks of gestation with removal of a partially gangrenous (due to torsion) 10 cm simple cyst on the right side. Delivery of a living female child occurred at 36 weeks of gestation.

CASE 6 A 28 year old para-2 gravida-3, operated upon at 16 weeks of gestation with removal of an 11 cm simple cyst of the left ovary. Delivery of a male child occurred at 35 weeks.

CASE 7 A 26 year old para-1 gravida-2, operated upon at 10 weeks of gestation with removal of a partially gangrenous (due to torsion) 6 cm dermoid cyst on the right side. Delivery of a female child occurred at term.

CASE 8 A 25 year old para-o gravida-1, operated upon at 15 weeks of gestation with removal of a 7.5 cm dermoid cyst on the left side. Delivery of a male child occurred at 38 weeks.

CASE 9 A 33 year old para-1 gravida-2, operated upon at 14 weeks of gestation with removal of a 7 cm simple cyst on the right side with the corpus luteum of pregnancy in the specimen. Delivery of living, identical, female twins occurred at 38 weeks by cesarean section, because of a previous cesarean section for a true conjugate of 9.5 cm.

CASE 10 A 31 year old para-1 gravida-2, operated upon at 15 weeks of gestation with removal of a 6 cm dermoid cyst on the left side. Delivery of a female child occurred at term.

CASE 11 A 22 year old para-o gravida-1, operated upon at 15 weeks of gestation with removal of an 8 cm endometrial cyst on the left side. The cyst was discrete, free of adhesions, and easily removed, upon microscopic study it showed a pronounced decidual reaction in the ectopic endometrium. Delivery of living female twins occurred at 37 weeks.

CASE 12 A 38 year old para-o gravida-1, operated upon at 16 weeks of gestation with removal of an 8 by 11 cm granulosa cell tumor on the left side. Delivery of a male child occurred at term.

CASE 13 A 22 year old para-2 gravida-3, operated upon at 12 weeks of gestation with removal of a 6 cm parovarian cyst on the left side. Delivery of a female child occurred at term.

CASE 14 An 18 year old para-o gravida-1, operated upon at 13 weeks of gestation with removal of a 7 cm simple cyst on the left side. Delivery of a male child occurred at term.

CASE 15 A 31 year old para-1 gravida-2, operated upon at 15 weeks of gestation with removal of a 6 cm simple cyst on the right side with the corpus luteum. Delivery of a male child occurred at term.

CASE 16 A 30 year old para-1 gravida-2, operated upon at 14 weeks of gestation with removal of a 5 by 6 cm papillary cystadenocarcinoma on the left side which had not broken through the capsule. Delivery of a female child occurred at term. This patient feels well and is in good health. Her tumor was removed 17 months ago and she is now 5 months pregnant again.

CASE 17 A 27 year old para-2 gravida-3, operated upon at 9 weeks of gestation with removal of a 7 cm lutein cyst on the right side. Inspection of the left ovary at the time of operation revealed that no corpus luteum was present. Delivery of a female child occurred at term.

CASE 18 A 37 year old para-5 gravida-8, operated upon at 39 weeks of gestation with removal of an 8 cm cyst which presented such marked dry gangrene that no histological details were discernible. Simultaneously, a living male child was delivered by low flap cesarean section and the patient had an uneventful convalescence.

CASE 19 A 29 year old para-1 gravida-2, operated upon at 34 weeks of gestation. Upon opening of the abdomen, the bloody contents of a ruptured endometrial cyst welled up through the peritoneal incision. The ruptured endometrioma was found to be adherent in the cul-de-sac, so living male twins were delivered by low flap cesarean section. Following closure of the uterine incision, the uterus was drawn up out of the wound and the ruptured endometrioma was excised from the cul-de-sac. The patient had a nonseptic postoperative course and was dismissed from the hospital on the twelfth postoperative day. The ectopic endometrium showed a pronounced decidual reaction.

CASE 20 A 26 year old para-o gravida-1, operated upon at 14 weeks of gestation with removal of a 11 cm dermoid cyst on the right side. Delivery of a male child occurred at term.

CASE 21 A 28 year old para-1 gravida-2, operated upon on the fifth postpartum day with removal of an adherent left ovary about 6 cm in size and a normal right ovary. The left ovary was a solid carcinoma. The tumor was first observed as a palpable mass while the patient was in labor. Postoperative irradiation therapy was given but the patient died of metastases 8 months later.

The authors wish to thank Dr. Buford G. Hamilton for permission to observe 1 case which occurred while they were under his preceptorship. The author (H. G. H.) had the pleasure of surgically assisting Dr. Richard B. Schutz in another case which is included with his permission.

In the foregoing series of cases, gestation is calculated from the date of the first day of the last menstrual period. Interrupted, cotton (No. 30), mattress sutures were used on the peritoneum, interrupted, cotton (No. 30) sutures were used on the fascia, cotton (No. 50 or 30) ties were used in ligating abdominal wall bleeding vessels, and a

continuous cotton vertical mattress suture was used on the skin. In the suturing of viscera, Nos 0 and 00 chromic catgut sutures were used. The incision used was of the paramedian, rectus rolling type. Early ambulation was used. The patient sat up in bed on the first postoperative day, swung her feet off the bed on the second postoperative day, sat in a chair on the third day, and had bathroom privileges on the fourth day. If she developed gas pains she was mobilized earlier.

Intensive progestin therapy was instituted in all cases not terminated at surgery, the progestin being given at the rate of 10 mgm every 8 hours for 48 hours preoperatively and 72 hours postoperatively. The preparation used was proluton.

All operations were performed under spinal anesthesia, with either pontocaine or procaine, with light additional sodium pentothal (given intravenously) if the patient was nervous. There was no case of wound dehiscence, nor was there any case of incisional hernia.

Several cases of this series lend added weight to evidence presented earlier to the effect that the presence of the corpus luteum is not necessary for the human female to carry a child to term. Likewise, it is apparent that with good anesthesia and the liberal use of progestin therapy surgery of ovarian tumors complicating pregnancy can be undertaken in the first half of pregnancy with relative impunity. It is probable that one of the main reasons for the greater success of early surgery, as compared with surgery later in gestation, is the fact that with a smaller uterus it is technically and mechanically easier to excise the tumor with a minimum of handling of, and trauma to, the uterus. Of paramount importance is the early examination of patients, the diagnosis of the pelvic pathology, and immediate surgical intervention.

#### CONCLUSIONS

1 All pregnant women should be encouraged to report for examination during the first 75 days of their pregnancy.

2 A careful searching bimanual examination should be made of every pregnant woman on her first visit to her obstetrician.

3 The same ovarian tumors that would warrant surgical intervention in the nonpregnant woman, demand surgical intervention in the pregnant woman.

4 The safest time for operation is in the first half of pregnancy.

5 If a surgical emergency arises, ovarian tumor surgery should be undertaken at any period of gestation.

6 If any ovarian tumor that makes for dystocia escapes early diagnosis and care, it should be removed at the time of elective cesarean section.

7 Adequate progestin therapy is a useful adjunct to ovarian tumor surgery in pregnancy.

8 The greater the amount of time elapsing between surgery and labor, the firmer the wound will be.

9 Two additional cases of endometriosis complicating pregnancy are added to the literature, making a total of 19 cases.

10 Three cases of malignant ovarian neoplasms complicating pregnancy are added to the literature.

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# ABSTRACTS OF CURRENT LITERATURE

## SURGERY OF THE HEAD AND NECK

### HEAD

**Malignant Disease of the Face and Scalp** Excision and Repair G M FITZGIBBON and D C BODEN  
HAM *Brit J Plast Surg*, 1949, 2 13

Malignant disease of the face and scalp should be treated by a co operative program outlined by the radiotherapist, the general surgeon, and the plastic surgeon. The surgeon, taking advantage of the developments in anesthesia and blood transfusion techniques, should extend the field of operability. The plastic surgeon can complete the closure of any large defect.

Excision of epitheliomatous or rodent ulcers is undertaken when a case is considered unsuitable for radiation because of the site, when recurrence after heavy irradiation has occurred and further radiation would produce necrosis, when necrosis of bone or cartilage is present as a result of radiation, and recurrence may or may not be present, and when necrosis and sepsis are present and further radiation seems inadvisable.

In all cases certain general principles are followed. To prevent possible recurrence, wide and often ruthless excision is done with a cold knife and not diathermy. All doubtful tissue is sacrificed. Biopsies taken from one part of the lesion are not representative of the whole. At times large areas of the skull must be removed and the dura is exposed. Heavily irradiated tissues with signs of necrosis should be removed. When glands are palpable, a full block dissection of the side of the neck should be done. Occasionally it is wise to ligate the external carotid artery in neck dissections to prevent troublesome hemorrhage.

Immediate cover should be provided to decrease the possibility of sepsis, scarring, and deformity. Free, thick skin grafts may be used if a suitable base remains after excision. Usually, large flaps are preferable when the bed is irregular or the dura or other important structures are uncovered. The secondary defects of face and scalp lend themselves readily to skin grafts.

Illustrative case records with photographs are presented to demonstrate the application of these principles.

Closed circuit anesthesia by endotracheal tube, preventing loss of fluid and heat and giving the necessary free access for surgical procedures, is used. Blood transfusion at the commencement of the operation, and continued during and after surgery, is used, and elderly patients are found to tolerate lengthy procedures well. Late repair is done after a substantial period if it is believed to be necessary.

EARL H KLABUNDE, M D

### EYE

**Penicillin as a Prophylactic Against Ophthalmia Neonatorum** A Comprehensive Study ARTHUR SACKS-WILNER and ERWIN P SACKS WILNER *Arch Ophthalm*, Chic, 1949, 41 444

The efficacy of penicillin in the prophylaxis of ophthalmia neonatorum was studied in 251 newborn infants. Immediately after birth a conjunctival smear was taken from each eye and a penicillin solution containing 5,000 units per cubic centimeter was instilled into each conjunctival sac. Smears were made 24 hours later, and upon discharge from the hospital.

At birth, 37 infants showed pus cells, 52 had gram positive cocci, 1 had gram positive rods, and 2 had gram negative rods. Twenty-four hours after birth 20 infants showed pus cells, 25 had gram positive cocci, 1 infant had gram positive rods, and 1 had gram negative rods. On discharge from the hospital, 11 infants had pus cells in the smear without evidence of infection, 32 had gram positive cocci, none had gram positive rods, gram negative cocci, or rods.

It is concluded that local instillation of penicillin in the newborn is nonirritating, painless, prophylactic, and therapeutic. FRANK W NEWELL, M D

**Further Gonioscope Studies on the Canal of Schlemm** PETER C KRONFELD *Arch Ophthalm*, Chic, 1949, 41 393

Under normal conditions of life, the canal of Schlemm contains a colorless fluid. Various experimental procedures cause gonioscopically visible entrance of blood into the canal. When the process is fully developed a continuous, homogenous salmon red or brick red band is visible in the pigment ring of the trabecular zone. The condition is produced by sudden drops of intraocular pressure, or by raising the venous pressure. The blood may be displaced out of the canal with ease—by compression of the globe, if the condition was produced by ocular hypotonia, or by release of compression if produced by an increase in venous pressure. These observations lend support to the concept that a pressure gradient and, consequently, a continuous flow exists between the canal and the anterior scleral vein.

FRANK W NEWELL, M D

**Vascularization of the Cornea** Its Experimental Induction by Small Lesions and a New Theory of Its Pathogenesis DAVID G COGAN *Arch Ophthalm*, Chic, 1949, 41 406

New blood vessel formation in the rabbit cornea was induced by small, discrete lesions produced with actual cautery or by local injection into the corner of

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0.1 normal hydrochloric acid or sodium hydroxide. A latent period of approximately 2 days was followed by engorgement of proximal vessels, chiefly the venules and capillaries, and by the formation of saccular aneurysms on their walls. These aneurysms burst, causing hemorrhage into the corneal stroma and prompt deflation of the vessel. The hemorrhagic area then became riddled with new capillaries, most of which receded in the course of a few days, leaving a few loops directed toward the lesion.

That the hemorrhagic extravasates played a determinant role in this new blood vessel formation was disproved by the absence of similar phenomena occurring when blood was injected into the cornea. That toxins played a significant part seemed unlikely, since no abnormal "permeability factor" could be demonstrated in extracts from corneas that were undergoing vascularization. The one event which appeared to be correlated with, or to precede, the vascular changes was swelling of the corneal stroma. The thesis is therefore presented that the engorgement of the vessels, the formation and ultimate bursting of the saccular aneurysms, and other events leading to interstitial vascularization of the cornea are due to reduction in the tissue compactness of the cornea in the region of pre-existing vessels.

FRANK W. NEWELL, M.D.

### Pharmacology and Toxicology of the Cornea Temporary Concepts KENNETH C. SWAN *Ophthalmology*, Chic, 1949, 41: 253

The author states that the precorneal film contains protein and mucoprotein and this layer has high wetting properties. The viscosity is maintained by a balance in the rate of evaporation and the lacrimal secretion.

Pathological changes occur in the cornea when the precorneal film undergoes changes, and keratitis results. Apparently, there is a hormonal control of lacrimation, as indicated in keratoconjunctivitis sicca during the menopause. Keratoconjunctivitis sicca may also follow chronic conjunctivitis with secondary inflammation of the lacrimal ducts. Methyl cellulose (a 0.5 to 1.0 per cent solution of 4,000 centipoise type of methyl cellulose containing 0.9 per cent of sodium chloride) has appeared to be the best type of artificial tear.

The corneal epithelium is sensitive to injury and nutritional disturbances. It has a high metabolic rate and heals quickly. Local anesthetics seem to impede epithelial repair, while a bandaged eye results in more rapid healing of the epithelium. The effect obtained from local anesthetics depends upon physical properties. In general, a highly surfacel active compound penetrates well, has a greater miscibility, and a greater wetting power.

There are several irritating factors to be considered in relation to the cornea: (1) the physical properties of a drug vehicle, (2) the pH of the drug solution (usually pH 6-8 is well tolerated), (3) surface activity—dilute wetting agents are preferable, and (4) vehicles with emollients are desirable.

Knowledge of the characteristics of permeability of the cornea is important and this knowledge aids in treating bedewing of the cornea, which occurs in acute congestive glaucoma. The use of glycerin clears the cornea for a period of time.

Bowman's membrane and the corneal stroma have a low metabolic activity. Bowman's membrane is more permeable than the epithelium.

Prompt treatment of acid and alkali burns is important and prolonged irrigation with isotonic sodium chloride is necessary.

The removal of a rust ring involving the corneal stroma is one of clinical judgment. It may be removed, or the surgeon may wait for the lesion to heal over, and if too much reaction occurs it may be removed at that time.

In deep corneal lacerations, silver proteinate produces an opacity in Descemet's membrane.

The endothelium is very sensitive to physical and chemical injury, which is followed by edema of the overlying stroma, consequently great care in selecting an irrigating solution for the anterior chamber is essential.

A better clinical effect is obtained from drugs which enter the anterior chamber through the cornea by having the drug contact a larger portion of the cornea and remain in contact with it for a greater length of time. Vehicles of high viscosity and miscibility aid in this effect too.

Drugs which are highly water-soluble should be administered in an oil vehicle and drugs which are highly oil-soluble should be given in an aqueous vehicle.

Iontophoresis is a method by which a greater concentration of drug can be obtained in the cornea or anterior chamber. J. WOODHULL OVERTON, M.D.

### Traumatic Choroiditis: Review of the Literature and Report of 10 Cases PAUL TOWER *Ophthalmology*, Chic, 1949, 41: 341

The author makes a differentiation in ruptures of the choroid. One type of rupture is direct and the trauma is at the place of impact, another type is indirect and the trauma is produced by contrecoup. The second type, which occurs in the posterior segment, is more common. In the present article the author deals with the indirect type.

The lesion may occur singly, or multiple breaks may occur in the choroid. In the present article these breaks are usually segments of a circle in shape, and follow the outline of the disc in a concentric fashion or extend parallel with the equator.

There are many theories as to the cause of this condition. Most of the theories involve vascular changes, either rupture of vessels, vasoconstriction, or pulling of the vessels by the optic nerve when the injury occurs. Other theories favor some nerve control mechanism. All agree there is tissue necrosis. Many smaller vessels of the choroid disappear, atrophic proliferation of neuroglia, wandering pigment, and new vessels were observed. Scar tissue

formation was present in the inner layer of the sclera.

Ten cases are presented. The choroidal lesions are of various shapes, sizes, and positions. Two of the patients had almost normal vision. In all cases, necrosis and atrophy of the choroid were present. The author believes that the term "rupture of the choroid," as it is usually applied to the discontinuity of the choroid following nonpenetrating injury, is a poor one and that traumatic choroiditis would be more appropriate. Furthermore, he believes a form traumatic choroiditis should be reserved for the concentric lesions and that all other lesions of irregular outline should be described as diffuse traumatic choroiditis. J. WOODHULL OVERTON, M.D.

**Ocular Complications of Temporal Arteritis.** CARROLL SMITH and PHILLIP B. GREENE. *Am J Ophthalmol*, 1949, 32: 685.

The original description of temporal arteritis came from the Mayo Clinic in 1932. Since then more than 40 cases have been reported, and about half of them have been associated with visual disturbance.

The authors record the details of 4 additional cases with this complicating feature. The diagnosis is suggested when elderly individuals with advanced arteriosclerosis recall having felt nodules along the temples and severe head and scalp pains some weeks before the occurrence of eye symptoms. The marked visual loss, which may eventuate into total blindness, is associated with a comparative lack of fundus findings. The interruption of blood flow probably comes on gradually so that the dramatic changes of ischemic edema and cherry-red spot do not occur. In cases with visual disturbance it is likely that the ophthalmic artery is involved. Certainly the affection is more widespread than the term, temporal arteritis, would indicate. In all the cases reported the temporal arteries were hard, nodular, and without pulsation. Section was bloodless and showed an obliterative endarteritis with marked cellular infiltration of the muscular coat.

JAMES E. LEBENSON, M.D.

## EAR

**Antibiotics in the Treatment of Diseases of the Ear, Nose, and Throat.** A. C. FURSTENBERG. *Ann Otol Rhinol*, 1949, 58: 5.

There can be no criticism of the immediate administration of penicillin in cases in which the diagnosis of acute infection is made. When response to the drug is unsatisfactory, the organism must be identified and its sensitivity determined. The use of another antibiotic may be indicated.

To be effective, penicillin must come in actual and sustained contact with the organism, therefore, topical administration of penicillin and penicillin aerosols are of little or no value. A dense capsule surrounding a chronic abscess in the neck is a barrier to penicillin therapy. Penicillin does not cure chronic suppurative otitis media and mastoiditis, osteo-

myelitis of the calvarium and facial bones, or chronic sinus disease. Operative procedures are imperative in such cases if one hopes to obtain a cure.

The ability of aureomycin and chloromycetin to permeate cell membranes, and the blood-brain barrier makes them agents of great promise.

Streptomycin is effective in tuberculous adenitis and in tuberculous lesions of the mucous membrane. Dihydrostreptomycin, which is comparatively free from neurotoxic effects, will soon replace streptomycin in the treatment of these conditions.

JOHN R. LEONARD, M.D.

**Experiences with Penicillin in the Treatment of Acute Otitis Media.** N. GREFFLUS and A. SJOBERG. *J. Lar. Otol*, Lond., 1949, 63: 286.

The authors have reviewed the results of penicillin therapy in 366 consecutive cases of acute otitis media during the year of 1948, as compared to a clinical control group of 329 patients in 1947 who were treated prior to the introduction of penicillin in Sweden.

The bacteriological findings from the external auditory canal in patients treated in 1948 revealed the predominant organisms to be hemolytic streptococci and staphylococcus aureus, or 6 per cent of the patients in whom bacteria was present proved to be sensitive to penicillin in vitro.

The penicillin dosage varied from 15,000 units (3 injections in 24 hours) for infants up to 100,000 units (3 times daily) for adults. The average dose per patient was 1,500,000 units given in an average of 8.6 days. The penicillin therapy was stopped in the simple cases after the ear had been dry for 2 or 3 days, unless the state of the tympanic membrane or some other circumstance called for longer treatment. No certain allergic manifestations were observed except in 2 cases of suspected "drug fever."

The principal findings in the penicillin-treated series and in the control series were as follows:

1. Penicillin treatment, started as early as possible and given prophylactically to prevent complications, considerably shortens the period of hospitalization.

2. The average duration of hospitalization for patients who were not treated with sulfonamides was 20 days, for patients who received sulfonamides 14.6 days, and for those treated with penicillin, 11.9 days.

3. The average duration of secretion in cases in which penicillin was used was 8 days, in comparison with 12.7 days in the sulfonamide-treated group, and 15.9 days in the group treated without the use of sulfonamides.

4. During penicillin treatment the sedimentation rate shows an average decrease of 32.2 mm during the first week of treatment, compared to a decrease of 6.8 mm in the control group.

5. Only 9 of the 366 patients whose cases were studied (2.6%) required operation. The percentage is practically the same as that found in 2,113 out-patient cases of acute otitis media in the same 11 ti-



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tution where the operative percentage was 25 per cent. This was compared to an average of 8 to 20 per cent of operations for mastoidectomy among cases of acute otitis media during the years from 1938 to 1947 in the outpatient clinic.

In addition, the authors mentioned 6 cases with obvious signs of mastoiditis in patients who were treated with penicillin and in whom healing resulted without surgical intervention. In 6 cases of meningitis, intramuscular injections of penicillin were necessarily supplemented with intrathecal administration of penicillin to bring the meningitis under control.

EUGENE L. DERLACKI, M.D.

**Vestibular Function Prior to and Following Operation for Otosclerosis** HELMER RASMUSSEN *Arch Otolar, Chic, 1949, 49 402*

The author presents the results of his investigations of vestibular function in 79 of 88 patients operated upon for otosclerosis according to Popper's method at the Sundby Hospital, Copenhagen. In 27 per cent of 67 patients questioned, vertigo was present preoperatively. In 16 per cent of the 79 patients it was present for 1 to 15 months postoperatively.

Spontaneous nystagmus occurred following the operation in all but 4 of the patients. Various tests for fistula were performed, and the results appear in Table I below.

The author concludes that if the fistula has not closed after a period of 6 months, the chance of its remaining open is great.

Labyrinthine function also was investigated by rotation tests. Examinations with the head in the upright position revealed preoperative vestibular abnormalities in 7 cases. Postoperative findings suggested a reduced function of the lateral horizontal canal on the side of operation, but in only 2 cases was the reduced function permanent.

Rotation with the head bent forward or backward suggested that there were disturbances of function of either the superior or the posterior canal, or both, postoperatively in 12 patients. The abnormality persisted in only one case.

Rotation with the head bent to the right or to the left gave inconclusive results.

Caloric tests were made before operation with the use of 100 c.c. of water at 10 to 15 degrees C. Five patients reacted abnormally to this test. Postoperatively

TABLE I — FISTULA SIGN AFTER OPERATION

Number of months after operation	Patients in whom sign was still present	Patients in whom sign later disappeared	Total
1 to 1 1/2	8	5	20
1 1/2 to 2	7	5	20
2 to 3	15	1	17
3 to 6	16	11	57
6 to 15	46		
Total			

tively, the caloric test was made by the insufflation of air and with the head in various positions. The test revealed various degrees of abnormality in 48 of 76 patients. In 6 of the 48 patients no caloric reaction was obtainable although the author notes that in 5 of the 6 patients spontaneous nystagmus was present.

JOHN J. BALLENGER, M.D.

**Biochemical Conditions in Patients with Otosclerosis** NIELS RISKAER *Arch Otolar, Chic, 1949, 49 414*

The author has examined fasting blood serum from 51 patients who had been operated upon for otosclerosis in 1947. Analyses were made for calcium, inorganic phosphate, phosphatase, total cholesterol, albumin, and globulin.

"In general, it may be said that in the great majority of cases of otosclerosis, normal valves were found on the first analysis for all the examined substances." Where slight deviations from normal were found, control analyses revealed normal levels in all cases. The author believed he would have found more abnormal valves if stricter normal limits had been observed, as has been done by other authors. He also comments that differing reports by other surgeons "may denote variations in the serum concentration in different phases, active and inactive, within the course of otosclerosis." He doubts such a theory.

JOHN J. BALLENGER, M.D.

**Conditions of the External Auditory Meatus and the Tympanic Membrane in Patients with Otosclerosis** SVEND SELSØ *Arch Otolar, Chic, 1949, 49 420*

In examining patients in the ear department of Sundby Hospital, Copenhagen, the author has tried to discover conditions in the external auditory meatus and the tympanic membrane which might be of importance in differentiating between otosclerosis and other forms of deafness.

In the present study, 29 otosclerotic patients and 29 control patients who had no ear disease were used. Tests were made for sensitivity of the skin and variation in the lumen of the external meatus, for Schwartz's sign, and for cerumen production. The conclusion reached by the author was that "the external auditory meatus and the tympanic membrane present no characteristics that may contribute to differentiate otosclerosis from other forms of deafness."

JOHN J. BALLENGER, M.D.

## NOSE AND SINUSES

**Carcinoma of the Antrum** Report of 9 Cases, with a 10 Year Survey of the Literature CHARLES A. SEELIG *Ann Otol Rhinol, 1949, 58 168*

Nine cases of carcinoma of the antrum are presented. Only one patient survived. This patient was treated by radical antrotomy, and is living and free of recurrence 7 years after operation.

The signs and symptoms which should suggest antral carcinoma are unilateral nasal discharge, nasal



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obstruction, epistaxis, ulceration of the hard palate, anesthesia of the face, lacrimation, pain, swelling exophthalmos, and diplopia. The prognosis is poor even when surgery is combined with radiation therapy. The average length of life in the reported cases was 57 months from the date of diagnosis. Early diagnosis and radical therapy are essential to success.

JOHN R. LINDSAY, M.D.

**Diagnosis of Malignancy of the Nasopharynx. Cytologic Studies by the Smear Technique.** LEWIS F. MORRISON, EUGENE S. HOFF, and ROSALIN WU. *Ann Otol Rhinol*, 1949, 58: 18.

The diagnosis of exfoliating carcinoma of the nasopharynx can be made by examining the secretions for malignant cells by the Papanicolaou technique. The examination should be used as an adjunct and not as a substitute for biopsy. Positive smears were obtained in 7 of 8 proved cases of nasopharyngeal carcinoma. In one instance the persistence of a positive smear encouraged the authors to take repeated biopsies, and the fifth biopsy showed anaplastic carcinoma. The method is time-consuming and requires meticulous attention to detail.

JOHN R. LINDSAY, M.D.

## NECK

**The Treatment of Thyrotoxicosis.** I. S. RAVDIN, EDWARD ROSE, and JAMES D. MAXWELL. *J Am Med Ass*, 1949, 140: 141.

With the possible exception of the true toxic adenoma, it seems probable that the primary cause of thyrotoxicosis lies outside the thyroid gland itself. Certain clinical evidence suggests the possible etiologic importance of functional disturbances in the higher psychic centers, the hypothalamus, the anterior pituitary, the autonomic nervous system, the gonads, and the adrenals. Proof of such relationship, however, is still lacking. Theoretically, the thyrotoxic state might be considered therapeutically vulnerable at three possible levels: (1) by an attack on the initiating factors, (2) at the thyroid itself, or (3) at the level of the peripheral target tissue cell where the impact of the excessive output of thyroid hormone is exerted. The principal approach at present is at the thyroid level.

Those methods of treatment which require consideration may be listed as follows: (1) iodine therapy, (2) treatment with goitrogenic compounds, (3) external irradiation of the thyroid or pituitary, (4) radioactive iodine therapy, and (5) radical resection of the thyroid gland.

Iodine in any absorbable form will produce a variable degree of remission in at least 95 per cent of thyrotoxic patients. The use of iodine should, in general, be limited to (1) preoperative preparation, (2) treatment of the "thyroid storm," (3) temporary postoperative administration, (4) occasionally as a therapeutic test when the diagnosis of thyrotoxicosis is in doubt, and (5) certain cases of hyperophthalmopathic (Graves') disease.

The goitrogenic compounds now being used produce a remission in the thyrotoxic state by inhibiting the synthesis of thyroid hormone. Although their administration alleviates the symptoms of toxicity, the glands of patients receiving these drugs remain hyperplastic and show the typical histologic features found in untreated thyrotoxic patients. Patients with large or nodular goiters, or those recently treated with iodine may be slow to respond. Some patients are partially or completely refractory without apparent reason. The present consensus indicates that sustained remissions following prolonged therapy cannot be expected in more than about 50 per cent of cases. The authors' experience suggests that the majority of patients showing a sustained remission and a return to normal activities have exhibited the milder forms of thyrotoxicosis, with minimal goiter, slight to moderate elevation of basal metabolic rate, and no cardiac or other visceral complications.

These goitrogenic substances have proved useful in the prolonged control of certain thyrotoxic patients in whom thyroidectomy cannot, for various reasons, be undertaken even though, theoretically, it is the treatment of choice. This group includes certain older patients, those who refuse operation, and those who cannot be brought by medical therapy to a point at which operation can be considered justifiably safe.

Although most patients can be satisfactorily prepared for thyroidectomy by the use of iodine, it has proved inadequate in two important groups of cases: (1) certain severely toxic patients in whom iodine alone fails to produce a satisfactory operative remission, and (2) patients rendered "iodine fast" by the prolonged use of this substance. In such patients a complete remission can usually be produced by the prolonged use of goitrogenic agents.

Irradiation of the pituitary has received a limited trial. Its usefulness at present would appear to be restricted to certain patients with the hyperophthalmopathic syndrome of toxic diffuse goiter (Graves' disease). In these patients thyrotoxic phenomena are frequently mild and may be at times entirely absent or replaced by evidence of hypothyroidism. Ocular signs and symptoms dominate the clinical picture and may include varying degrees of proptosis, periorbital and palpebral edema and pigmentation, edema and congestion of the conjunctiva, keratitis, lacrimation and swelling of the lacrimal glands, fixation of the eyeball, pseudo hypertrophy of the extraocular muscles, papilledema or optic neuritis, and edema or infiltration of the orbital tissues. This ophthalmopathic syndrome occasionally develops rapidly and unexpectedly after thyroidectomy in patients with minimal preoperative ocular signs, but its presence can usually be suspected by one or more of the aforementioned manifestations. Too great a suppression of thyroid function in such cases, whether by thyroidectomy or

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any other means, may be followed by disastrous progression of the ocular changes. The pathogenic mechanism of these changes is still obscure, but some kind of abnormal effect is believed to be exerted by the anterior pituitary on the extraocular muscles and the orbital tissues. Suppression of thyroid function appears to aggravate the ocular disturbance by removing an inhibitory effect on the anterior pituitary. In the presence of pronounced ocular symptoms and a mild thyrotoxic state, thyroidectomy is, in the authors' opinion, contraindicated. Therapy should be aimed at inhibition of anterior pituitary activity and has included such measures as desiccated thyroid, estrogenic substances, and the intermittent use of iodine. Irradiation of the pituitary, while far from being precisely controllable in its placement, or in the exact amount delivered to the pituitary, nevertheless appears justifiable in severely progressive cases.

Although radioactive iodine was used in the treatment of thyrotoxicosis as early as 1941, the first detailed reports concerning it did not appear until 5 years later. Its use has been limited chiefly to selected cases, most of them of either toxic diffuse goiter (Graves' disease) or recurrent postoperative thyrotoxicosis. Few patients with toxic nodular goiter appear to have been treated. Its effective use is limited at present to a relatively few clinics.

Internal irradiation by the gamma rays results in a gradual reduction of the activity of the toxic thyroid, although this may be preceded by a temporary exacerbation of the disease. Remission may be complete in from 1 week to 6 months, or longer. The incidence of satisfactory end results appears at present to be somewhere between 70 and 80 per cent, but it should be remembered that most of the reported series have consisted of selected cases. Myxedema with fibrosis of the thyroid may occur, and the ocular complications are occasionally aggravated. Late carcinogenic effect on the thyroid and damage to the urinary tract during excretion are possible dangers which cannot at present be evaluated.

The basic principles of preoperative care of patients with hyperthyroidism are the same, regardless of the type of the disease. The patient should be placed on a program which will tend to (1) bring the basal metabolic rate to normal, (2) improve the general nutrition as demonstrated by a gain in weight and an improvement in the general physical condition, (3) lead to a stabilization of the pulse rate, and (4) finally, but not the least important, restore the patient's confidence in ultimate recovery. In the severely toxic patient propylthiouracil is administered in amounts varying from 150 to 300 mgm per day, until the metabolic rate begins to approach normal. Ten days to 2 weeks before operation is planned, treatment with iodine is begun in the form of potassium iodide (10 drops of saturated solution, three times a day). Thiamine hydrochloride, in amounts of 50 to 200 mgm daily, is given in addition to riboflavin, 450 mgm, and nicotinamide, 750 mgm, daily. The

authors also found it useful to give additional vitamin B in the form of a potent yeast concentrate. A highly nutritious diet is provided, consisting of 3,000 to 5,000 calories a day. The important thing is that the patient eat an amount sufficient to meet energy requirements and have left a modicum for restoration of the depleted body tissues. The criteria of achievement of this objective are a gain in body weight in the absence of edema, and an improvement in general muscular tone.

Even though the pulse rate may remain above normal, a diurnal uniformity of rate is desirable and should be regarded as one of the major objectives of the preoperative preparation. It is facilitated by mild sedation during the preoperative period and by optimal hospital environment.

The staff must be thoroughly conscious of the psychogenic factors that played a part in the initiation or extension of the disease, and of the fears that beset these patients.

In patients who were severely toxic when first seen, and in those who are still easily frightened, the authors employ the method of "stealing the thyroid." On the morning of operation the house officer who has most actively participated in the care of the patient administers thiopental sodium (pentothal sodium) intravenously. The patient, thinking that only another test is being made, goes to sleep unaware that within a few moments the operation will proceed.

Inhalation anesthesia is then administered. The specific anesthetic employed is less important than the prevention of anoxia. Some anesthetic agents, such as cyclopropane, may affect cardiac activity, others, such as ether or ethylene, may affect the liver, but these risks may be accepted as long as anoxia is avoided. Under conditions of anoxia, cardiac integrity may suffer, liver injury may become further accentuated, and a pre-existing renal injury may become worse.

Every possible care must be exercised not to injure the recurrent laryngeal nerves. No thyroid resection should be attempted without prior identification of parathyroid tissue. These glands vary in number and in position even in normal persons. Their location may be further distorted by enlargement of the thyroid.

The thyroid isthmus should be divided and the trachea exposed. Sparing the isthmus and pyramidal lobe results in a higher incidence of persistence of hyperthyroidism. A radical resection of both lobes of the thyroid should be accomplished in every instance if a high incidence of permanent cures is to be expected. It is far better to remove too much than too little, for the hypothyroid state which may follow a very radical thyroidectomy is far better and more easy of control than is persistent hyperthyroidism.

The gland should be adequately exposed, if necessary, by division of the prethyroid muscles. Mass ligation of the superior poles is undesirable. It leaves thyroid tissue in amounts that cannot always

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be assessed, and it results in injury to the superior laryngeal nerve, thus predisposing to excessive mucous secretion in the trachea.

Crisis is the most dreaded of the postoperative sequelae. It is now so infrequent that younger surgeons rarely see this complication and may therefore underestimate its importance. Perfect anesthesia reduces the risk of a severe reaction. The intravenous use of dextrose during and after operation assists in reducing its incidence and severity.

When crisis occurs, therapy should be begun at once. The blood volume must be maintained, dextrose and iodine given intravenously, and attention directed to any specific electrolyte imbalance. Large amounts of sodium salts should not be administered if the imbalance is one chiefly associated with potassium disturbance, and neither should be administered without careful study of renal function is impaired. Adequate sedation, oxygen therapy, method of refrigeration in the presence of pronounced hyperpyrexia are all of value. Adequate doses of all components of the vitamin B complex should be given, parenterally, when necessary. Propylthiouracil may also be of assistance.

Acute traumatic parathyroid insufficiency, while rarely fatal, may be an important cause of postoperative morbidity. In many cases the insufficiency is self-limited, and spontaneous readjustment may occur up to 6 months after injury.

The authors report on 655 thyrotoxic patients operated on in the 10 year period prior to June, 1947.

The mean age of the entire group was 40.6 years. Of the total number of patients, 145 (22.2%) were males and 510 (77.8%) were females. Four hundred and fifty-two (69%) of the patients had diffuse toxic goiter and 203 (31%) had toxic nodular goiter, there were 82 patients (12.5%) with serious heart disease, 24 patients had true diabetes mellitus, and 6 had active pulmonary tuberculosis. The average period of preoperative iodine administration while in the hospital was 12.3 days. Many had received iodine for a variable period prior to admission. The mean period of days of thiouracil therapy was 37.2 days, of amiothiazole, 17.5 days and of propylthiouracil, 67.8 days.

The patients with diffuse toxic goiter showed a mean basal metabolic rate of 42 per cent, and those with toxic nodular goiter, of plus 58 per cent. The overall mortality rate was 0.9 per cent.

There were 3 instances of true crisis (0.46%). No patient died in crisis subsequent to the use of iodine plus thiouracil or propylthiouracil in the preoperative period. Twenty-three patients (3.5%) had postoperative impairment of the motion of one vocal cord. Of these 23 patients, 20 recovered completely. Two patients showed evidence of hypoparathyroidism.

The average basal metabolic rate for the entire group at the last follow-up visit was plus 3.7 per cent. Fifteen patients (2.3%) had recurrent thyrotoxicosis.

#### Amyloid Tumors of the Larynx, Trachea, or Bronchi. A Report of 15 Cases. DAVID B. STARK and GORDON B. NEW. *Ann Otol Rhinol*, 1949, 58, 117.

The clinical features of 15 cases in which the pathologic diagnosis was amyloid tumor of the larynx, trachea, or bronchi were reviewed by the authors. The pathologic features considered characteristic of the tumors are occurrence of the homogeneous concentric-layered masses, and a characteristic reaction of the amyloid material with one or more of the so-called amyloid stains. No concomitant disease considered of etiologic significance was noted. The presenting signs and symptoms of amyloid tumor are dependent on the size and location of the lesion.

Classification of the tumors into the localized variety and the diffuse infiltrating variety is of significance in determining the type of treatment to be employed and the prognosis after treatment.

The localized tumor was surgically removed, with an excellent functional result. The diffuse lesion involving the subglottic region and the upper part of the trachea was removed with immediate grafting of the resultant denuded area. A permanent tracheostoma was avoided, and the functional results were excellent. The functional results obtained by treatment of the diffuse lesion involving the glottis proper were not so satisfactory. The prognosis as to life was excellent, except in some cases of endobronchial lesions. The disease tended to be self-limiting.

# SURGERY OF THE NERVOUS SYSTEM

## BRAIN AND ITS COVERINGS, CRANIAL NERVES

**Percutaneous Cerebral Angiography and Cerebral Abscess** H. F. FABRITIUS, A. G. FRØYIC, and K. KRISTIANSEN *Arch Neur Psychiat*, Chic., 1949, 61 352

This report summarizes the etiology, diagnosis, and treatment of 7 cerebral and 1 cerebellar abscesses observed at the Oslo University Hospital. Three of the abscesses were multiple, 2 were metastatic from the lungs, 3 were of otitic origin, and 2 of sinus origin. The main diagnostic aid was percutaneous cerebral angiography which showed dislocated vessels around an avascular or poorly vascularized area representing the abscess.

The authors' treatment consisted of aspiration of the abscess content, local injection of penicillin in the abscess cavity, and systemic as well as intrathecal administration of penicillin and sulfadiazine. In some cases thorotrast or air was injected into the abscess cavity for better visualization. There were 3 fatalities.

GEORGE PERRET, M D

**Abscess of Brain Due to Clostridium Perfringens Treated with Penicillin** RALPH B. CLOWARD *Arch Neur Psychiat*, Chic., 1948, 60 504

A case report is given of a patient with a fulminating infection of the brain due to clostridium perfringens, which developed after a depressed fracture of the frontal lobe. The patient was treated with operative drainage and with penicillin which was introduced locally into the area of infection through a permanent catheter. The patient was also given 20,000 units of penicillin intramuscularly every 2 hours. A second operative procedure was necessary to clean out further devitalized brain and accumulations of pus. Further treatment with penicillin followed, the patient receiving a total of 2,385,000 units of penicillin, and 95,000 units of penicillin injected locally into the abscess cavity.

The patient made a satisfactory recovery. The author attributes the recovery to surgical drainage of the abscess coupled with penicillin, and points out the specificity of penicillin in the treatment of infections due to the gas bacillus as reported by previous observers.

HOWARD A. BROWN, M D

**A Contribution to the Study of Chronic Subdural Hematoma** (Contribution à l'étude de l'hématome sous dural chronique) G. R. HOFFMAN *Acta chirurg*, 1948, 47 569

It is pointed out that a chronic subdural hematoma usually occupies a position more or less limited to the convexity of a hemisphere. Exceptionally, it may be found between the two hemispheres, over the contents of the posterior fossa, or in the potential subdural extra-arachnoidal space.

A subdural hematoma in the chronic state characteristically consists of a cyst (with two walls) containing a few clots and a liquid which is the result of a breakdown of the blood. It is only when the hematoma has existed for quite some time that the walls of this cyst have a definite character. The external wall is thin and adheres to the dura mater, it shows a massive infiltration of polymorphonuclear cells as well as extensive fibroplasia. The inner wall is equally thin and delicate, it may be found free, but more often it is adherent to the underlying pia mater. It is made up almost completely of fibroblasts. While it is true that such hematomas may arise from congenital vascular malformations, the commonest cause is certainly that of trauma resulting in rupture of dura mater, or a sinus passing from cortex to dura mater.

The time from the beginning of bleeding to the diagnosis of the clot may be anywhere from 15 days to several months. The author believes that more commonly chronic subdural hematomas present their signs between the third and sixth week. There are various clinical signs, including headache, mental changes, motor dysfunction, pupillary changes, epileptiform seizures, bradycardia, and nausea. Surgically, the author follows the more common surgical procedure, that is, the washing out of the clot through two burr holes. He feels that this simple trephine operation is preferable to the placement of a flap.

JOHN MARTIN, M D

**Multiple Brain Tumors** (Multiple Gehirntumoren) HERBERT KRAUS *Wien med Wschr*, 1949, 99 174

The author states that the occurrence of multiple primary brain tumors is not a rarity and he quotes Bier, of Jena, who stated that 3 to 3.4 per cent of all primary brain tumors are of this type. Six cases are reported in detail, to illustrate the various types of tumors and some of the difficulties encountered.

The first case was one of bilateral acoustic neuroma which, following ventriculography, was considered to be an inoperable midline tumor at the base of the posterior fossa, because of elevation of the posterior third of the third ventricle, the aqueduct, and the fourth ventricle. The author stresses the difficulty of diagnosing bilateral acoustic neuromas because both internal acoustic meati present a regular, symmetrical enlargement and comparisons show no variation. In addition, large or bilateral acoustic neuromas can show a dorsal displacement suggesting a single midline inoperable lesion.

The second case presented both an acoustic neuroma and an undiagnosed small parasagittal meningioma. This is a relatively common combination.

Another patient had Recklinghausen's disease with an acoustic neuroma which was partially scooped out. At autopsy neuromas were likewise

## INTERNATIONAL ABSTRACTS OF SURGERY

found in the intercostal nerves and along the roots of the vertebral canal

The fourth individual was only operated upon at his expressed wish, and bilateral acoustic neuromas were shelled out. At autopsy on the following day several small meningiomas were found over the left cerebral hemisphere and over the right parietal lobe. In addition to the bilateral acoustic neuromas there were similar lesions in the right olfactory bulb, left trochlear nerve, oculomotor, glossopharyngeal, and vagus nerves, bilaterally, also in numerous intercostal nerves, the brachial plexus, and the right radial and femoral nerves bilaterally. The condition was diagnosed as Recklinghausen's disease with multiple meningiomas. It is believed that a biopsy should be made in every case to substantiate the diagnosis of Recklinghausen's disease. The prognosis is poor, and usually operation should not be attempted.

In the fifth case, 12 meningiomas, totaling 200 gm., were removed from the brain along with simultaneous excision of one meningioma from the spinal cord. In spite of the necessary radical surgery the patient survived and was in fair general condition. The final case reported was one in which a spongioblastoma was found to be present in the left and right thalamus, with another glioma at the seventh thoracic vertebra. It is very unusual to find multiple glomatous tumors in both the brain and spinal canal.

RICHARD C. SCHNEIDER, M.D.

#### Analysis of Electroencephalographic Findings in 40 Cases of Varied Brain Tumor. Electroencephalographic Findings in Meningiomas. HENRY M. CUNEO, CARL W. RAND, and H. SJAARDEMA. *Bull. Los Angeles Neur. Soc.*, 1949, 14, 1

In this first of a series of articles an analysis is made of electroencephalographic studies of 10 meningiomas which were exactly localized either by surgery or autopsy.

It was found that electroencephalographic tracings localized the tumor correctly in 3 instances—in the left frontal, the right frontal, and the right occipital regions. Localization was mistaken in 1 case in which a right midfrontal tumor weighing 117 gm. was localized in the right temporal region. In the 4 other instances the tracings were not localizing, in these cases the tumors were located in the left sphenoidal ridge, the right parasellar region, the left parasagittal region, and in the subtentorial midline. The electroencephalographic tracings showed slow waves, phase reversals over the seat of the lesions, or both.

Clinically accurate localization was made in 6 cases. The tumor could not be localized in 2 cases and was wrongly localized in the 2 other cases in which the electroencephalograms had also failed. Ventriculographic studies were made in 6 cases, including the 4 in which correct clinical localization was impossible, and permitted accurate diagnosis. In this study the electroencephalographic tracings failed to provide any diagnostic advantages, they

confirmed a correct clinical diagnosis but did help in 1 case which could not be clinically localized. GEORGE F. PERRET, M.D.

#### Operative Restoration Following Facial Paralysis (Die operative Wiederherstellung der Facialis-musculi). OTTO LORENZ. *Z. f. Forsch.*, 1949, 107

The author has briefly reviewed the causes of facial paralysis and listed them in the following groupings: (1) mechanical (traumatic and postoperative), (2) inflammatory, (3) bacterial or toxic, and (4) rheumatic (70 per cent of total). Consideration is given to the most opportune time for restorative surgery following facial paralysis. Too early operation is not deemed advisable, and the author suggests that the appearance of reaction of muscle degeneration should probably be the criterion for the timing of the procedure. In addition, the neurologist and the otologist should be consulted for their opinions.

There are four fundamental methods of operative reconstruction, and the advantages and disadvantages are discussed very completely. They are:

1. The removal of local scarring of the nerve in the petrous bone, with the bridging of the gap by means of a free nerve transplant or, in rare cases, by primary nerve suture.
2. Anastomoses of the facial nerve with the spinal accessory, glossopharyngeal, trigeminal, or, preferably, the hypoglossal nerve. Under this heading the direct neurotization of the paralyzed facial muscles by the hypoglossal nerve was considered and discarded.
3. The removal of antagonistic nerve supply by cervical sympathectomy, and mechanical supply by suspension with wires, fasciae, various plastic substances, and myoplastic procedures.
4. Muscular neurotization, which method is elected as the treatment of choice.

In muscular neurotization, described and used by Lexer and Rosenthal, the paralyzed muscle is neurotized by the implantation of a well innervated muscle bundle. Usually two bundles are dissected free from the temporal muscle and implanted in the musculature of the upper and lower eyelids. Three more flaps are cut from the masseter muscle and curved upward to the alar nasae and to the orbicularis oris at the upper and lower lip. The first movements are noted in from 4 to 6 weeks after operation. Good results may be expected if the operation is carried out within 2 years after the development of paralysis.

In the West German Oral Surgery Clinic, this procedure has been used with much success. The method is regarded as one of the great advances in restoration of function in facial paralysis, for it does away with unsightly associated movements.

Although the latest reference cited in the bibliography is 1940, this article offers an orderly and comprehensive review of the topic.

KENNETH

## SURGERY OF THE NERVOUS SYSTEM

### SPINAL CORD AND ITS COVERINGS

**Intervertebral Disc Hernias of the Cervical Region**  
(Les hernies discales de la région cervicale) J-A  
LIEVRE *Presse méd*, 1949, 57 303

The author has reviewed the previously reported history and clinical studies relating to the cervical disc and has appended rather a complete biography to his article.

He points out that the most frequent locations for such herniations are at the fifth and sixth interspaces, but that they may also occur in the third, fourth, and seventh interspaces. Even double herniations may occur. Such herniations occur most commonly in middle age, oftener in men than in women, frequently follow injuries of one sort or another, and may be accompanied by a secondary arthritis, the result of malalignment of the vertebrae. He points out also, in that connection, that cervical arthritis, per se, may simulate the syndrome of herniated cervical disc. While it is true that the "typical" herniated disc produces a single root syndrome of pain, numbness, and selective dermatome and myotome defect because of the fact that the cervical roots leave the cord at a right angle and pass directly out between the corresponding vertebrae, nevertheless a disc large enough and centrally enough placed will give definite cord signs, and such a lesion must be thought of in the differential diagnosis of lesions of the cervical cord. Mild increase in the total protein may be present in either type of cervical disc.

The author does not feel that medical treatment such as rest, physical therapy, local anesthesia, antihistamine injections, or collars give the patient much hope of relief, and probably none of cure. He believes that the proper treatment in most cases is cervical hemilaminectomy and removal of the disc.

JOHN MARTIN, M D

### PERIPHERAL NERVES

**Late Paralysis of the Ulnar Nerve and Occupational Accident** (Paralysie tardive du nerf cubital et accident du travail) ALBERT MOUCHET and GUY SEILLÉ *Presse méd*, 1949, 57 197

A carpenter, 63 years old, experienced isolated paralysis of the right ulnar nerve with complete degeneration after a heavy piece of iron fell on his hand. The history revealed that at the age of 4 years he had suffered a fracture of the external condyle of the humerus with subsequent deformation of the joint and progressive cubitus valgus. However, until the recent accident, the patient was able to use his right hand fully in his heavy work and did not experience any particular weakness.

The nerve was disengaged from adhesions and transposed anteriorly of the epitrochlear muscles. The paralysis gradually decreased after the operation.

The long interval of 59 years between the fracture and the onset of the paralysis is remarkable. The author discusses the role of the recent occupational

accident in the development of the paralysis. He believes that degeneration of the ulnar nerve, caused by pressure of the displaced condyle, had begun long before the new accident without causing subjective symptoms. The new traumatism acted as a kind of trigger mechanism and aggravated the condition so that the paralysis became manifest.

WERNER M. SOLMITZ, M D

**Traumatic Lesions of the Sciatic Nerve and Its Branches. An Anatomicoclinical Study of the Therapeutic Results in 53 Cases** (Lésions traumatiques du nerf sciatique et de ses branches. Étude anatomoclinique et résultats thérapeutiques d'après 53 cas) R. FONTAINE, A. DANY, and PH. SCHUMACHER *Lyon chir*, 1949, 44 185

This report concerns 31 patients with traumatic lesions of the sciatic trunk, 13 with lesions of the peroneal, and 9 with lesions of the tibial nerve.

The authors have categorized the results of their clinical studies rather differently from the manner in which these lesions are studied in America. They lay particular stress on the trophic changes which occur with such lesions, both in the skin of the foot and the bones of the toes. They have found that surgical suture rarely gives 100 per cent functional results and that one must wait 2 or 3 years, at least, before the final end point is reached after such surgery. They believe that fresh heterografts are more effective than a preserved heterograft, but that autografts are by all odds more effective when grafting is necessary. Nevertheless, they feel that suture by graft or end-to-end proximation (the latter always being ideal if possible) is the beginning point in the rehabilitation of a patient with such a lesion. They stress a long follow up on patients with sciatic nerve lesions for a true evaluation of spontaneous or post-surgical recovery.

JOHN MARTIN, M D

### MISCELLANEOUS

**Causalgic Syndromes** W V MACFARLANE *Austral N Zealand J Surg*, 1949, 18 191

Causalgia in general is discussed by the author and the theoretical considerations advanced to explain this phenomenon are further listed. A summary of previous reports and work in regard to causalgia is included, and a classification of the syndromes included under this category is given.

The author's method of attack included attention directed toward ascertaining the level in the pain conduction pathways, at which section would lead to relief of pain. They have used local anesthetic infiltration into painful scars and tender subcutaneous areas, and injections of the sympathetic chain, as well as of nerve trunks and roots proximal to the site of the injury. Sympathectomy was undertaken if local blocks appeared successful. Posterior rhizotomies were also used in some cases. Chordotomy has also been used.

The author believes that the absence of burning pain does not exclude the diagnosis of causalgia.



# SURGERY OF THE THORAX

## CHEST WALL AND BREAST

**Testosterone Propionate in the Treatment of Breast Cancer** SIGVARD KAAE *Acta radiol*, Stockh, 1949, 31 97

This is a report of the use of testosterone propionate in 15 cases of breast cancer observed over a period of 10 months or longer. All the patients had osseous metastases and all were women in whom the menopause had begun. It is concluded that, without doubt, in many cases of breast cancer with metastases to bones there is a temporary, but marked, relief from pain, associated with considerable improvement of the patient's general condition following treatment with testosterone propionate.

Sometimes, and especially in cases in which there is initial hypercalcemia, the therapy may give rise to toxic manifestations. Therefore, the patient should be observed carefully, particularly after the first injections, and the serum calcium controlled. However, if it rises to high values the treatment will have to be discontinued. In women in whom men- struation has been present before the institution of the therapy, just as good effects can undoubtedly be obtained, and more readily, by roentgen irradiation of the ovaries, and the testosterone can be reserved for a later time.

STEPHEN A. ZIEMAN, M.D.

## TRACHEA, LUNGS, AND PLEURA

**Surgical Extrapleural Pneumothorax in the Treatment of Large Tuberculous Cavities at the Upper Lobe of the Lung** G. L. RONZONI *J internal chir thor*, 1949, 1 75

In this first experimental series of cases the problem of an expedient indication for extrapleural pneumothorax is studied with regard to the treatment of large tuberculous cavities in the upper lobe of the lung. By expedient indication the authors mean an indication to be substituted for the more theoretical- ly correct one either because of the evolution of the disease, or because of the condition of the patient.

A technique of extrapleural stripping is described. It permits the performance of a pneumothorax with particular features which allow either a hypotensive or hypertensive method of maintenance and a progressive graduation of the pulmonary collapse. It is be- ing proposed to call this special type of intervention a "subtotal lateral mediastinic extrapleural pneumo- thorax," adding "hypotensive" or "hypertensive" as the need may be.

JOHN J. MALONEY, M.D.

**Experimental and Clinical Study of Collapse Ther- apy with Fiberglas Wool and Fabric** THOMAS J. E. O'NEILL, HECTOR P. REDONDO RAMIREZ, and ROBERT G. TROUT *J Thorac Surg*, 1949, 18 181

Experimental studies were undertaken with a combined series of 20 dogs. Two procedures were

used. In one series, extrapleural packing of fiberglas raw wool was used. This resulted in tissue reaction which was regarded as unsatisfactory. In the second series, fiberglas fabric was used intrapleurally, to invest a selected lobe. This proved satisfactory as an excellent selective atelectasis was accomplished and the implantation of the material occasioned only a minimal tissue reaction.

Ten case histories are reported. In 3 cases, the upper lobes were wrapped in fiberglas fabric to ac- complish selective collapse and in 7, extrapleural pneumonolysis was done, and the created space was filled with fiberglas wool. In 1 case the raw wool alone was placed in the space. This resulted in the same kind of tissue reaction as seen in the experi- mental animals, in which there was considerable foreign body response, this foreign mass became in- fected and had to be removed. In the remaining 6 cases the space was first lined with fiberglas fabric (which in the dogs was shown to be practically non- reactive) and then the lined space was filled with raw fiberglas wool. No infections resulted in these cases and the collapse was regarded as satisfactory.

SAMUEL KAHN, M.D.

**An Evaluation of Extrapleural Pneumonolysis with Lucite Plombage** JOSIAH C. TRENT, JAMES D. MOODY, and JOSEPH S. HIATT, JR. *J Thorac Surg*, 1949, 18 173

Extrapleural pneumonolysis with plombage is a desirable operation because (1) it can be done in one stage, (2) it is technically easy, (3) it is well toler- ated, (4) there is no deformity of the chest, (5) the function of good lung tissue is maintained, and (6) the hospital stay is short.

The ideal material for insertion in the extrapleural space, to maintain pulmonary collapse, has not yet been found because of the susceptibility of the extra- pleural space to infection. Air, oil, and paraffin have been the most successful, however, their use is limited to highly selected cases in which thoraco- plasty is not indicated. Experimental studies seemed to indicate that lucite spheres approached the ideal plombage substance, but clinical trial has failed to substantiate the early promise of the operation.

Dense hyaline tissue was found to form around the spheres in the experiments, as well as in 3 clinical cases in which no infection occurred. Since lucite is an inert material in the body, the probable explan- ation for this tissue formation lies in the spherical shape of the plastic material, which allows sufficient space between the spheres for serum to accumulate, clot, and organize. When this dense hyaline mass forms, it is very difficult to remove the spheres, un- less infection and liquefaction of the surrounding tissue occur. Lucite plombage must, therefore, be a definitive procedure since, if it is not successful, no other operative procedure is feasible as the success



of the latter is dependent upon the removal of the spheres

Of 51 patients on whom extrapleural pneumolysis with lucite plombage was carried out, 10 were benefited, 3 received no benefit, 20 were adversely affected, and 18 died. The late results of the operation do not justify continuation of the procedure

SAMUEL KAHN, M D

### **The Malignant Nature of Bronchial Adenoma**

ALFRED GOLDMAN *J Thorac Surg*, 1949, 18 137

Five cases of bronchial adenoma which showed malignant qualities are reported. The most malignant changes to occur were found in the mixed tumor type of bronchial adenoma. The complete transformation to a clinical and histological picture of bronchiogenic carcinoma has been observed. Carcinoma of bronchiogenic origin may, at times, arise in a mixed tumor type of bronchial adenoma. Carcinoid types of bronchial adenoma not infrequently show metastatic involvement of the mediastinal lymph nodes. This may occur when the tumor has been present for as long as 30 years, or when the duration of symptoms has been only a few months.

The finding of bronchial adenoma in conjunction with multiple tumors of low grade malignancy in other organs suggests that the stimulus for the production of bronchial adenoma is the same as that capable of producing neoplasms in other organs than the lung. The failure of bronchial adenoma to produce vascular seedings, even though the tumor cells were demonstrated floating in the lumen of a large pulmonary vein, suggests that the only favorable soil for bronchial adenoma is in the bronchi and lungs.

The treatment of bronchial adenoma by lobectomy and pneumonectomy has given approximately 100 per cent 5 year cures, when this period of time has elapsed since operation. SAMUEL KAHN, M D

### **Pneumonectomy in a Case of Besnier Boeck's Sarcoidosis**

C L PETERSON *Arch chir Neerl*, 1949, 1 64.

A careful search of the literature has revealed no mention of surgery performed for irreversible pulmonary changes in Boeck's sarcoidosis.

Ordinarily, surgery in this disease may be considered as contraindicated or unnecessary, because of the universal distribution of the sarcoidosis throughout the body and the usual bilateral reversible pulmonary manifestations. However, there is one development of the pathology which may demand such an intervention.

In the latter stages of the pulmonary involvement a tendency toward fibrosis and healing may occur. This fibrosis in rare instances may take a pernicious course with gradual interference in the normal pulmonary physiology. Involvement of the bronchi and bronchioles may produce severe stenosis with interference in the air passage resulting in atelectasis. Involvement of the pulmonary arterioles and capillary bed by the fibrosis may consecutively cause

narrowing of the vessels, mechanical obstruction of the blood flow, pulmonary hypertension, cor pulmonale, congestive heart failure, and, ultimately, death. Distortion and stenosis of the bronchi, further, may predispose to pulmonary infection of either an acute or chronic nature with a fatal termination.

Surgery may be precluded by the presence of bilateral involvement by the progressive disease process or by the localization of the lesions in other organs. These intrapulmonary and extrapulmonary deposits may be so extensive and may have so debilitated the patient that interference may be unwise. However, a patient with an irreversible lesion, unilaterally placed, with minor or no involvement elsewhere, and presenting sufficient symptomatology to justify surgical intervention, prior to the cardiac sequelae, should be considered as a possible candidate for lobectomy or pneumonectomy.

One such patient who presented these conditions was treated at this clinic and the author considers that the case may be of interest in view of its rarity and because of the gratifying results obtained.

The patient's marked general improvement after operation was dramatic. One year after the pneumonectomy the disease continues to remain in a quiescent state with no evidence of pulmonary recurrence.

The pulmonary form of Besnier Boeck's sarcoidosis is briefly discussed.

A rare case with subsequent resolution of the lesions throughout, except in a localized area involving the left upper lobe, is presented.

JOHN E. KIRKPATRICK, M D

### **The Clinical Use of a Prosthesis to Prevent Overdistention of the Remaining Lung Following Pneumonectomy**

JULIAN JOHNSON, CHARLES K. KIRBY, C S LAZARIN, and J A COCKE *J Thorac Surg*, 1949, 18 164

Lucite balls placed in the pleural cavity of dogs following pneumonectomy prevented mediastinal shift, and were well tolerated, as evidenced by autopsy studies 1 year after the operation.

In 8 patients in whom lucite balls were placed in the pleural cavity after pneumonectomy, the mediastinum has remained in the midline, and there have been no apparent complications resulting from the presence of the balls.

The use of a lucite ball prosthesis may be a simple and effective method for preventing overdistention of the remaining lung following pneumonectomy.

SAMUEL KAHN, M D

### **Pyogenic Empyema with Extension Below the Diaphragm**

WILLIAM LEHMAN GUYTON and HOWARD W JONES, JR *South M J*, 1949, 42 359

The authors add 3 new cases of pyogenic empyema to the 12 already described in the literature. The anatomic pathways by which the infection spreads through the diaphragm are discussed. In the first 2 cases the drainage tract extended along the course of

## SURGERY OF THE THORAX

the medial and lateral arcuate ligaments. In the third case, erosion of the diaphragm occurred without following the anatomical spaces. This patient survived the operation and was treated with antibiotics which perhaps offer a more hopeful prognosis inasmuch as the mortality rate to date, in the reported cases, is 50 per cent.

STEPHEN A. ZIEMAN, M.D.

### HEART AND PERICARDIUM

**The Surgical Treatment of the Patent Ductus Arteriosus** P. DECKER *J. internal chir. thor.*, 1949, 1, 63

The three different methods of surgical treatment of the patent ductus arteriosus are described:

1. Ligation of the ductus by two strong, braided silk ligatures, one placed near the aorta and the other near the pulmonary artery. Such a technique, as the simple ligature, has resulted in a relapse of the ductus. That is why the injection of a hypertonic glucose solution into that part of the ductus between the two ligatures has been associated with the double ligature. Also, after placing the two ligatures the occlusion was reinforced by tying over them a small knot similar to that used to ligate the umbilicus, or by wrapping them in cellophane.

2. When the ductus is long enough it is dissected as widely as possible, and then its two ends are ligated with two strong, braided silk ligatures. Two or more transfixed ligatures are placed on the portion of the ductus between the two main ligatures.

3. Resection of the ductus (Gross' technique). The ductus is approached by the anterior route. At first it is dissected along its externoanterior surface, then it is grasped with a blunt clamp. Two unfasted silk knots are placed around it. By pulling first one knot and then the other the ductus can be stretched during dissection. The anterior surface is stripped of its pericardium fold. The ductus is thus afforded an amazing length partly resulting from the fact that by the alternate traction there has been some trespassing upon its aortic and pulmonary artery junctions. The most difficult stage is that of the dissection of the posterior surface. Even when performed by a skilful and experienced surgeon such as Gross the dissection of the posterior wall is long and difficult.

When the ductus has reached a sufficient length, 4 small Crile clamps are placed on it side by side (usually they are special, narrow, blunt clamps). The ductus is then resected between the two clamps in the middle. The middle clamp on the pulmonary stump is removed, and a narrow collar of the ductus wall is exposed. This collar is sutured forward and backward with a thin silk thread and in atraumatic needle. The same procedure is carried out with the aortic end of the ductus, and then the two remaining clamps are removed. After making sure of the stretching of the sutures, Gross places a muscle flap from the thoracic wall between the two lines of obliteration.

Which of these three techniques is the best one? It is difficult to answer this question by a single word. Gross's operation is a magnificent surgical achievement affording security against relapse. But even when it is performed by its creator one cannot help realizing its magnitude. In older subjects with stiffer tissues and more sclerosed vascular walls it is, according to Gross, a dangerous operation. The same can be said when it is used in cases of viridans streptococcus arteritis in which the vascular walls may be extremely brittle. It seems to the author that the real difficulty of Gross's operation lies not in the suture of the vascular stumps, but rather in the dissection of the ductus over a sufficient length to section of the four clamps.

The author is convinced that for a beginner in this operation the placing of a patent ductus arteriosus according to Gross' technique should be restricted to very "good risk" patients, i.e., patients having a somewhat long fistula.

The surgeon performing his first operation for patent ductus arteriosus should, in the opinion of the author, prefer the multiple ligature, at least in the case of short ductus, and resort to resection only when he has acquired a wide experience in this field.

JOHN J. MALONEY, M.D.

**Surgical Treatment of Persistent Ductus Arteriosus** (Traitement chirurgical de la persistance du canal artériel) DE VERNEJOUL AND H. MÉTROS *J. chir.*, Par., 1948, 64, 497

The authors present a brief review of the history of the surgical treatment of persistent ductus arteriosus from the time of its suggestion by Monroe, in 1907, its first clinical application by Graybiel, Strieder, and Boyer, in 1937, the first successful operation by Gross, in 1938, and the first successful operation in a case complicated by endocarditis, by Tourouff and Tuchmann, in 1940. In the past 8 years we have seen chiefly modifications of the technique, with preference for section of the duct, since ligation was followed frequently by recanalization. The chief elements of diagnosis are mentioned, with emphasis on the fact that the continuous murmur can be considered as a conclusive sign of patent duct, only if phonocardiographically demonstrated. It is stressed that the incidence of this anomaly is greater than has been suspected. Most of the patients with this anomaly, if not operated upon, die early or succumb later to endocarditis, the average age at death being 24 years. Prognosis is especially poor in the presence of signs of decompensation.

The elective age for operation is 3 years. The operative mortality is 5 to 10 per cent in noninfected cases, and 50 per cent in infected cases. The details of technique as practiced by leading English, American, and Swedish surgeons are discussed, and the criteria for the selection of ligature or section are indicated.

Ligature may be followed by recanalization, and may lead to sclerosis involving the recurrent nerve and thus cause lasting dysphonia. The wall of the

canal may be fractured and lead to arterial thrombosis by fracture of the intima, or to aneurysm desiccans by fracture of the media. The type of the canal is also a factor in determining the type of treatment. In the case of a large arteriovenous fistula, section and suture are obligatory.

The results of ligature and resection in noninfected and in infected cases reported by various authors, are summarized. Among 734 patients without infection there were 37 deaths, and among 141 patients with infection there were 17 deaths. Gross considers section of the duct as the only certain method of preventing recanalization. In adults from 18 to 20 years of age, section followed by suture is recommended, whereas in young children, ligature may suffice. Postoperative care and the incidence of complications during and after operation are discussed on the basis of reported cases.

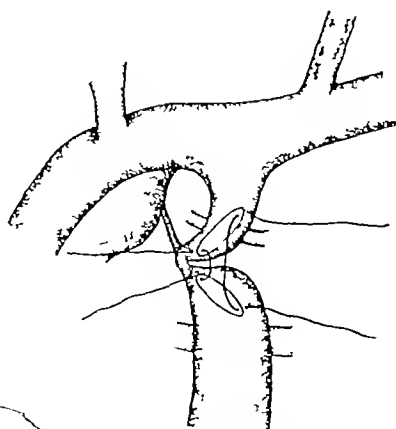
EDITH SCHANCHE MOORE

**The Operative Management of Aortic Coarctation**  
(Die operative Behandlung der Isthmusstenose der Aorta) FR BERNEARD *Chirurg*, 1949, 4 145

This article is mostly concerned with the case history of a 15 year old male with coarctation of the aorta who was successfully operated upon by the author. In connection with the case, the author presents a discussion of the electrocardiographic findings (extrasystoles, lowered ST segments, and myocardial damage), the clinical picture (a blood pressure of 220/230 Hg of mercurv), the roentgenographic picture (notching of the ribs where the collateral circulation develops), photographs of the surgically removed coarctation segment, and a well integrated review of the literature on the subject of coarctation.

In presenting the technique, the author includes a rather clever, side-to-side anastomosis technique which might be used in cases in which the aorta is more or less angulated at the point of constriction.

JANE C MACMILLAN M D



hard) Sketch of side-to-side anastomosis proximal and distal to the coarctation

**A Case of Aneurysm of the Aorta after Resection for Coarctation Cured by Excision** J R. BLICKMAN  
*Arch chir Neerl*, 1949, 1 50

The surgical interest in the subject of coarctation of the aorta has developed after Crafoord and Nylin and Gross published their cases in 1945. Prior to that time the interest was mainly from a casuistic point of view.

It appears that rupture of the aortic wall is the most frequent cause of death (Abbott), and it seems a well established fact that the aortic wall shows changes, especially near the site of constriction. Although most aneurysms have been described proximal to the coarctation, the severest changes of the aortic wall have been found distally. Recently the circumscribed lesion in the aortic wall distal to the constriction has been named by Edwards and his coworkers at the Mayo Clinic as the "jet lesion." On examination of the aortic wall in cases of coarctation they found a well defined lesion of the intima and media. This they considered to be the result of a constant "jet" of blood being squirted through the narrow opening in the constriction, which hit the wall and caused a traumatic lesion.

Several of the aneurysms showed a penetrating tendency toward the surrounding tissues. In 5 older cases cited by Abbott the aneurysm perforated into the pleura, mediastinum, and lung. One of these terminated in a fatal pulmonary hemorrhage.

Leudet, Reifensien *et al* compiled 5 cases of infiltrating aneurysms with open connection with the bronchus. In these cases the aneurysm was always found distal to the constriction.

The first case of a primary aneurysm at the site of the coarctation which was treated by resection was reported in 1948 by Schumacher. Crafoord *et al* reported 1 case with death after resection caused by a false aneurysm, in their opinion death resulted from insufficiency of the aortic suture line.

The author reported this case as an example of the complications which may be expected more frequently as more of this surgery is performed.

A 20 year old girl was, until 1946, free from complaints, even in wartime during which she was in a Japanese concentration camp. On examination blood pressure of 210/110 in the arms and 150/130 in the legs was found. She complained of persistent headache and dizziness.

In May, 1947 an operation was performed by Crafoord in Stockholm. Resection of approximately 15 cm of the aorta with end-to-end suture was performed. It was not possible to resect the entire constricted area, as the aorta was narrowed over a distance between 4 and 5 cm.

Approximately 12 hours after operation a very severe hemorrhage occurred in the mediastinum and pleura, which was controlled by blood transfusions.

The diagnosis of aneurysm was made during convalescence. Further steps were not undertaken as no progression of the size of the aneurysm was found and little or no pulsation was observed. After the patient was discharged the general condition was not

## SURGERY OF THE THORAX

improved. There was no improvement in the headaches and dizziness. She was practically bedridden and only able to move about at home. The blood pressure at that time had improved (160/90 in the arms, 185/140 in the legs).

In March, 1948 the patient suffered a severe pulmonary hemorrhage and the diagnosis of aneurysm was confirmed. On bronchographic examination it appeared that the lung was involved in the process.

On admission to the surgical department of the University Hospital at Amsterdam the well nourished girl in no acute distress was found to have a blood pressure of 190/95 in the arms and 180/130 in the legs. On inspection she showed the scar of the previous operation on the left side of the thorax. A systolic murmur was heard over the heart and posteriorly to the left of the spinal column. The laboratory findings revealed the hemoglobin to be 70 per cent, and the erythrocytes to number 3,790,000.

On June 18, 1948 an operation was performed by Boerema with the assistance of Vermeulen-Cranch, anesthesiologist. The patient was placed in the right lateral position and the thoracotomy wound was reopened. There was scarcely any hemorrhage. The upper lobe was free. A tumor, the size of an orange, was found in the upper lobe. This tumor had invaded the lung in the hilar region and was situated on the descending aorta distal to the left subclavian artery. Commencing laterally, the aorta with its surrounding scar tissue was mobilized. This was especially difficult posterior to the aorta where adhesions with the vertebral column were very dense. It was not possible to free the aorta from the surrounding scar tissue. Two aortic clamps were placed above and below the aneurysm in such a way as to include the surrounding scar tissue. As the tumor was freed from the lung, rupture occurred. The clamps were tightened and bleeding was controlled. The aneurysm was opened and found to be filled with an old organized and fresh thrombotic mass. There was an open communication with the aortic lumen by way of a longitudinal slit, about 2 cm in length. This slit was closed by means of a continuous silk suture. Two flaps from the wall of the aneurysm were used to cover the suture over a piece of gelatin foam. The clamps were removed. Careful closure of the pulmonary lobe defect was done. A wide open bronchus, about 4 mm in diameter, was found. This was the perforation of the aneurysm in the bronchus and therefore the cause of the pulmonary hemorrhages. The opening was sutured. The thorax was closed. The postoperative course was uneventful. A slight hoarseness in speaking was caused by a paralysis of the left vocal cord. It is obvious that the recurrent nerve must have been caught in the clamp at operation.

The fact that it was not possible for the author to determine exactly the location of the slit makes all considerations about the cause highly theoretical. He feels fairly certain, however, that this long longitudinal slit cannot be simply the result of insufficiency of the suture line. Whether the tension on the

aorta was sufficient to damage a degenerated aorta in the wall of the vessel, or whether some mechanical trauma in clamping was the causative factor cannot be shown.

Pathological examination of the aneurysmal wall showed complete aortic wall structure with fresh and organized thrombotic masses. From this the author could conclude that in his case a true aneurysm had formed at or near the site of anastomosis.

The invasive behavior of the aneurysm was not uncommon. The fact, however, that a bronchus was found to be wide open after resection of the infiltrating part of the aneurysm clearly showed that for at least 2 months (date of the first pulmonary hemorrhage) an open communication had existed between the aortic lumen and the bronchial tree.

Recently the patient was re-examined. The general condition had improved considerably. The blood pressure readings were the same as on discharge. Headache, dizziness, and hemorrhages were no longer present.

The article is adequately illustrated.

JOHN E. KIRKPATRICK, M.D.

## ESOPHAGUS AND MEDIASTINUM

**Surgical Treatment of Megadolichoesophagus, Esophagogastrostomy of Necessity or on Principle** (Chirurgie du megadolichoesophage esophagogastrostomie de nécessité ou de principe.) JEAN PATEL and JEAN PAUL BINET. *Presse med.*, 1949, No 20 268.

The authors attempt to demonstrate whether Heller's cardiomyotomy as a treatment for megadolichoesophagus deserves the high repute it enjoys in France, or the relative disrepute into which it has fallen in America. Many writers have found the Heller operation satisfactory provided the myotomy is sufficiently extensive. Most of these surgeons, although not seeking a substitute operation, make an accessory unilateral resection on the left side, or a bilateral resection of the splanchnic nerves. This intervention evidently does not give satisfactory results. In America, the two most popular operations for this condition have been esophagocardioplasty with successful results in 93 per cent of cases, and esophagogastrostomy, which was first suggested by Gosset, in 1903. The fact that this operation is more time consuming has little weight under present conditions of surgery. Some writers have stipulated that in decubitus this procedure facilitates a reflux of gastric contents leading eventually to development of peptic ulcer of the esophagus. It would seem, therefore, that further statistics will be needed to demonstrate the superiority of one or the other of these operations.

The question is then approached as to the procedure to be followed in the event that a cardiomyotomy with adequate myotomy and supplementary splanchnicectomy has not yielded the desired result. Is further surgery justifiable? The authors answer the affirmative, but here again arises the ques-

the upper mediastinum eventually proved fatal. Except for the large recurrent mass which grew into the upper part of the esophagus, compressed the trachea, and involved the right lower cervical and upper mediastinal lymph nodes, no other tumor was found at autopsy.

SAMUEL KAHN, M D

**Thymectomy in the Treatment of Myasthenia Gravis Report Based on 32 Cases** L M EATON, O THERON CLAGETT, C ALLEN, and JOHN R McDONALD *Arch Neur Psychiat, Chic*, 1949, 61: 467

According to the authors, the pathologists have accumulated convincing evidence that there is some relationship between myasthenia gravis and the condition of the thymus gland.

Proper roentgenologic technique reveals evidence of thymic tumor in approximately 15 per cent of patients who have myasthenia gravis. Evidence has been presented to substantiate the claim that this figure closely approximates the true incidence of thymic tumor in this disease.

An analysis of the results obtained in 15 patients who had myasthenia gravis and associated thymic tumor, and in 17 patients without thymic tumor who underwent operation for removal of the thymus gland shows that 60 per cent of patients were improved  $4\frac{1}{2}$  years to one-half year after operation. Although these results are encouraging, they must

not be looked on as conclusive evidence that thymectomy is of value in the treatment of myasthenia gravis, since the course of myasthenia gravis cannot be predicted with sufficient certainty to make it possible to say that remission would not have taken place spontaneously in these cases.

At least, in certain cases in which myasthenia gravis is associated with thymic tumor, the tumor is present before the onset of the symptoms of myasthenia gravis.

On the basis of this study it would seem that roentgen-ray irradiation of the thymus gland may be of value in treatment.

At present, no significant correlation can be made between the result obtained and the duration of the disease, the length of preoperative treatment with neostigmine, or the histologic observations made by the authors in a study of the thymic tissue removed.

The problem of determination of whether a thymus gland removed at operation is or is not hyperplastic is not a static one. Such designations must be considered tentative at this time.

A conclusive opinion as to the value of thymectomy in myasthenia gravis awaits the careful study of a larger number of cases over a longer period, and a comparison of the course in this group of patients treated surgically with the course of a control group receiving medical treatment only.

# SURGERY OF THE ABDOMEN

## ABDOMINAL WALL AND PERITONEUM

**Incidence of Hiatus Hernia and Associated Lesions Diagnosed with Roentgen Ray** IRVING B BRICE *Arch Surg*, 1949, 58 419

An evaluation of the frequency of hiatus hernia diagnosed with roentgen rays was undertaken and at the same time the type and frequency of accompanying lesions were determined. Among 3,448 barium studies of the upper gastrointestinal tract there were found 308 hernias of the esophageal hiatus, an incidence of 8.93 per cent. The diagnosis of this lesion was second in frequency to duodenal ulcer and more than twice as frequent as gastric ulcer or gastric carcinoma. In 1 of every 4 cases of hiatus hernia associated gastrointestinal lesions were diagnosed, which could have been responsible for the clinical picture. There were also 5 cases in which an ulcer niche or crater was noted within the herniated portion.

Clinical study would no doubt reveal that the hiatus hernia was a coincidental finding as regards the explanation of symptoms in some of these cases. On the other hand, the hiatus hernia should not be overlooked as a potential source of symptoms because another gastrointestinal lesion is present. Some of the associated lesions, such as duodenal and jejunal diverticula, are usually, but not always, thought of as being asymptomatic. There is no easy method of determining, in the presence of such combinations, which lesion is productive of the patient's symptoms, since either lesion alone may produce them. Observation and careful attention to the clinical course under treatment will usually uncover the answer to this perplexing problem.

JOHN L. LINDQUIST, M.D.

**Revascularization Following Experimental Mesenteric Vascular Occlusion** RUDOLF J. NOER and JOHN WILLIAM DEER *Arch Surg*, 1949, 58 576

The authors made preparations for injection of the vessels supplying the small intestine in the dog, opossum, and man. The injections were carried out in some instances with liquid latex and in others with India ink. The human specimens were obtained at autopsy, while the animals studied were anesthetized and the injections were carried out during life. Three types of mesenteric vascular interruption were carried out in each species: (1) ligation and division of the intestinal arteries alone to 15 cm loops, (2) ligation and division of the intestinal arteries to 15 cm loops plus the arcuate vessels at the extremities of these loops, and (3) ligation and division as in (2) with the added interruption of all the vasa recta to the segment. Injections were made at pressures between 100 and 150 mm, to approximate the normal arterial pressures. In each type of vascular interruption it was found that the injection produced

vascular filling in loops about 15 cm long. In the third type of vascular interruption the dog was the only animal in which some specimens failed to fill completely at the central portion of the deprived loops.

The intramural circulation contains communications of three general types: (1) direct cross communication between the mural trunks, (2) "plexiform" anastomoses in which the adjacent vessels break up into fine radicles and then anastomose with each other, and (3) arcuate communicating vessels which run parallel to the long axis of the intestine to connect the adjacent mural vessels along the side of the intestine, usually near the antemesenteric border. The first type is best seen in the human intestine and also in that of the opossum. The dog shows chiefly the plexiform type and has direct anastomoses between the mural vessels. It is the authors' impression that this situation best explains the poorer filling seen in the dog loops injected after mesenteric vascular deprivation.

The authors are convinced that the injection method is a convenient one for studying routes available for revascularization, since there is sufficient correlation between survival in animals and the ability to inject such loops to justify inferences based on the results of injection studies. Since the intramural circulation appears to be such an important factor in revascularization, the authors suggest that distention is an obvious hazard to revascularization.

HAROLD LAUFMAN, M.D.

## GASTROINTESTINAL TRACT

**A New Operation for Gastropotosis** ANTON RAABE *Acta chir scand*, 1949, 98 40

The author protests the disregard paid in the recent surgical literature to gastropotosis. The symptoms which the author considers as indications to surgery are: (1) an x-ray view showing a ptosis with the lesser curvature situated at least 8 inches below the umbilical level, (2) considerable emaciation due to anorexia, (3) severe constipation due to the pronounced bend of the pylorus, and (4) symptoms of gastric retention such as distress immediately after meals when the patient is standing erect.

Surgical treatment has never been employed generally for this condition because none of the indicated methods are satisfactory. The stomach is not a fixed organ and it is difficult to find a structure to which it can be fixed. The author considers the pancreas a conveniently situated organ for such purpose. His operation he describes consists of placing <sup>four</sup> sutures in the following manner: three <sup>lesser</sup> sutures are placed at intervals through the lesser curvature and the upper border of the pancreas; the fourth suture is placed in the prepyloric pouch of the curvature and through the rou-

liver When these sutures are tied the stomach is pulled up considerably

During the last 18 years the author has followed 74 patients on whom he has performed this operation. This group is divided into two categories. In the first category, 66 patients are exceedingly well pleased with the results. All these patients are apparently well and can eat all sorts of food without symptoms. The majority of them have gained an average of 20 pounds in weight, and one patient gained 55 pounds. Roentgenographic check-up showed a "good" position of the stomach. In the second category, the 8 remaining patients are classified as "neurotic" by the author. In these patients the results have not been good and, in retrospect, they are considered poor candidates for surgery. The author emphasizes that the operation should be undertaken only when the indications are very definite.

HAROLD LAUFMAN, M D

**The Fate of Patients Following Stomach Operations**  
(Das Schicksal des operierten Magens) FRITZ HRESE *Deut. Gesundheits*, 1949, 4, 142

The late results of 237 operations on the stomach are analyzed and presented in statistical form. Questionnaires sent out revealed that 21.5 per cent of the patients were dead, 34.6 per cent survived, and in 24.0 per cent of the cases the fate was unknown, 19.9 per cent of the questionnaires were ignored. The material is tabulated in detail and summarized in the following table:

	Per cent
Gastric carcinoma	18.2
Benign pyloric stenosis	36.3
Gastric ulcer	18.2
Duodenal ulcer	0.1
Penetrating and perforating ulcer	18.2
Men	85.0
Women	15.0
Under the age of 50	36.4
Over the age of 50	63.6
Hereditary history	36.4
Operative methods: Gastroenterostomy	36.3
Billroth I	6.1
Billroth II	18.2
Polya-Reichel	18.2
Suturing	21.2
Complaints at present	75.6
No complaints at present	24.4
Ulcer at present	18.4
Gastritis at present	30.3
Carcinoma at present	3.3
Limited earning capacity	48.5
Unlimited earning capacity	51.5

Studies of gastric acidity revealed normal values in 42.4 per cent of cases, hyperacidity in 27.3 per cent, and hypoacidity to achylia in 30.3 per cent. Further statistical analysis of the material is presented.

The author concludes that in those patients operated upon for gastric carcinoma, only a certain prolongation of life can be anticipated, and hardly any permanent cures. Of the remaining patients, in-

cluding those with complaints, only a few can be classed as unfit for work. Attention is drawn to the use of a mathematic statistical method of study for avoiding subjective errors of observation.

JOHN L. LINQUIST, M D

**Regional Hypertrophic Enteritis at the Ileocecal Bottleneck, Crohn's Disease** (Entérite régionale hypertrophique localisée au défilé iléo caecal, maladie de Crohn) G. BROHEE, L. DAUMERIE, and G. RICKAERT *Acta gastroenter. belg.*, 1949, 12, 158

The authors discuss the symptoms, the pathologic anatomy, and the treatment of terminal ileitis, and report one case of their own observation.

The disease should be suspected when a patient presents a movable, sausage-shaped mass in the right iliac fossa, with or without subfebrile temperature, and shows any of the following symptoms: attacks simulating occlusion of the bowel, acute crises of abdominal pain without fever, and abscesses in the right iliac fossa or at the cul de sac.

The affection is often mistaken for chronic appendicitis, colitis, postoperative bands or adhesions, invagination, volvulus, mesenteric thrombosis, or intestinal tuberculosis.

In the majority of cases, only roentgenologic examination makes it possible to clinch the diagnosis. The findings include hypermotility, spasm of the ileocecal sphincter, dilatation of the ileum proximally to the affected area (megacolon), moderate to extreme narrowing of the lumen ("cord sign"), rigidity and irregularity of the intestinal wall, especially at its mesenteric aspect which shows indentations, spicules, and fissures.

The pathologic anatomy shows extreme hypertrophy of the muscularis, chronic inflammation of the mucosa, small abscesses in the involved area, fissures, necroses, and sinuses into neighboring organs or in the abdominal wall.

Treatment is surgical only (resection of the affected part of the ileum). Better results are obtained when resection is performed as early as possible in order to prevent complicating stenosis or abscess formation.

WERNER M. SOLMITZ, M D

**The Development of Deep Duodenal Ulcer** (Zur Entstehung des tiefen Ulcus duodeni) VICTOR HOFFMANN *Chirurg*, 1949, 20, 49

In studying many specimens of resected ulcer, the author has often found the ulcer process in a condition which presented a clue to its evolution. He has found histologic evidence of ulceration occurring secondarily in a zone of infarction. Opposite to callos ulcer of the duodenum he has found an area in which the superficial layer of mucosa was preserved, but beneath which a process of degeneration in the submucosa, muscularis, and serosa was evident.

Photomicrographs are presented showing a wedge-shaped zone of degeneration of the entire thickness of the duodenal wall with the point of the wedge directed toward the mucosa. The sharply demarcated wedge of degeneration presents the histologic



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picture of an infarct. It cannot be said, however, that this infarct is a result of thrombotic closure of the vessel, since the broad side of the wedge lies immediately at the vessel barrier. The author is inclined to consider a functional disturbance of circulation (such as spasm), or interference as a result of arteriovenous anastomoses, as the cause of this degeneration.

Two facts stand out which permit the inference that duodenal ulcer is a result of circulatory disturbance: (1) the definite zone of degeneration beneath a preserved superficial layer, and (2) its localization to an area predisposed to ulcer.

JOHN L. LINDQUIST, M.D.

## Treatment of Jejunal Ulcer: A Comparative Follow-Up Study. HENRY K. RANSOM. *Arch. Surg.*, 1949, 58: 684.

This study was made on a group of 81 patients treated surgically for postoperative jejunal ulcer at the University Hospital, Ann Arbor, Michigan, during the past 20 years. Operations performed for gastrojejunocolic fistula or for a malfunctioning or unnecessary gastroenterostomy opening, as well as those for recurrent duodenal ulcer following plastic procedures on the pylorus have been excluded intentionally.

The previous operation which had failed most often in these patients was (1) gastroenterostomy, (2) duodenal exclusion operation, (3) gastric resection, which in this series included 3 pylorotomies.

In the entire series of 81 patients there had been 106 operations, as listed in the following table:

	No. of operations
Gastroenterostomy	60
Devine exclusion	8
Gastric resection	7
Closure of acute perforation	7
Finsterer resection for exclusion	6
Pylorotomy	3
Excision of gastric ulcer	2
Closure of acute perforation and gastroenterostomy	2
Dismantling of gastroenterostomy mechanism	1
Gastroenterostomy and excision of duodenal ulcer	1
Vagotomy (abdominal)	1
Plastic to jejunal ulcer	1
Jejunojunostomy	1
Gastrostomy	1
Closure of gastrostomy	3
Unknown	106
Total	

Among the 9 gastric resections which failed, 2 small resections which were scarcely more than pylorotomies had been performed, in the remaining 7, one half or more of the stomach had been removed. In these 7 cases the reconstruction had been made by the posterior Polya method in 3, the anterior Polya method in 1 case, and the posterior Hofmeister method in 2 cases, all without enterostomy. The exclusion operation of Devine was done in 8 instances and Finsterer's resection for

exclusion in 7 additional ones. The total experience with exclusion operations at the University Hospital may be summarized briefly as follows: Data available on 22 cases of primary duodenal ulcer treated by the Finsterer type of resection for exclusion, 14 similar cases in which the Devine exclusion method was used, and 29 cases in which the Finsterer procedure was modified by "exenteration" of the antral mucosa. The results in these three groups are:

1. Finsterer—7 patients are well, 5 were benefited, and 10 are in poor condition.
2. Devine—2 patients are well, 3 were benefited, and 9 are in poor condition.
3. Finsterer with exenteration—25 patients are well, 1 patient was benefited, and 3 are in poor condition.

When treating a patient with jejunal ulcer, the operator must be governed considerably by the previous operative procedure, the condition of the patient, the technical difficulties present, and to a certain degree by his own preferences. In this series of patients there were 6 deaths, 1 of which occurred in the dismantling of a gastroenterostomy from peritonitis, 1 from intestinal obstruction in a similar procedure, 1 from hemorrhage, 1 from peritonitis due to the resection, 1 from pancreatitis and peritonitis following an antral excision, and 1 from inanition due to jejunostomy.

Of the 75 remaining patients, 52 are alive and 23 are dead. The causes of death in these 23 were:

	Cases
Recurrent ulcer	0
Reoperation for recurrence	5
Coronary thrombosis	3
Pneumonia	2
Hypertension and myocarditis	2
Cerebral hemorrhage	1
Accident	1

This article included a study of vagotomy, which was employed in 64 cases with the following results: good in 41 (64.1 per cent), fair in 17 (26.5 per cent) and poor in 6 (9.4 per cent).

In the definitive treatment of gastrojejunul ulcer following gastroenterostomy, the dismantling operations with restoration of the gastrointestinal tract to normal have proved unsatisfactory, and there would now seem to be few if any indications for their use. An adequate gastric resection, on the other hand, probably offers the greatest chance of cure. When recurrence follows a conventional or an exclusion gastrectomy, the status of the original resection should be carefully evaluated. If the antrum remains or if the resection was small, a resection that is adequate as judged by present day standards, is indicated. When recurrence is encountered in patients who already have been subjected to an acceptable resection, vagotomy affords a new and promising mode of treatment, whereas formerly, for this group of patients, only total or nearly complete gastrectomy remained.

SAMUEL J. FOGELSON, M.D.



Present Concepts in Ulcerative Colitis A W Morrow  
*Med J Australia*, 1949, 1 403

Ulcerative lesions of the large bowel are produced by many diseases, the best known are bacillary dysentery, tuberculosis, lymphogranuloma venereum, amebiasis, and uremia. However, in many cases, no etiologic factor can be determined and the disease has been variously named idiopathic ulcerative colitis, nonspecific ulcerative colitis, or thromboembolic colitis. Sir William Osler is said to have described the disease in 1875. The malady may be defined as a disease or group of diseases of unknown etiology, characterized clinically by diarrhea (bloody at some stage), crampy abdominal pain, fever, anorexia, anemia, asthenia, and weight loss, remissions and exacerbations are frequent and unpredictable, and during the active phase sigmoidoscopic examination usually shows an ulcerated mucosa.

Under etiology the author discusses the factors of infection, allergy, dietary and vitamin deficiency states, neurogenic and psychogenic concepts, and the enzymatic (lysozyme) theory. There is no one primary etiologic factor. Infection plays a large part in the clinical manifestations but it probably follows some other factor which alters mucosal resistance. Also local allergy may play a part and should be considered in the treatment. Emotional disturbances are undoubtedly concerned in exacerbations and relapses, and if they can be shown to be the causal factor in the production of excess lysozyme, then perhaps the disease may be regarded as primarily neurogenic.

Clinically, the disease has not changed through the years, but recently certain manifestations have been noted more often.

Crohn called attention to segmental, regional, and right-sided colitis in 1925. He states that in this subgroup the process begins in and is commonly limited to, a segment or segments of the proximal part of the colon. The characteristic history of the disease is a progressive march to the left, until by skip lesion or by continuity the whole colon from cecum to sigmoid may become interruptedly or continuously involved. The local signs and symptoms such as bloody diarrhea and straining are less severe, but constitutional symptoms such as fever, joint pains, and anorexia are more apparent. The condition is amenable to surgical short-circuiting procedures. Sigmoidoscopic examination may reveal a normal mucosa. Occasionally the terminal portion of the ileum is involved, in which instance the condition is usually grave.

It has been commonly believed that the disease is inevitably progressive from the rectum to the cecum, but evidence has suggested that in the majority of patients the disease attacks the colon either partially or completely during the initial episode and usually remains relatively stationary in distribution thereafter.

The extent of involvement as shown roentgenologically is not correlated directly with the type of onset, the duration of symptoms, or the clinical

severity of the disease. Roentgenologically, the colon may appear normal in a patient with clinical evidence of the disease, and occasionally the colon appears extensively involved in a patient with minimal clinical signs. Sigmoidoscopy and stool examination are essential in order to determine the pathological state of the bowel.

Undoubtedly, severe liver damage occurs in cases of extensive ulceration, but the incidence of liver disease is probably no higher than in some other diseases which cause chronic protein deficiency. This systemic effect of the disease should not be neglected by the clinician.

Malignant degeneration is an important complication of chronic ulcerative colitis. The incidence was 3.2 per cent in 871 cases at the Mayo Clinic and 2 per cent in 450 cases at the Lahey Clinic. Morrow re-emphasizes Cattell's point that the incidence of malignancy is high in children and that it may occur in patients who have been in remission for years, and in a colon which has been excluded by ileostomy. Undoubtedly, malignancy is much more frequent in the bowel of a patient with ulcerative colitis.

In treatment, the main objectives have not changed, they are control of the symptoms, arrest of the inflammatory lesion, and prevention of invalidism. There are no specific therapeutic measures. Reliance must be placed on palliative and supportive measures such as control of diarrhea by opium, papaverine, belladonna, bismuth and kaolin, correction of malnutrition, blood loss, and protein depletion, eradication of other foci of infection, and attention to the psychogenic factors. In addition to the general measures, varying methods are in use for the treatment of the inflammatory process in the colon. At present a chemotherapeutic and antibiotic approach, locally and parenterally, seems most successful. If the colon can be put at rest, the effect of the therapeutic combination used will be enhanced. Ileostomy will do this but it is permanent. The author gives two methods of placing the colon at physiologic rest, at least for a short period, to assist other therapeutic measures, they are total intravenous alimentation and medical ileostomy.

The author reports on 4 patients treated by total intravenous feeding, the period extending from 8 to 13 days. Various casein digests, glucose, saline solution and blood transfusions, parenteral liver extract, and vitamins were used. The total fluid intake was approximately 3 liters daily. Only sips of water were allowed by mouth. Within 48 hours, bowel actions ceased in 3 of the 4 patients, the fourth having one to two movements a day throughout the period. Fever subsided in 2 patients. One patient remained in remission after cessation of the therapy, the 3 others relapsed when oral feeding was started but their general condition was much better. The sigmoidoscopic examination showed no great improvement, in contrast to the clinical state. During this period there was no sensation of thirst,

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and the colicky abdominal pains ceased. Bowel actions occurred if anything additional to sips of water was taken by mouth.

In medical ileostomy the aim is to pass a Miller-Abbott tube to the terminal portion of the ileum and then to apply continuous suction. By these means, small bowel contents are prevented from entering the large bowel. Fluids of a high protein, high carbohydrate, and high vitamin content are given freely by mouth. The purpose is to supply adequate nutrition and at the same time to place the large bowel at rest. Frequent fluoroscopy is necessary to determine the location of the tip of the tube. This is sometimes distressing to a seriously ill patient. Considerable skill and constant attention are required to keep the tube in position and functioning. There is a constant tendency for the tube to pass into the colon, which is indicated by increase in the frequency of bowel movements or diarrhea and abdominal pain. Because of these factors the method may have to be abandoned in some cases. If position of the tube can be maintained, the results are gratifying. These two methods are helpful, and for the acutely ill patient who is rapidly deteriorating either method may be life-saving.

EDWIN W. PASSARELLI, M.D.

### Ulcerative Colitis The Ileostomy Life E. E. Dunlop *Med J Australia*, 1949, 1 399

Experience has shown that ileostomy and colectomy are the most important surgical procedures for the treatment of nonspecific ulcerative colitis. Extensive initial operations are contraindicated because of the condition of the patients, therefore, ileostomy is employed both as a form of treatment per se and as a preliminary measure to colectomy.

In favorable cases, especially when diseased segments of bowel can be removed, it may be possible to restore alimentary continuity without relapse or deterioration. When there is heavy involvement of the rectum, especially when extensive perirectal suppuration and fistulas are present, such an artificial anus should not be made without consideration of the fact that subsequent closure might involve a great risk of relapse. Some patients will not regain health without complete excision of the colon and rectum. In a disease which presents such chronic and intractable forms, it may be wise to allow prolonged periods to elapse between the stages of operation. Good management is of great importance.

There is a natural prejudice against an artificial anus of any type that is shared by doctors and patients alike. Some doctors have shrunk from surgical treatment because of misconceptions of the magnitude of the difficulties, dangers, and discomforts of ileostomy drainage.

The objections to ileostomy are stated as continued soiling with fluid feces, disturbances of the metabolism and nutrition, digestion of the skin, frequency of the formation of abscesses and fistulas, and the incidence of strictures of the colon due to

The author answers the objections as follows. Ileal discharge thickens postoperatively and is not as offensive as in colostomy drainage. No lasting disturbance of the metabolism occurs, as evidenced by many clinical observations including those in Japanese prison camps. Excoriation and redness of the skin are likely to occur if the skin is permitted to be continually moist, but the contents of a healthy ileum will not cause digestion of the tissues nor failure of wound healing. The author relates abscess formation and fistulas to errors of operative technique and particularly to the exteriorization of the diseased ileum. The scarring must be attributed to the severity of the disease itself, because in long standing, severe damage with extensive loss of mucosa scarring is inevitable and structure may take place.

Although the objections are not well grounded, ileostomy is an inconvenience. It has not been shown that temporary ileostomy will cure the disease at any stage and an apparent complete remission may be followed by relapse. The author suggests that the operation is indicated as the initial step in surgical treatment (a) when failure of medical treatment associated with grave deterioration has occurred in fulminating, acute, or chronic cases, and (b) when serious complications arise. The author uses Bargen's outline of complications (a) perforation, threatened or present, (b) repeated hemorrhages, (c) fistulas and sinuses associated with the colon or rectum, (d) stenosis and obstruction associated with extensive colitis, (e) polyposis (pseudopolyposis), and (f) carcinoma of the large bowel. The last is not infrequent in long standing ulcerative colitis with pseudopolypoid changes.

Preparation for ileostomy in the absence of grave emergency consists in the correction of dehydration, chloride depletion, anemia, and hypoproteinemia by intravenous methods or high caloric, high protein, low residue diets and added vitamins.

For these sick patients, the initial operative procedure should be simple and of as short duration as possible. The author prefers a double-barrelled ileostomy through the right lower rectus for the reason that it will usually insure sufficient improvement for colectomy to be performed in a single stage, then the proximal limb of the ileum may be transferred to a similar site on the left side where it is brought out with the distal stump of colon.

The author stresses three points of technique as follows:

- 1 The long exploratory incision should be avoided except when there is a special indication, and the temptation to examine the friable colon should be resisted. The site of the incision is dictated mainly by comfort for the patient in wearing an ileostomy bag, which necessitates a stoma below the belt away from the anterior superior iliac spine, the umbilicus, and the inguinal fold.

- 2 The site is of great importance in view of subsequent wound suppuration and fistula formation because the terminal ileum is frequently

volved in the disease process. The site selected should be at least from 12 to 18 inches from the ileocecal junction.

3. In fixation the selected loop is withdrawn and first the mesentery and then the bowel are divided. Soft flexible tubes of good internal bore are fixed in both limbs in a water-tight fashion. The two limbs with the contained tubes are so placed in the wound so as to allow a projection of about 1 inch of bowel, and the functioning stoma is placed below the other. It is necessary only to suture the ileal mesentery to the wound incision with an interstitial mattress suture through all layers of the abdominal wall and an avascular area of the mesentery. Abscesses and fistulas about the stoma usually arise from needle punctures in diseased ileum.

Postoperatively, the afferent tube is irrigated in the operating room to be sure it is open, the bowel is covered with vaseline gauze, and the wound is not disturbed from 7 to 9 days, when the tubes loosen. The skin is healed sufficiently for a bag to be applied. Morphine is valuable in the early stages. Fluids by mouth are permitted on the day of operation, and on the next day a soft, low residue diet with ample vitamins is started. This promotes an ileal discharge. Hiccup, abdominal pain, distention, and vomiting may accompany cessation of the drainage. Obstruction is most often due to roughage in the diet and this should be avoided in the first few weeks when the exteriorized bowel is edematous. Treatment may involve finger dilatation, irrigation of the obstructed loop, or Wangenstein suction to the ileum. Attention to fluid balance must be thorough because the discharge at this stage may be from 50 to 60 fluid ounces a day. Skin excoriation is usual at first, but this passes as the skin becomes inured to irritation; tannic acid jelly may be of help. When signs of active colitis and toxicity persist, colon lavage may help, occasional good results have been noted with sulfaguanidine suspended in saline solution and with phthalylsulfathiazole.

The ileostomy stool following the compensatory changes is nonoffensive and alkaline in reaction. The stool thickens in a few weeks and is usually semiformed by 3 months. When the largest meal is in the evening, the discharge is most profuse in the early part of the night and there is relatively little in the mornings. The bags are usually emptied from 3 to 6 times daily. Those patients who cease to have rectal motions usually prefer to wash the colon instead of removing the debris at 1 or 2 week intervals. The essential features of a suitable bag are accurate fit and ease in emptying; it should also prevent soiling of the skin. With all types of bags, prolapse of the ileum may occur occasionally, especially if the patient continues strenuous pursuits. A restriction of roughage is essential for a few weeks after the operation. The patient soon learns which foods cause an unfavorable reaction and most patients find no restrictions necessary after a few months.

The mortality rates are determined largely by the condition of the patients prior to operation and the range is therefore wide, varying from 3.8 per cent to 23 per cent in different series.

Early treatment by ileostomy is advocated by some surgeons before changes in the large bowel become irreversible so that eventual disconnection of the ileostomy may be practical. The author cites Lattell's criteria for closure: complete remission for at least 12 months, no ulceration on sigmoidoscopic examination, and x-ray evidence that the colon has a satisfactory lumen and some flexibility as shown by haustral markings. Relapse occurs frequently, even under these favorable conditions so that closure of the ileostomy has only limited application. For the type of patient seeking surgical aid at present, colectomy is usually advisable, and some types require excision of the rectum as well. When the rectum shows apparent healing after colectomy, ileo-rectal or ileosigmoid anastomosis may restore continuity. The period of "dysfunctioning" of the rectum should be prolonged, restoration of continuity by the crushing clamp method is much safer than by suture.

The relief from distressing invalidism experienced by most of these patients gives them a cheerful mental attitude so that many find it possible to return to their normal occupations and to live a full life.

EDWIN W. PASSARELLI, M.D.

#### Ulcerative Colitis: Clinical Features, Diagnosis, and Treatment. GEOFFREY A. PENINGTON. *Med J Australia*, 1949, 1: 405.

The initial manifestations of ulcerative colitis are usually acute diarrhea, followed by the passing of blood-stained mucus in gradually increasing amount, mild fever, anorexia, and malaise. In other patients the onset is insidious, extending over a period of several weeks with the gradual development of uncontrolled diarrhea and ill health. In some instances, there is a history of recurrent attacks of diarrhea and normalcy extending over several weeks. A fulminating onset may occur.

The clinical features of ulcerative colitis are readily understood if the pathology and morbid anatomy are considered. There is a gross inflammatory reaction in the mucosa with actual destruction resulting in ulceration, which may extend deeply into the muscularis and actually cause perforation. The surviving mucosa is edematous and even inflamed. Infiltration of the whole thickness of the intestinal wall may be present with thickening, pericolic inflammation, adhesions to neighboring viscera, and the formation of abscesses and fistulas. Remote complications due to bacteremia or toxemia are common. Attempts at healing result in fibrosis with stenosis and shortening of the bowel and mesentery. The peristalsis is abnormal. Intestinal contents become abnormal, and blood, pus, and serous exudate are present. The bacterial flora is altered and recognized pathogenic organisms are often present. The personality of the patient is inevitably affected by the na-

## SURGERY OF THE ABDOMEN

ture of the illness and the physiologic activity of the whole alimentary tract is upset.

The author directs particular attention to the personality, toxemia, nutritional changes, intestinal manifestations, and local and remote complications. That personality changes occur in these patients is undoubted, these changes occur to such a degree that there have been protagonists of the psychogenic causation of the disease. Immaturity, childishness, emotional instability, dependence, sensitiveness, over conscientiousness, fussiness, anxiety, and fear of failure, may be present singly or in combination. It is obvious that social, economic, or domestic difficulties cannot fail to have a profound effect on such individuals, and aggravation of existent lesions would be inevitable in greater or lesser degree. However, it remains to be proved that psychogenic factors actually cause ulcerative colitis. Many clinicians of repute have asserted that colon neurosis does not progress to ulcerative colitis.

Toxemia is always present and is manifested in intermittent fever, sweats, tachycardia, loss of weight, malaise, anorexia, headache, and lesions remote from the colon, namely, arthritis, ocular disease, renal lesions, thrombosis, inflammation of serous membranes, and splenomegaly.

Emaciation may be extreme, it is due not only to decreased caloric intake as a result of a poor appetite, but to the loss of blood and protein, disordered digestion, and increased catabolism from toxemia. Too often the caloric value of food has been wrongly reduced in order to obtain a diet with no residue. Severe hypochromic anemia and low serum protein content, especially the albumin fraction, are in some measure the result of toxemia, but they are aggravated by deficient diet and by persistent loss of blood and protein from the ulcers. Leucocytosis usually indicates the presence of complications. Avitaminosis is seen as the result of deficient diet aggravated by the use of sulfonamides and defective absorption from the intestinal mucosa.

The intestinal manifestations are disordered motility, toxemia, defective absorption, abnormal intestinal contents, and exudation from the mucosal lesions resulting in loss of appetite, colicky lower rexia, vague abdominal discomfort, colicky lower abdominal pain, and diarrhea with small, liquid, offensive stools containing fecal material mixed with blood, pus, and varying amounts of mucus. Defecation is often prurient but anal symptoms result from the frequent evacuations, and excoriation, hemorrhoids, and even prolapse of the mucosa may occur. Sleep is disturbed, vomiting is uncommon except in the fulminating cases, but when present may be well nigh uncontrollable. Abdominal tenderness is minimal over the course of the colon. The ileum may be felt as a firm, tender, cylindrical mass. Rectal examination provides little useful information, but must be done.

Local complications are the direct result of spreading of the inflammation, penetration of the mucosal layer, or of attempts at repair. The mucosa be-

tween the ulcers is greatly swollen and may resemble polyps, both radiologically and sigmoidoscopically. Fibrosis may be present in adjacent areas, and the contraction resulting from healing of the ulcers causes narrowing of the lumen which is further augmented by the swollen mucosa, and may produce partial obstruction. An apparent stricture may be due principally to mucosal swelling, and, with remission of the disease, the lumen returns to approximately its normal diameter. Actual strictures, in addition to these pseudostrictures, do occur. Pericolic inflammation, adhesions, fixation of the colon, shortening of the mesentery and shortening of the colon develop in the uncontrolled disease. Abscess formation and fistulas are the direct result of extension from the intestine.

Carcinoma of the colon in association with ulcerative colitis is higher in frequency than in the general population. Whether there is any causal relationship between these diseases is a matter of conjecture. It is very important to exclude the presence of carcinoma in these patients.

Hemorrhage from the colon is present to some degree in every case. Ileostomy decreases this tendency, but does not obviate it. This is readily understood if the pathological picture of the lesions is considered. Severe hemorrhage with a fatal result is more likely to occur at a late stage of the illness. Hemorrhage may actually be the presenting symptom and may wrongly be attributed to hemorrhoids. The bleeding is in a large measure responsible for the severe hypochromic anemia found in ulcerative colitis.

Perforation of the colon and general peritonitis occur rather frequently in fulminating cases, perforations may be multiple. Ileostomy is part of the emergency treatment in such cases.

The remote complications result chiefly from toxemia and are not particularly characteristic of ulcerative colitis, polyarthritis is common, the pleura and pericardium may be the site of inflammatory reactions, endocarditis occurs. Septicemia may terminate the illness. Renal lesions producing the nephrotic syndrome and splenomegaly are due to the toxemia. The presence of hepatic damage may be partially responsible for the low blood proteins. Thrombophlebitis has occurred even after ileostomy. Ileostomy does not obviate the complications although the local lesions are spared from aggravation.

The course of the disease varies according to its severity and mode of onset. In fulminating illness, perforation is a frequent cause of death early in the disease. In less severe cases there is great variability in the natural history. Spontaneous remissions and relapses make assessment of therapeutic difficult. Fevers may be very slight in spite of progressive deterioration both locally and generally. The complications may become the predominant clinical features. Prolonged remission of many years' duration may simulate cure, but eventual relapse after 10 to 20 years shows the unpredictable course of the disease. Ileostomy and subsequent colectomy appear to be the most suitable means of attaining reasonable h-

in intractable cases—those showing progressive deterioration, lack of response to adequate medical treatment, or severe toxemia

The diagnosis of ulcerative colitis is made by exclusion of conditions resembling it and by recognition of its specific features. Colon neurosis must be excluded, it must be remembered that this may be superimposed or may result from an organic lesion. Chronic dysentery, protozoal and helminthic infestations may be difficult to differentiate, but a competent pathologist can usually provide positive evidence of the cause. Actinomycosis, tuberculosis, lymphogranuloma venereum, Crohn's disease, carcinoma, polyposis, hemorrhoids, diverticulitis, mercurial poisoning, uremia, and thyrotoxicosis can be excluded by careful history, thorough physical examination, and appropriate investigations. Granular proctocolitis (hemorrhagic proctitis) is probably the most difficult condition to differentiate from early ulcerative colitis. In this stage they may exactly resemble one another. The only certain method of differentiation is in the fact that granular proctitis does not progress to frank ulceration, is not accompanied by a profound general disturbance, and eventually resolves. Recurrences are seen but the patient never presents the general clinical picture found in ulcerative colitis.

Among the diagnostic procedures used in disorders of the rectum, sigmoidoscopy is the most important and should always be performed if digital examination shows no contraindication. The clinical history must include a social and personal history, occupational and environmental history, past and present, inquiry regarding dysenteric infection, protozoal or helminthic infestations and the administration of mercury.

Macroscopic and microscopic examination of feces is made for pus, mucus, and blood, microscopy involves a search for cells, ova, amoeba, cysts, and organisms. Cultures are necessary for pathogenic organisms. Frequent blood counts must be made. Serum protein levels give an indication of toxemia. Agglutination tests are performed if there is increased temperature, and blood culture may provide valuable information. Roentgenography of the colon by means of the barium enema is of great value in determining the extent of the lesions and in excluding carcinoma, polyposis, stricture, etc., but an accurate diagnosis of the state of the colon cannot be made from the x-ray picture alone. A drastic purge must never be given to a patient suspected of having colitis prior to this examination because of the real danger of precipitating a relapse. The examination alone causes some general and local disturbance. A fractional gastric analysis is of no diagnostic importance, but may help in management. Allergy tests should be performed if there is any reason to suspect an allergic factor. Mantoux, Kahn, or Wassermann tests and chest roentgenograms should be routine practices.

Chemotherapy is a means of combating infection in the lumen of the bowel and some attempt must be

made to destroy organisms actually in the wall. It is practically impossible to determine whether the organisms are susceptible to sulfonamides or penicillin, but there is reason to believe that toxemia is controlled in some measure by their use. There is preference for phthalylsulfathiazole and penicillin used simultaneously in full recommended dosage or larger. The patient must be kept at rest in bed and given sufficient fluids to overcome dehydration. In addition, the diet must be carefully arranged to provide a high caloric value (3,000 calories or more), high protein, high carbohydrate, high vitamin content, but little residue. The residue must be soft and not mechanically irritating. Vitamin supplements are given, especially vitamins A, B, C, and K. Increases in diet must be made gradually and with resumption of a more normal diet, care must be taken to avoid indigestible substances. Blood transfusion will correct the anemia, frequent small transfusions are preferable to infrequent large ones. The social, economic, and domestic difficulties must receive attention oftentimes by the psychiatrist. Symptomatic therapy by use of antispasmodics, sedatives, and adsorbents is necessary for control of pain, diarrhea, hiccup, malaise, headache, cramps, and disturbed sleep. The only surgical procedure that can be effective in affording some rest to the damaged colon is ileostomy. The improvement in the patient's general condition after operation is remarkable. Operation should not be a last resort in treatment of a moribund patient. If there is progression of the lesion, continued loss of weight and strength, uncontrollable toxemia and a certain diagnosis of ulcerative colitis, ileostomy should be performed without delay. Colectomy must follow. Only if the rectum is not involved is it reasonable to consider later anastomosis of the ileum and rectum. Lesions remote from the colon must be treated as necessary, but colectomy is the only sure means of obviating such complications.

EDWIN W. PASSARELLI, M.D.

**Discussion on Hirschsprung's Disease** T. TWIST, INGTON HIGGINS, F. DOUGLAS STEPHENS, MARTIN BODIAN, and RICHARD MEYER. *Proc. R. Soc. M., Lond.*, 1949, 42, 221.

In the reported discussion, the authors reach similar conclusions on Hirschsprung's disease.

Hirschsprung's disease, or megacolon, may be classified as

1. Acquired (or "pseudo") Hirschsprung's disease in which comparatively simple treatment affords a good prognosis.

2. True Hirschsprung's disease of a mild type, in which the distal segment is relatively short and wide. Simple treatment by spinal anesthetics or other conservative measures may give relief, and the prognosis is relatively good.

3. True Hirschsprung's disease of a severe type, in which the distal segment is long and narrow. The clinical picture is intractable and relentless from birth. Treatment by spinal anesthesia and symp-

thectomy does not afford effective relief, and the only alternative is surgical resection of the distal obstructive segment, upon which it has been learned to focus attention rather than on the dilated proximal loop of bowel. Removal of the dilated bowel will not remove the obstruction and the new proximal loop will undergo identical dilatation. It seems that the crux of the matter must lie in the distal segment in the severe type of the disease, and this etiologic factor must be removed.

SAMUEL J. FOGELSON, M.D.

**Emetine and Appendicitis** (Emetin und Appendicitis) EDUARD MELCHIOR. *Helvet. chir. acta*, 1949, 16: 126

The author's report, from the Chirurgischen Klinik des Numune Hastanesi, Ankara, is based on the experiences of the author in the use of emetine as a supportive measure following surgery for acute appendicitis when profuse generalized purulent peritonitis is encountered. The author states that cases in which there was a stormy postoperative course were controlled quite rapidly when the patient was given emetine. Several case histories are presented in support of this thesis. It would appear from the evidence presented that the administration of this drug was followed almost invariably by a remarkable diminution in fever, leucocytosis, and other toxic manifestations. The drug was used also in a number of cases after drainage of an appendiceal abscess. No evidence is presented to indicate that these patients were afflicted with amebiasis, although this possibility is discussed. The favorable effect of emetine is considered to be due not so much to its bactericidal action as to the fact that it is "antitoxic."

HAROLD LAUFMAN, M.D.

**Volvulus of the Sigmoid Loop** (Volvulus del asa sigmoidea) ALFREDO PIERINI. *Dia. med.*, B. Air, 1949, 21: 526

The author reports the results of his observations on 11 men and 7 women suffering from volvulus of the sigmoid.

Torsion of the mesosigmoid causes occlusion of the corresponding part of the gut, and strangulation of the blood vessels and nerves in the mesosigmoid. Volvulus occurs with greatest frequency in the fourth, fifth, and sixth decades of life. Its predominance in the male sex is more apparent than real, because in women a spontaneous detorsion is facilitated by the wider pelvis.

A redundant or an abnormally long sigmoid or megasigmoid is a predisposing factor. The condition may be of a congenital or acquired nature. Congenital abnormalities of the mesocolon, such as an unusually large formation, and abnormalities caused by mesosigmoiditis, adhesions, constipation, diarrhea, exclusive vegetarian diet, or the habitual use of laxatives may predispose to a volvulus of the sigmoid.

Among the determining factors, the following must be mentioned: sudden contraction of the

abdominal wall, brisk movements of the body, hyperperistalsis caused by cathartics or food, and rotation of the body transmitted to the distended sigmoid.

The torsion may be partial (less than 360 degrees) or total (360 degrees or more). Acute, chronic, and recurrent types may be distinguished.

Roentgenologic studies and rectosigmoidoscopy are indispensable in arriving at a diagnosis of the condition.

Conservative treatment, consisting of enemas administered in the knee-chest position, can be employed only in exceptional cases.

Surgical disengagement of the volvulus, with or without sigmoidopexy, does not prevent recurrences if a megasigmoid is present. Enteroanastomosis between the transverse colon and the sigmoid, or between the sigmoid and the cecum, is an unreliable method. A one-stage colectomy with an end-to-end anastomosis is the method of choice if the patient is not very old and his general condition is good; otherwise a two-stage colon resection, according to the Paul-Mikulicz technique, is recommended by the author. The spur is crushed 10 to 15 days after the second stage of the operation.

JOSEPH K. NARAT, M.D.

**Critical and Experimental Studies of Sutures of the Colon in Dogs** (Etude critique et expérimentale des sutures coliques chez le chien) D. GEROTA, K. PAMBUCCIAN, and F. SCOBATU. *Acta gastroenter. belg.*, 1949, 12: 81

The authors report the histologic findings following sutures of the colon in a series of 45 dogs. The animals were divided into three groups. In the first group of dogs, total transverse resection and end-to-end anastomosis was done. Catgut (No. 00) was used for the mucosa, and linen thread for the serosa. In the second group, linen was used for both layers. In the third group, the same technique was applied, but in addition the anus was closed by linen sutures for several days in order to test the solidity of the sutures in the colon.

The authors arrive at the following conclusions although the same stages of healing are observed in sutures of the colon as in sutures of the stomach and duodenum, regeneration is slower and there is more likelihood of complications. This is probably due to the consistency and the bacterial contamination of the feces.

The fibrinous exudate of the peritoneum following the operation plays an important role in the prevention of bacterial invasion from the intestine; in addition, it forms a base for the development of scar tissue.

Continuous suture is not inferior to separate sutures, however, with separate sutures, a more exact fitting of the wound edges is assured. Infections and ulcerations are more apt to occur when linen is used in place of catgut for the mucosa. Voluminous knots should be avoided as they present an obstacle to the elimination of the threads.

WERNER M. SOLMITZ, M.D.



**The Treatment of Carcinoma of the Rectum with Special Reference to the Preservation of the Sphincter Mechanism** ROBERT MAILER. *Edinburgh M J*, 1949, 56 13

After reviewing the literature on carcinoma of the rectum, the author analyzes 19 cases of carcinoma of the rectum observed during the past 3 years. These patients were treated by "resection with restoration of continuity." The operations performed on these patients were divided into five groups (1) resection and primary anastomosis entirely from above, 11 cases, (2) abdominosacral resection with anastomosis, 3 cases, (3) abdominosacral mobilization with Hochenegg "pull-through," 3 cases, (4) sacral "cuff" resection with anastomosis, 1 case, (5) pre-anal resection and anastomosis, 1 case.

In the first group of 11 patients there was one death, and all but one (or 9) of the remaining patients have remained well to date with perfect sphincter control. Groups 2 and 3 comprised 6 patients, one of whom died, the remaining 5 developed fistulas and posterior space infection, and convalescence was prolonged. Two of the patients had local recurrence within 1 year of the operation and in both of these patients sphincter control was imperfect. Another patient had necrosis of the lower segment of the sigmoid, and 2 more developed severe stricture at the line of anastomosis. Thus, none of the patients in these groups obtained good results. The limited number of patients in groups 4 and 5, and the short period of observation hardly permits any significant conclusion from this material.

SAMUEL J. FOGELSON, M.D.

**Advantages of End-To-End Anastomoses with Separate Sutures in Surgery of the Gastrointestinal Tract** (Avantages des anastomoses à points séparés terminoterminals en chirurgie digestive) A. SAMAIN. *Acta chir. belg.*, 1949, No 1 25

The author discusses the advantages of separate over continuous suture and of end-to-end over end-to-side anastomosis in surgery of the gastrointestinal tract. Separate sutures are preferable because, (1) by not disturbing the vascularization an optimal blood supply is maintained and necroses of the intestinal wall is avoided, (2) by sparing the longitudinal and transversus muscles normal peristalsis is assured, whereas, by continuous suture the motility of the smooth muscles may be impeded and may lead to postoperative complications, and (3) non-absorbable suture material can be used with greater safety in separate sutures than in continuous suture. If a single linen suture is not tolerated and is eliminated, no harm is done, whereas, in continuous sutures, giving of the suture may lead to disaster. The author uses linen thread only in all resections.

End-to-end anastomosis permits better motility and prevents the formation of a cul-de-sac which may give rise to stasis and sinuses. Moreover, it is simpler from the technical point of view and goes farther in restoring the normal anatomic structure of the intestine.

WERNER M. SOLMITZ, M.D.

**Continuous Suction Drainage** JOHN R. PAINE. *J. Am. M. Ass.*, 1949, 140 149

Internists first developed the duodenal suction tube for diagnostic purposes. This work was started in the late nineteenth century. In 1921 Levin, of New Orleans, developed the smooth-tipped tube that could be passed through the nares and tolerated for a long period of time by the patient.

Wangensteen's contribution was antedated by sporadic reports of the use of such tubes for treatment by Westermann in 1910, Kappis in 1911, Kanavel in 1916, and Matas in 1924.

Ward, of San Francisco, described the use of continuous gastric or duodenal suction through a Jutte tube in the treatment of general peritonitis, postoperative ileus, intestinal obstruction, and acute gastric dilatation.

Wangensteen was not aware of Ward's work in 1931. About this time a man entered his ward with peritonitis of 42 hours duration from a perforation of the stomach. The perforation was closed surgically, and a catheter inserted through the anterior wall of the stomach. The resident and intern were assigned the task of keeping the stomach empty if possible, by constant suction. By morning they had improvised what is known now as "a suction set." This consisted of the familiar two bottles, connecting tubes, with one bottle draining water into a lower one and producing a negative pressure in the upper bottle.

Wangensteen speculated on the use of this principle in the treatment of mechanical bowel obstruction and subsequently treated 4 patients with the use of a duodenal tube and constant suction. In 3 of the 4 cases the results were remarkably good. He reported this in December, 1931 at the Western Surgical Association in Denver, and then returned to make a more thorough clinical study of the principles involved.

The chief significance of Wangenstein's contribution lies in the fact that it marks the beginning of a downward trend in the mortality rate of patients with intestinal obstruction. The mortality rate which had varied from 30 to 50 per cent dropped to about 15 per cent. The advent of the use of continuous indwelling suction marked the beginning of a new chapter in the understanding of the pathologic physiology of intestinal obstruction, and in the treatment of patients with all varieties of this condition.

FREDERICK C. HOEBEL, M.D.

**LIVER, GALL BLADDER, PANCREAS, AND SPLEEN**

**Use of Portacaval Anastomosis in Portal Cirrhosis** A. C. PATTERSON. *Arch. Surg.*, 1949, 58 590

Fourteen patients with portal cirrhosis, presenting either ascites or hemorrhage from esophageal varices, were operated on, and an end-to-side portal vein inferior vena cava anastomosis was accomplished in 10 cases. In 4 cases anastomosis was not feasible for various reasons. There was 1 postoperative death in the series of 10 portacaval anasto-

moses as a result of postoperative hemorrhage. All patients had been on medical management for prolonged periods.

On the basis of this series there are 3 operative findings that seem to be significant in the prognostication of the ultimate result. These are the size of the spleen, the height of the pressure in the portal vein, and the difference in the degree of pressure between the portal vein and the inferior vena cava.

The results in the group presenting massive hemorrhage from esophageal varices have been particularly gratifying, since no subsequent massive hemorrhages have occurred. Assessment of the group presenting ascites is more complex, mainly because of the multiple factors involved in the production of the ascites. In only 1 case was the ascites immediately controlled after operation. In others there was no improvement whatsoever for several months and then a gradual decrease of the ascites. One fact seems to be developing, that assessment of the end result cannot be made immediately.

Many preoperative and postoperative liver function tests have been made in all of these cases. These tests show no decrease in the functional status of the liver following portacaval anastomosis.

JOHN L. LINDQUIST, M.D.

#### Primary Carcinoma of the Liver: 25 Year Study

G. F. STRONG, H. H. PITTS, and J. G. MCPHREE  
*Ann. Int. M.*, 1949, 30: 791

The authors discuss 43 new cases of primary carcinoma of the liver which, when added to the 12 cases previously reported by them, constitute 55 cases, i.e., 35 Chinese males, 2 Japanese males, 17 white males, and 1 white female. The tumors consisted of 41 hepatomas and 14 cholangiomas. The liver fluke was found in 4 of the Chinese patients. The incidence in whites was 0.26 per cent, more than double the previous incidence, and the incidence among the Chinese was 5.4 per cent.

Primary carcinoma is one of the most rapidly fatal of all malignant neoplasms. It matters little whether the tumor is hepatoma or cholangioma as far as prognosis is concerned. For orientals, the average age at death from hepatoma is 40.5 years, and for whites, 66 years; the average age at death from cholangiomas is 51.4 years for the former and 59.7 years for the latter.

The symptoms of primary carcinoma of the liver are those of a rapidly progressive cirrhosis, coupled with cachexia, weakness, and weight loss. The whole picture of cirrhosis is foreshortened and the portal obstruction leads to early ascites. In the authors' patients, pain, anorexia, weakness, and dyspnea were prominent symptoms.

The physical signs were of greater importance in diagnosis. The most common sign was ascites (31 cases), and hepatomegaly was present in 22 cases. The liver is enlarged and fixed early in the disease, with the result that the right diaphragm is elevated and shows diminished respiratory movement. Jaundice was present in 10 cases.

Primary carcinoma of the liver is of two types: (1) hepatoma arising from liver cells and (2) cholangioma arising from bile duct epithelium. There appears to be much greater pleomorphism and polymorphism of the cells in the hepatomas. The major distinction in the two types is the abortive attempt at bile duct formation and the relatively smaller size of the tumor cells in general in the cholangiomas. There is little question as to the relationship of cirrhosis to primary cancer of the liver, and some observers question the authenticity of a diagnosis of primary cancer of the liver in the absence of cirrhosis.

EARL O. LATIMER, M.D.

#### A Case of Gall Bladder Tuberculosis

GUSTAF ELFVING *Ann. chir. gyn. fenn.*, 1949, 38: 80

The author was able to find in the literature reports of only 25 cases of tuberculosis of the gall bladder. He presents the case of a woman 63 years of age who had no family history of tuberculosis. The patient suddenly became ill before Christmas of 1947 with symptoms of intestinal obstruction. At this time a small tumor was discovered in the right abdomen. The tumor slowly increased in size. The liver was enlarged 3 fingers breadth below the costal margin. X-ray examination of the chest revealed a faint shadow and calcification in the apex of the right lung. Gastrointestinal examination revealed the tumor to be to the right of the stomach and duodenum and above the hepatic flexure of the colon. Pyelography revealed the tumor to be independent of the kidney, and the left kidney could not be demonstrated.

A cholecystectomy was performed. The gall bladder was found to be greatly enlarged and inflamed, and was filled with small stones. The gall bladder wall was 5 mm thick. Histologic examination demonstrated extensive areas of necrosis in the mucosa nearly 1500  $\mu$  in width. In the layer beneath the epithelium was a round focus about 1000  $\mu$  in diameter. The core of the necrotic area was full of blood and cells that had undergone great degenerative changes. There were numerous giant cells in this area, and an infiltration of small cells and abundant connective tissue. Apparently tubercle bacilli were not demonstrated.

There is little difference between the symptoms of tuberculous cholecystitis and chronic gall bladder disease. Obstipation and a slight fever is not unusual. A palpable mass is not uncommon. In one-half the cases reported in the literature, gallstones were present. With the exception of patients who died ofiliary tuberculosis, and of one other patient, all were middle-aged women.

EARL O. LATIMER, M.D.

#### Gall Bladder Disease Among Filipinos, with a Report on Ascariasis of the Biliary Tract

F. ESQUIVEL and R. I. ALFONSO *Philippine J. Surg.*, 1949, 4: 22

The authors analyze the incidence, symptoms, and the pathologic findings in 100 cases of gall-bladder



disease occurring in Filipino patients treated surgically during the first 3 postwar years. The authors speculate that a general state of malnutrition in the environs of Luzon immediately following the Japanese surrender might have been a contributing factor favoring bile stone formation, since the incidence of gall-bladder disease decreased significantly with an amelioration of widespread starvation.

The authors present the remarkable finding of the presence of *ascaris lumbricoides* in 15 of the 100 cases. No other parasites were found. Two ascarides were found in the gall bladder in one case, in the remaining cases the worms, varying in number from one to eight, were found in the common bile duct, frequently in association with calculi.

In discussing ascariasis of the biliary passages the authors point out that there is no other entrance for the parasites than through the ampulla of Vater, and it is their impression that the worms cannot penetrate a normal sphincter. In cases in which the sphincter has been dilated by the passage of a stone, it is possible that the ascaris may roam freely to and from the duodenum, occasionally becoming entrapped in the upper levels in a milieu unsatisfying to its monosaccharide requirements and, as a result, vermicidal. The mere presence of the parasites in the common duct probably does not produce any special symptoms, even of obstruction. However, in the remote recesses of the biliary tree the dead worms acting as foreign bodies (or because of the bacteria they have transported from the duodenum) may start inflammatory processes in the bile passages or in the liver substance proper.

WAYNE CAMERON, M D

**On Acute Pancreatic Affections Following Gastric Resections for Ulcer or Cancer, and the Possibilities of Avoiding them.** ERIC MILBOURN. *Acta chir scand*, 1949, 98 1

Acute pancreatic affection (the author avoids the term "acute pancreatitis") and pancreatic fistulas are not uncommon postoperative complications of gastric resections for ulcer or carcinoma. In a series of 147 gastric resections, tests of the postoperative urinary diastase by the Wohlgemuth procedure showed the presence of involvement pathologically of the pancreas in at least 10 per cent of the cases. In 6 cases the pancreatic affection was subclinical and was manifested only as a transient increased diastasia, in 2 cases moderate clinical symptoms were observed, in 5 cases severe symptoms were present, and in 2 of these acute pancreatic affection was the cause of death.

The etiology of acute pancreatic affections following gastric resection is not uniform. Possible factors are (1) mechanical injury to the pancreatic tissue from the mildest (such as gentle) traction to the most severe, entailing breaks in the viscous, (2) vascular injuries, particularly those involving the superior or inferior pancreaticoduodenal and splenic arteries, (3) stagnation of the duodenal contents, possibly with regurgitation of bile into the pancre-

atic duct system, and (4) spasm of the muscles about the pancreatic duct orifices. A fifth factor, injury to the pancreatic ducts, is considered particularly important by the author.

The lesser pancreatic duct (Santorini) is especially exposed to possible damage during mobilization of the duodenum. If the duct of Santorini is the sole or main efferent channel of the pancreatic parenchyma, which it is in about 10 per cent of cases, the consequences of duct injury or of ligation during duodenal mobilization may prove to be deleterious to the patient.

It is the author's contention, therefore, that in duodenal ulcers the mobilization always be effected with an open duodenal stump in order that the surgeon may definitely determine the position of the greater and lesser duodenal papillas by palpation. Frequently the lesser papilla may be difficult or impossible to palpate. It is absent in 4 per cent of cases, and in spite of this the duct of Santorini may be well developed. In such cases care must be taken not to detach the duodenum from pancreatic tissue nearer than 3 cm adjacent to the greater papilla, especially in a ventral direction where the duct of Santorini usually opens into the duodenum.

When, during an operation, it becomes evident that a pancreatic duct has been injured, the type of pancreatic duct system (and the implications so far as ligation of the duct is concerned) can be determined by retrograde injection of methylene blue into the pancreatic portion of the duct or by the use of contrast media and the x-ray. With knowledge of the duct anatomy so obtained the measures taken by the surgeon in an individual case will be more adequate.

WAYNE CAMERON, M D

**Indications and Results of Splenectomy.** WARREN H. COLE, LEROY WALTER, and LOUIS R. LIMARZI. *Ann Surg*, 1949, 129 702

The normal spleen contains the largest collection of lymphoid tissue in the body, and the bulk of the reticuloendothelial cells. It is intimately concerned with destruction of the red blood cells (almost one trillion per day) and potentially concerned with blood formation, although the physiologic mechanism involved in these splenic functions is not known. In fetal life, the spleen is active in the formation of all types of blood cells and can revert to this function upon demand at any period of life. In the adult this activity is limited to the production of lymphocytes and monocytes. By the reticuloendothelium of the spleen, the hemoglobin from worn-out erythrocytes is converted into bilirubin for passage to the liver. Much of the iron in the body is stored in the spleen, where it is available for the elaboration of hemoglobin and the formation of new red blood cells. The spleen, by virtue of its spongy network of pulp elements, serves as a controllable blood reservoir. The spleen exerts an inhibitory action on the hemopoietic function of the bone marrow, as evidenced by the almost constant occurrence of thrombocytosis and leucocytosis following splenectomy.

Most of the abnormal functions of the spleen are related to overactivity of one or more of the normal functions, thus giving rise to the term "hypersplenism." The functions most often becoming abnormal or overactive are the inhibiting effect on the bone marrow and the increase in fragility of the red blood cells. If the inhibition on the bone marrow affects platelet formation, thrombocytopenic purpura is produced. In hemolytic anemia the fragility of the erythrocytes, particularly the spherocyte, is increased, thus giving rise to sufficient erythrocytic destruction to produce anemia and jaundice, the latter from increased formation of bilirubin from the hemoglobin of destroyed red cells. If the bone marrow inhibition is limited to formation of neutrophils, the disease is known as splenic neutropenia. Various combinations of these abnormalities are encountered. When all three are present, the disease is designated as panhematocytopenia. In Banti's disease and in Felty's disease the inhibition of granulocytic maturation is also present, although in these diseases other abnormal features are encountered. The cellular elements of the blood may be formed in excess by the spleen. When the white cells are involved, one of the types of leukemia will result.

Leucocytosis and thrombocytosis regularly follow splenectomy. These changes reach a peak in 6 to 14 days and then slowly revert to normal. There is also a temporary slight increase in the erythrocyte count. The platelets may increase from a normal figure varying between 200,000 and 400,000 to 1,500,000. If the increase approaches the last figure named, it is desirable to give an anticoagulant such as heparin because thrombosis (venous) and emboli (pulmonic) are so apt to develop.

1 *Hemolytic jaundice* There are two types of hemolytic jaundice, namely, congenital (familial) and acquired. Because the results of splenectomy in the acquired type are so unsatisfactory, it is essential to differentiate between these two types. In the congenital type, several members of a family may be affected and the condition may be traced back through several generations. In the average case there is little interference with the well-being of the patient except for a marked yellow coloration of the skin and sclera, and a slight anemia. Symptoms are occasionally not noted until adult life. Splenomegaly, jaundice, anemia, microspherocytosis, and increased fragility of the red cells in hypotonic salt solution are prominent manifestations of congenital familial jaundice. Reticuloecytosis and increased urobilinogenuria are usually noted. The spleen is usually greatly enlarged, and one-half to two-thirds of the patients have gall stones. The bone marrow study cannot be considered diagnostic.

In less than 50 per cent of the cases splenectomy will cure an acquired hemolytic anemia, but without affecting the underlying primary condition, such as leukemia, Hodgkin's disease, etc.

2 *Thrombocytopenic purpura* of the primary type responds to splenectomy, but the operation is of

little or no value in the secondary or symptomatic type. Marked enlargement of the spleen speaks against primary thrombocytopenic purpura. Bone marrow examination is diagnostic and will reveal a marked increase in the number of immature megakaryocytes without platelet production. The number of megakaryocytes in the bone marrow is such a reliable indication of true thrombocytopenic purpura that it may be used as an index of prognosis following splenectomy.

The authors are convinced that severe hemorrhage is a strong indication for immediate operation and not a contraindication. Huge quantities of blood may be required, and if shock is present intra-arterial transfusions may be indicated.

3 *Banti's disease* The authors believe splenectomy may have a curative, but most often remedial, effect on the disease in early cases. In the advanced cases the mortality rate is so high (5 of 13 cases in their series) that it overweighs by a large margin any benefit produced by splenectomy.

4 *Thrombosis or anomalous obstruction of the splenic vein* There is controversy as to whether or not this is a manifestation of Banti's disease. The authors have no final opinion as to the proper classification of this lesion. They are strongly of the opinion that splenectomy in the early stages of splenic vein obstruction should be curative, but equally convinced that splenectomy in early Banti's disease will by no means be curative in all cases.

5 *Felty's disease* Regardless of whether this is a separate entity, the authors recommend splenectomy in patients falling in the classification. At least temporary improvement was observed in 3 of 5 patients so classified.

6 *Splenic neutropenia* Results of splenectomy will be very good if the bone marrow shows a normal or increased number of normally developing granulocytes.

7 *Primary splenic panhematocytopenia* This, like splenic neutropenia, is a rare disease. It responds well to splenectomy.

8 *Rupture of the spleen* is, of course, an indication for splenectomy.

9 *Cysts, primary tumors and abscesses* are fairly definite indications for splenectomy.

The authors mention miscellaneous indications for splenectomy, such as Gaucher's disease, and massive resection of the stomach when it simplifies the procedure. Ptosis is occasionally an indication, as is splenomegaly with symptoms due to malaria, but only if the malaria has been eradicated, or to eradicate the site of malarial organisms giving rise to recurrent attacks.

Pernicious anemia, Hodgkin's disease, leukemia, and polycythemia are diseases in which splenectomy is contraindicated. This is true also for agnogenic myeloid metaplasia. Acute enlargement of the spleen in certain acute infections is a contraindication for splenectomy, also, enlargement due to such parasites, as encountered in trichinosis, filariasis, balazsar, and distomiasis constitute contraindications,

although splenectomy in echinococcal disease may occasionally be justified. There is no justification for splenectomy in patients with metastases of malignant tumors.

The authors have adopted an incision that starts at the ensiform cartilage, proceeds downward and across the rectus muscle and thence laterally, parallel to the costal margin. The twelfth intercostal nerve is preserved and the eleventh is sacrificed. They frequently perform a preliminary ligation of the splenic artery before proceeding with removal of the spleen. The artery can be secured through an opening in the gastrohepatic omentum, but they prefer to ligate it at the superior border of the pancreas where it is found readily after incision through the thin posterior peritoneum. When the artery is large, as it will be if the spleen is large, exposure of the vessel will be most readily obtained. The incision is closed with nonabsorbable suture material.

The authors discuss in detail their results from splenectomy.

EARL O. LATIMER, M.D.

**The Value of Splenectomy in Splenomegalies Caused by Malaria** (La valeur de la splénectomie dans les splénomégales d'origine maldéenne) KAZIM İSMAIL GÜRKAN and BÜLENT TARCAN. *J. internat. chir.*, Brux., 1949, 9, 77.

The authors observed a great number of splenomegalies of malarial origin in Turkey, corresponding to the high incidence of malaria in this country. They differentiate three types: (1) those combined with liver cirrhosis, (2) those presenting the syndrome of Banti, and (3) those involving the portal circulation.

In a number of cases, there was no previous history of malaria, nor could the plasmodium be isolated from the blood. However, typical malaria attacks and the presence of the plasmodium in the blood after splenectomy proved the malarial origin of the splenomegaly in some of these cases.

The blood picture frequently resembled that of Banti's disease. It showed leucopenia, lymphocytosis, and anemia. In these cases splenectomy was the treatment of choice. The blood picture gradually returned to normal. Furthermore, the operation exerted a beneficial effect on the liver. Beginning cirrhosis was arrested, and the danger of hypertension in the portal system with all its sequelae was removed. Finally, degenerative processes like infantism and retarded puberty cleared up after the operation.

However, splenectomy in these cases is not without great risks and the postoperative mortality is high. (No figures were given by the authors.) Retraction of the pedicle, excessive venous vascularization, and great friability of the organ make the intervention technically difficult. Thrombophlebitis of the venae lumbales occurred frequently after the operation. The average weight of the removed spleen was between 1 and 1.5 kgm.

In the preoperative and postoperative management, sulfonamides are strictly contraindicated be-

cause of the danger of agranulocytosis. Penicillin produces a beneficial effect. Heparin and blood transfusions were used frequently.

WERNER M. SOLMITZ, M.D.

**Combined Splenectomy and Portacaval Shunts in Portal Hypertension** LOUIS M. ROTHSCHILD. *J. Am. M. Ass.*, 1940, 140, 282.

The experience at the Spleen Clinic of the Columbia Presbyterian Hospital, New York, in 58 cases of portal hypertension is presented. The importance of the obstructive factor is stressed. The ultimate prognosis and selection of the type of surgical therapy depend on the following factors: (1) the nature of the obstructive factor, (2) its location, (3) the degree of portal hypertension, and (4) the efficiency of the collateral circulation.

Patients with intrahepatic block, that is, the cirrhotic patients, require the greatest exercise of judgment in timing before operation is contemplated because of their depleted state. In the noncirrhotic patients, the anemia associated with the congestive splenomegaly or from preceding hematemesis usually requires transfusion.

The author is convinced that splenectomy should always form the basic part of every surgical procedure, i.e., splenectomy with or without portacaval shunt rather than portacaval shunt alone. It is believed that the spleen in congestive splenomegaly exercises an inhibitory effect on blood formation. After splenectomy alone, there is usually a prompt rise of the granulocytes and thrombocytes to normal or greater levels. The erythrocytic rise is a slower process. Furthermore, the enlarged spleen in this disease probably carries some 40 per cent of the total portal blood flow, and its removal minimizes the sudden thrust of a large volume of blood on the overburdened esophageal varices.

With a block in the splenic vein close to the hilum of the spleen, splenectomy alone will suffice and a recurrence of hematemesis will be rare. When the block is at any point in the portal bed closer to the liver (that is, from the entry of the inferior mesenteric vein to the liver itself), a more radical operation must be considered. Experience has shown that in cases with hematemesis in which the block is proximal to the inferior mesenteric vein, bleeding will invariably recur if splenectomy alone is done, and the eventual rate of mortality will approach 100 per cent.

Practically all of the patients seen in the past 2 years have been treated by the suture method with preservation of the kidney and the use of the larger veins in the portal bed. The choice of portacaval shunt may be one of two main forms, the splenorenal shunts or the portal vein to inferior vena cava anastomosis. The splenorenal diversion is used in most of the cases with an extrahepatic block. The lesion in these cases is predominantly in the portal vein, which precludes the possibility of the Eck fistula. The Eck fistula, if used at all, should be reserved principally for patients with cirrhosis.

## SURGERY OF THE ABDOMEN

The following outline is a résumé of all the various combinations of operations utilized in this series of cases

- 1 Splenectomy, left nephrectomy, splenic vein to left renal vein
  - a End-to-end, vitallium tube
  - b End-to-end, by suture
- 2 Splenectomy, no nephrectomy, splenic vein to left renal vein, end-to-side, by suture
- 3 No splenectomy (Eck fistula), portal vein to inferior vena cava
  - a End-to-side, vitallium tube
  - b End-to-side, by suture
- 4 Postsplenectomy
  - a Superior mesenteric vein to inferior vena cava, end-to-side, by suture
  - b Inferior mesenteric vein to left renal vein, end-to-side, by suture
  - c Splenic vein to inferior vena cava, end-to-side, by suture
  - d Inferior mesenteric vein to inferior vena cava, end-to-side by suture
- (1) Splenic vein to left renal vein, end-to-end, by tube
- (2) Inferior mesenteric to left renal vein, end-to-end, by suture (double shunt at bifurcation to left renal vein)

The hospital mortality rate in the cases of cirrhosis of the liver was 21.4 per cent and in the non-cirrhotic group 12.5 per cent. The long term follow-up for the two groups shows a slightly higher death rate for the cirrhotic patients.

The author's experience is in accord with that of Linton who said that a surgeon should not attempt splenectomy in a case of portal hypertension without preparation to do a portacaval shunt, since this may be the only opportunity to construct a satisfactory shunt.

JOHN L. LINDBQUIST, M.D.

### MISCELLANEOUS

#### A Study of Penetrating War Wounds of the Abdomen in the Finnish Fighting Forces During the War of 1941-1944 E. TITTINEN *Ann. chir. fenn.* 1949, 38 Supp. 2

The warfare in this case was carried on in the north of Finland, partly north of the Arctic Circle, for the most part in sparsely settled forest districts, and distances for transport were therefore comparatively long. Weather conditions were poor, with long, cold winters and much snow. There was a lack of buildings, lack of space, poor conditions for the care of the wounded, and a shortage of trained surgeons. In fact, in the words of the author, it can be said that "when a small country like Finland is at war with a great power there is a lack of everything except enemies."

The data upon which this report is based is from the death certificates, the discharge notices and the clinical reports of the surgically treated patients. Only those with injuries of intra-abdominal organs were included in the statistics. In the Finnish Army,

during the war of 1941 to 1944, the patients with penetrating abdominal injuries numbered 3,471—an incidence of 1.6 per cent of the killed and wounded. This figure is lower than that reported from other fronts both in this war and in previous wars.

Of the patients with abdominal wounds, 2,089, or 60.1 per cent, were operated upon. The mortality rate in this group was 66.3 per cent, and if we include patients with abdominal injuries who died without operative intervention, the mortality is 79.7 per cent. Wounds from shell fragments were more common than bullet wounds, the mortality from bullet wounds was higher, probably because of greater velocity of the missile.

The total operative mortality was 66.3 per cent. Wounds of the small bowel had the best prognosis, the mortality in these was 58.6 per cent.

The next most common wounds, in order of their frequency, were small and large bowel wounds, large intestinal wounds, liver wounds, and stomach wounds. The highest mortality occurred in patients with wounds of the spleen. In 1968, or 46.3 per cent of patients with abdominal wounds operated upon, there were coexisting injuries. Patients with thoraco-abdominal wounds numbered 146 (7.0 per cent), and the mortality in these was 80 per cent. There were 2 patients with pancreatic injuries and both died. A high mortality occurred among patients with vascular injuries.

In wounds of the colon, simple suture gave the best results, with a mortality of only 61.6 per cent. The mortality following resection of a portion of the colon was 79.3 per cent, and following exteriorization of a portion of the colon, 90.5 per cent. Exteriorization and colostomy were apparently used only in the severest wounds.

The most common cause of death was shock. Patients operated upon between 3 and 10 hours after being wounded had a lower mortality than those who were operated on under 3 and over 10 hours after being wounded. The apparent reason is that in those patients operated upon within 3 hours, shock was not recognized or had not become clinically evident, while in those operated upon after a period of 10 hours, shock was more profound and could not be corrected. Among those patients operated upon between 3 and 10 hours the mortality was lower, probably because shock had been corrected preoperatively, during operation, and postoperatively. With regard to wounds received in 1944, it is also true that when adequate shock treatment had been instituted, particularly the adequate use of blood and plasma, the mortality rate dropped. During the 2 days immediately following operation, 961 patients died (69.4 per cent of all postoperative deaths). Most of these deaths occurred as the result of shock. From the third to the fifth day 170, or 12.3 per cent, of the operative patients died. Most of these deaths were due to peritonitis with paralytic ileus.

Of the 705 patients with perforating abdominal wounds who had undergone operation, only 184 had wounds that healed by primary intention. For this

reason the author believes that despite the administration of sulfonamides (they did not have penicillin), most of these wounds should have been closed secondarily. The majority of those patients who recovered were fit for military duty of some sort. Only 54 were unfit, mainly because of coexisting wounds that produced some permanent disability.

In the light of the statistics presented, the author discusses methods of lowering the mortality. These include effective shock treatment as the most important single item. He believes that shock treatment should be started immediately at the Battalion Aid Station, and carried on before and during operation, too extensive operative procedures should be avoided, the number of qualified surgeons should be increased, colostomy is imperative in rectal injuries and exteriorization should be used more frequently in colonic injuries, if primary suture of the colon is carried out a proximal colostomy should be done. Postoperative observation of the fluid balance and the treatment of paralytic ileus by Miller Abbott tubes is important. FREDERICK C HOEBEL, M D

**Massive Penicillin Therapy of Abdominal Actinomycosis** GILMAN E SANFORD and RICHARD O BARNES *Surgery, 1949, 25 711*

Two patients with severe abdominal actinomycosis who had failed to respond to therapy with penicillin

in doses of 800,000 units per day plus sulfonamides, adequate surgery, and supportive treatment over periods of 8 and 9 months, respectively, showed dramatic response to massive penicillin therapy. The only change in the treatment of these patients was that of the administration of massive doses of penicillin.

In 1 case penicillin was administered as a continuous intravenous drip for 24 hours a day, in a dosage of 10,000,000 units per 1,000 c.c. of normal saline solution or 5 per cent glucose solution for 7 days, which was then reduced to 1 daily intravenous injection of 10,000,000 units in 1,000 c.c. of saline solution plus 500,000 units given intramuscularly every 3 hours until the twenty-fourth day. Ten days later the daily intravenous injection was discontinued and the intramuscular injections were reduced to 100,000 units every 3 hours. This dosage was continued for 4 weeks. The second patient, who also had a subphrenic abscess, received a similar course of treatment.

One patient was apparently cured in 63 days after an illness of 16 months and the other in 48 days after an illness of 9 months. Both patients were observed for a year after their discharge but there were no signs of recurrence. No toxic effects of massive penicillin therapy were noted.

JOHN L. LINDQUIST, M D

# GYNECOLOGY

## UTERUS

**The Uterine Roentgenogram with Respect to Function, with the Exclusion of Malformations**  
(Das Röntgenbild des Uterus in Hinblick auf seine Function—unter Ausschluss der Missbildungen) E. PHILIPP *Geburtsh & Frauenh*, 1949, 9 151

The author attempts to draw conclusions with respect to labor and delivery from roentgenographic and hystero-graphic studies. Various deviations from normal are discussed. The author states that the hypoplastic uterus with a triangular uterine cavity is to be differentiated from the "transitional type" which is characterized roentgenographically by a uterine cavity which is triangular, but with pointed angles. The former type of uterus affords a better prognosis with respect to labor and delivery than does the latter.

The author also discusses cervical changes which are visible roentgenographically, in addition to acute pathologic ante-flexion and an enlarged uterine cavity. Since only one each of these conditions was observed, he draws no definite conclusions.

WARREN R. LANG, M.D.

**Clinical Classification of Carcinoma of the Endometrium** (La clasificación clínica del carcinoma del endometrio) ANDRÉS RIESCO U. *Bol. Soc. chilena obst. gín.*, 1948, 13 378

An analysis of 49 cases of carcinoma of the endometrium observed at the National Institute of Radiology during the period from November, 1930 to January, 1944 shows that data pertaining to the size of the uterus found at bimanual examination is recorded in only 25 cases and that the terms used are "normal size," "slight increase," "increased," "increased in size." In addition, it is impossible to evaluate the late results of treatment since 11 of the 25 patients did not return for follow up examinations. Data on hystero-metry are given in only 15 cases. Data on partial or total infiltration of one or both parametria are available in 17 patients and for one reason or another, none of the patients can be regarded as cured. All of these factors indicate that up until now, no clinical classification of patients with carcinoma of the endometrium has been followed in this country (Chile), and that the statistics do not provide the necessary data to place these patients (retrospectively) in one of the known classifications. Therefore, the author proposes a classification that is precise and can be easily used after a methodical gynecologic examination has been made. It is based on the observations of Healy and Brown and has been adapted and modified for classification by Norman Miller, in addition, the condition of the parametria has been taken into consideration. It is not claimed that this classification is a perfect one,

but it will serve as a starting point in the orientation of this basic aspect of the neoplasm in question.

With this classification the patients are divided into four grades (I to IV) in which, respectively (1) the parametria is free, (2) is free, (3) one or both is partially infiltrated, (4) one or both is totally infiltrated, (1) hystero-metry shows 7 cm or less, (2) from 8 to 11 cm, (3) from 12 to 14 cm, and (4) more than 14 cm, (1) the size of the uterine body is small or normal, (2) corresponding to a pregnancy of from 1½ to 2 months, (3) 2½ to 3 months, and (4) more than 3 months, (1) metastasis or cachexia is absent, (2) metastasis or cachexia is absent, (3) vaginal metastasis is present, and (4) distal metastasis or cachexia (or both) is present.

Since hystero-metry and the size of the uterine body may be modified by the coexistence of fibromyoma, the important symptom for this classification will be the condition of the parametria, whether there is a fibromyoma or not, that is, provided there is no distal metastasis or cachexia which would place the patient automatically in grade IV. If there is no parametrial infiltration, hystero-metry will be the decisive sign for the classification. Finally, the size of the uterine body, as found by bimanual examination, and as compared to the size of the pregnant uterus, will determine the grade of the classification, and that hystero-metry cannot be performed always provided there is no parametrial infiltration.

RICHARD KEMEL, M.D.

**ADNEXAL AND PERIUTERINE CONDITIONS**  
**Remarks on the Pathologic Physiology of Endometriosis on the Occasion of 3 Observations of Endometriosis of the Posterior Vaginal Vault** (Remarques sur la physiologie pathologique des endométrioses, à propos de trois observations d'endométriose du cul de sac postérieur du vagin) P. MOCQUOT and R. MUSSET *Gyn. obst.*, Par., 1949, 48 135

Like the uterus itself, an endometriosis reacting to the ovarian hormones undergoes all the changes of the sexual life and of the periodic genital cycle of the woman and is found only in women with sexual activity. It undergoes a decidual transformation during pregnancy. All this shows that typically, in the more evolved and more active forms, the endometriosis is closely subjected to the influence of the sexual hormones. On the other hand, there is no doubt that many endometrioses, after a more or less prolonged period of serious functional disturbances, remain or become completely refractory to sexual hormone stimulation, and that during pregnancy, despite a considerable hormonal overload, the transformation of the endometriosis is not at all inevitable. The authors have studied 3 cases in which the endometriosis (being present in the posterior vaginal fornix) was easily accessible to biopsy.



## GYNECOLOGY

of pruritus of the anterior portion of the vulva which had persisted for 6 months. The pruritus developed after each micturition almost like a paroxysmal attack, persisted for a time, and then diminished or even subsided altogether until the next micturition. Recently she had observed slight traces of blood on her linen, and this caused her to seek medical advice.

A general examination and examination of the urine yielded negative results. Examination of the clitoris and of the adjacent portion of the labia minora for  $1\frac{1}{2}$  cm revealed a swelling resembling a strawberry, of a reddish brown color, and partly covered with fine whitish pellicles and partly with superficial excoriations. Palpation gave the impression of a chronic edema, a little firmer at the base, but otherwise of a fairly even consistency and not especially hard. Neither the glands nor other genital organs were involved. An epithelioma of the clitoris was suspected, but the lack of induration, deep infiltration, ulceration, and adenopathy after a duration of 6 months seemed to refute such a diagnosis. A wide excision was done including a large part of the labia majora, the clitoris, and all of the labia minora. Histologic examination revealed Bowen's disease. The lesion was considered precancerous, or perhaps an epithelioma in a localized stage. Healing occurred by primary intention and re-examination 3 months later revealed perfect cicatrization. The lesions of Bowen's disease may run an apparently benign course for a long time, even for years, but sooner or later a sudden malignant transformation takes place, either with invasion of the adjacent tissues and lymph glands with rapid metastasis to other organs, or with ulceration and deep penetration but no invasion of the lymph glands, and thus it remains localized.

When cancer supervenes, it is usually of the spinocellular type, but some forms more like the basocellular cancer have been described. Mucosal involvement usually differs from the cutaneous lesions and the course, although slow, is very often more rapid than that of the cutaneous lesions, and is very often accompanied by attacks of pruritus following irritation of any kind. Bowen's disease of the mucosa and erythroplasia are synonymous. Diagnosis is made by biopsy and microscopic examination, and differentiated it from tertiary syphilis, psoriasis, psoriasiform affections, lupus erythematosus, and senile keratosis. Opinions differ as to the frequency of malignant degeneration, which is usually common in the mucosal type of the disease. Histologically, some regard the lesion as precancerous, others as cancerous from the start. Treatment consists in excision, electrocoagulation, or roentgen or radium therapy.

EDITH SCHANCE MOORE.

## MISCELLANEOUS

**Culdoscopy** ALBERT DECKER *J Am M Ass*, 1949, 140: 378

With the patient in the knee-chest position, the rectovaginal pouch may be punctured with a needle

or trocar by a technique that is simple and safe. Endoscopic visualization of the female pelvis was attempted in 77 cases in which the diagnosis made by other means was indefinite or doubtful. The examination was successful and of diagnostic value in 88.3 per cent of the cases selected. The puncture was unsuccessful in 9, or 11.7 per cent, of the cases. When the puncture was possible, detailed information was obtained concerning the disease present. The procedure was particularly useful in disclosing 2 cases of tuberculosis, 4 cases of endometriosis, and 1 case each of adenomyosis and ovarian neoplasm.

The culdoscopic diagnosis was verified at operation or by subsequent events in all cases. On occasions exploratory laparotomy in suspected surgical emergencies was avoided. A more prompt diagnosis has in some instances resulted in the reduction of days of hospitalization and in the number of clinic visits. The procedure has been useful in the solution of problems of menstrual abnormality. In 13 selected infertility problems, detailed information was gained concerning the condition of the tubes and ovaries.

There were no serious complications or accidents in these cases. Culdoscopic visualization is a useful and harmless diagnostic procedure that allows a prompt and positive diagnosis in a large variety of gynecologic problems not readily diagnosed by the usual methods.

CHARLES BARON, M D

**The Effects of Various Estrogenic Preparations Changes in the Vaginal Mucosa and General Status of Climacteric Women Following the Injection of Aqueous Suspensions of Estrone and Estradiol** MILDRED VOGEL, THOMAS H. MCGAVACK, and JOSEPH MELLOW *Am J Obst*, 1949, 57: 682

The standardization of estrogenic material for use in human beings and the necessary dosage to yield clinical therapeutic results are problems of no mean proportion.

The preparations used in this study were aqueous suspensions containing 2 mgm of estrone and 0.5 mgm of estradiol administered in 1 cc and 1 cc doses, respectively. Twenty-three women with climacteric symptoms were the subjects of this study. Following a control period, injections were given at 3 week intervals. Vaginal smears were utilized to obtain objective evidence, and this was correlated with the patient's subjective response.

The injection of follicular stimulation of the ovary with the patient's estrone was followed by some degree of follicular stimulation of the vaginal epithelium in 69 per cent of the test subjects. The average "lag-time" following the injection of 2 mgm estrone was 120 hours, 4 mgm of estrone, 101 hours, 0.5 mgm of estradiol, 99 hours, and 1 mgm of estradiol, 91 hours. Estrogenic effects on the vaginal mucosa due to the injection of 2 mgm of estrone lasted 120 hours, 4 mgm of estrone, 110 hours, 1 mgm of estradiol, 99 hours, and 1 mgm of estradiol, 91 hours.



The height of the estrogenic response in the vaginal mucous membrane varied widely and could not be correlated with the amount of hormone administered

Symptomatic relief from climacteric symptoms was experienced by 21 of the 23 women. A cumulative action could be demonstrated as a result of repeated injections. The relief of subjective symptoms could not be correlated with the objective response as shown by the vaginal smear examination

JOHN R. WOLFF, M.D.

**The Genitocolitic Syndrome** (Sindrome genito colitica) CARLO VERCESI *Ann ostet gin*, 1949, 71 3

On becoming director of the Obstetric and Gynecologic Clinic of the University of Milan, Italy, the author spoke on the rehabilitation of women with so-called colitis, which he maintains has its origin in gynecologic disorders. The chief primary cause of this syndrome is genital tuberculosis in the young female. Later, tuberculosis heals, or at least becomes quiescent. In the colitic cases the left side is usually the part involved.

The patient is generally slender in build, poorly nourished, and more or less anemic. The symptoms are usually periods of constipation alternating with those of diarrhea, abdominal distention, dyspeptic symptoms, and pains, the pains are reflected toward the anus (dyschesia) and upward along the sigmoid and descending colon, to reach on occasion as far as the epigastrium. On examination the uterus is found to be poorly developed, more or less retroverted, and pulled to the left. There are indurative changes in the left broad ligament, especially near the upper peritoneal surface. Perhaps a hydrosalpinx is present. The entire side of the pelvis is more or less fixed and painful to palpation.

The medical man, despite the history of dysmenorrhea, relative sterility, and evident aggravation of symptoms after marriage and during the menstrual periods, frequently continues to treat the

condition as a simple colitis (diet, spa-treatment, vitamins) without thinking to refer the patient to a gynecologist for examination, and for the possible benefits of therapy directed at the gynecologic condition.

The therapy employed by the author in milder cases has frequently been limited to the simpler medical gynecologic procedures (medicated douches, hot applications to the lower abdomen, opotherapy aimed at promoting a proper uterine development). In the more severe conditions operation has at times been necessary. The uterus is brought back to its normal midline position by a right-sided antero-fixation (Alfieri method), the worst adhesions and indurative processes perhaps excised, and corrective surgery, when indicated, performed on the tube. Of course, the left adnexa may have to be partially or completely removed.

The author's experience with these therapeutic measures has now extended to 35 cases. Eighteen of the patients exhibited a mild condition and were treated medically. All of them received decisive and permanent benefit. Some of the patients were married and, although denied the privilege of motherhood, the married state did not produce a recurrence or even an aggravation of the condition. Eleven women presented advanced conditions of both the gynecologic and colonic regions but refused operation, or operation was contraindicated for some reason. These patients did not receive any considerable benefits from either the usual medical colitic or gynecologic methods of treatment. Six of them were subjected to operation and all received pronounced benefit from the procedure. Two of those treated by centralization of the uterus and by excision of the left tube and ovary later became pregnant. In one of these an abortion occurred, in the other there was successful delivery of a living male child at full term. This child is now in school and is in very good health.

JOHN W. BRENNAN, M.D.

# OBSTETRICS

## PREGNANCY AND ITS COMPLICATIONS

The Diagnosis of Tubal Pregnancy (Zur Diagnose der Tubargravidit t) A W SCHWENZER *Geburtsh und Frauenh*, 1949, 9 336

The author discusses the difficulties in the diagnosis of extrauterine pregnancy. Twelve cases are described in detail in which the diagnosis had either been missed altogether, or could be ascertained only after a longer period of clinical observation.

The value and limitations of the Aschheim-Zondek reaction and of aspiration of the cul-de-sac are discussed.

WERNER M SOLMITZ, M D

Diabetes Insipidus and Pregnancy (Diabete insipidus gravidanz) PIERO STRADELLA *Ann ostet gin*, 1939 71 90

Two examples of the rare complication of diabetes insipidus in the pregnant state are added by the author to the 57 already reported. Of the 57 patients with typical symptoms of polyuria and polydypsia during the pregnant period, only 22 developed the condition during the pregnancy itself. It is consequently only in these 22 cases that it might be hypothesized that the pregnant state was the cause of the polyuria. In all of these pregnant women the polyuria and polydypsia disappeared during the puerperium.

That the author's 2 cases were instances of true diabetes insipidus—although the polyuria was never excessive—was indicated by the constant alkalinity of the urine, and the results of the Veit test for salt tolerance. This test was given in one patient by the typical Veit technique, consisting of the oral administration of 20 gm of salt in 500 c.c of water, in the other patient the test was the same with the exception that only 10 gm of salt were given. Both of the patients reacted typically for primary polyuria, or true diabetes insipidus, by an aggravation of the polyuria and increase in the chlorides of the urine, but with no change in the normochloremia of the first patient, nor in the hypochloremia of the second. Therefore, in true diabetes insipidus the salt is thrown off in the urine and postulates for this condition a lack of capacity of the kidney to retain the salt, while in the hypothesized secondary, or symptomatic, form of polyuria the reaction to the test consists of an increase in the chlorides of the blood and a decrease in the polyuria and polydypsia.

That these 2 cases belong in the category of the 22 cases cited in the introductory paragraph is indicated by the fact that in the one the polyuria apparently appeared in the second month of pregnancy and disappeared in the eighth month on the implantation of the posterior hypophyseal lobes of 2 calves, and that in the other the disturbance developed in the sixth month of pregnancy and disappeared

spontaneously during the puerperium. In both of these patients the pregnancy ran an otherwise normal course and delivery resulted in perfectly normal children.

The benefits derived by the patient who received the implantation of posterior hypophyseal tissue lends support to the theory with reference to the antidiuretic effect of the posterior lobe of the hypophysis and its depression or failure in diabetes insipidus. Whether this effect is obtained by a counteraction against some diuretic principle of the anterior lobe, either as the direct effect of its own secretion, or indirectly through the action of this lobe of the hypophyseal gland on other glands of the endocrine system (thyroid, adrenal glands) remains an open problem.

JOHN W BRENNAN, M D

## PUERPERIUM AND ITS COMPLICATIONS

Artificial Delivery and Morbidity of the Puerperium (D hvrance artificielle et morbidit  des suites de couches) R KELLER and L GIOANNI *Gyn obst*, Par, 1949, 48 168

In a previous communication on the indications of uterine revision, the authors have shown that this intervention is not dangerous and is not a factor aggravating the puerperium. Now they feel justified in stating that, contrary to the generally accepted opinion, artificial delivery is not a dangerous intervention either.

Their study included 7,000 deliveries. In 148 of the patients, artificial deliveries were performed, an incidence of 2.11 per cent, which is higher than that of most other authors. The difference is due to divergences in the indications, which may be grouped under two main headings: (1) hemorrhage, whether the placenta is partially detached or the detached placenta is not expelled by an atonic uterus that is bleeding, (2) retention of placenta, whether the placenta remains attached (abnormal adherence, placenta accreta) or is more or less detached but is incarcerated. In case the placenta does not become detached, the authors do not wait more than 2 hours before intervening. Before performing artificial delivery they try manual expression—if necessary, under general anesthesia.

Artificial delivery is performed as carefully as possible, and with the greatest asepsis of the genital passages, and of the hand used, an intravenous injection of posterior lobe extract is given systematically. In the 148 cases there was no mortality. The total morbidity was low, quantitatively (11.7 per cent) and qualitatively, and was only partly due to the intervention. Other factors which aggravate the morbidity of the puerperium are severe hemorrhages, general diseases coexisting with pregnancy, disorders natural to pregnancy, obstetrical interventions, and the febrile conditions present at the time of delivery.

whether their cause is obstetrical or not. The role of the duration of labor deserves special mention, the chances for morbid sequelae increase with the prolongation of labor. In addition, the prognosis of artificial delivery, like that of uterine revision, becomes worse with delay, finally, certain local conditions, such as placenta accreta and abnormal adherence, increase the morbidity of the intervention.

From the practical point of view, it is useful to remember that a number of factors may increase the morbidity of the puerperium. Some of these, such as abnormal local conditions, general and obstetrical disease, fever at the time of delivery, etc., are unavoidable. In other cases an attempt should be made to decrease the risks of artificial delivery by using an anti-infectious prophylaxis. The authors have not used a systematic prophylaxis, but have administered sulfonamides or penicillin in febrile cases, in difficult or hemorrhagic labors, in those having occurred elsewhere, and in cases of laborious detachment of the placenta. In general, the results obtained were satisfactory. But there are other factors whose interference may be avoided or decreased. The first is the introduction of exogenous infection, the second is a too long delay between birth and artificial delivery which increases blood loss and the risk of infection. Finally, an attempt must be made to shorten the duration and improve the quality of labor by using the method of Kreis, which seems to be the best (spasmalgia, rupture of the membranes on small dilatation). The last improvement consists of the systematic intravenous injection of posterior lobe extract after artificial delivery.

RICHARD KEMEL, M D

**Delayed Hemorrhage Following Delivery Hemorrhagic Type of Puerperal Infection of Couvelaire** (Hémorragie tardive des suites de couches. Forme hémorragique de l'infection puerpérale de Couvelaire) JEAN SNOECK and M. ROCMANS. *Gyn obst*, Par, 1940, 48: 11.

A severe case of the hemorrhagic type of puerperal infection is reported. The comparative rarity of this formidable complication of delivery warrants the publication of this report.

The patient, a woman 30 years of age, was a quadripara. In the years of 1934 and 1936 she had been delivered by cesarean section, both of which operations were complicated by endometritis and infection of the abdominal wall. In 1937 she had had a spontaneous delivery of twins during the seventh month of pregnancy.

On November 29, 1938 she developed labor pains in her fourth pregnancy. An hour after labor began, an increasing hypertonicity of the uterus necessitated the administration of three doses, of 1 cc each, of spasmalgia. About 7 hours after labor had begun, the cervix was dilated the size of the palm of the hand.

The fetal membranes were ruptured artificially. The amniotic fluid was the color of purée of peas. The fetal heart sounds were barely audible.

Eight hours after labor had begun, surgical intervention was decided upon and cesarean section with sterilization was performed. On opening the abdomen, the uterus was found adherent to the peritoneum throughout its entire length. The bladder appeared immediately in the bottom of the wound. At the bladder level and in the area of the lower uterine segment, there was a large mass, which on being incised was found to be a collection of thick greenish amniotic fluid. There was a rupture of the uterus in the middle of the horizontal scar of a previous operation. After delivery of a live baby, sterilization was carried out.

The same night in which surgical intervention was carried out, the patient developed fever, and a blood culture which was taken was positive for the pseudodiphtheria bacillus. The patient's wound healed by primary union. There was an abundant normal lochia.

Nine days postoperatively the patient expelled three large clots and, later, showed the classical signs of massive hemorrhage, which necessitated blood transfusions. Vaginal examination revealed the cervix dilated to two fingers, and the vagina and the uterine cavity were filled with large clots. The patient's temperature was elevated for 2 days.

Seventeen days after delivery, a new hemorrhage with an abundance of bright red blood occurred and the patient collapsed. Three blood transfusions were given.

On the twenty second day after delivery, a third massive hemorrhage occurred. A hysterectomy to control the hemorrhage was decided upon. At operation, the uterus was found to be the size of a grapefruit. The walls of the uterus were hard and pallid. The myometrial vessels were dilated. The uterine cavity was gaping and empty and gave off a fetid odor.

The uterine mucosa was thickened. In the lower part of the uterus were numerous petechial thromboses and small ulcerations.

Microscopically, at the site of the placental insertion, there were areas of regeneration and numerous superficial areas of necrosis. Throughout the entire submucosa there was extensive leucocytic infiltration. Numerous vessels were thrombosed. No chorionic elements were present and there were no microorganisms visible.

Bacteriological examination showed colon bacilli, staphylococci, streptococci, and anaerobic bacteria.

This case represents two interesting clinical points.

The first was the insidious rupture of the uterus at the beginning of labor. This rupture occurred in the lower segment of the uterus at the site of an old scar of a former operation. The lesion, veiled by extensive adhesions, was practically without symptoms and had done no harm to the fetus.

The second point, the more important of the two and the one which dominated the clinical picture, was the septic hemorrhagic symptom of Couvelaire.

The puerperal infection occurred first. Its presence was demonstrated by the febrile attack and

the positive blood culture made directly after labor. After an 8 day afebrile period, the first massive hemorrhage occurred and other hemorrhages occurred at more frequent intervals. The hemorrhages were accompanied, or followed, by fever. This particular picture is classical for the hemorrhagic type of puerperal infection.

The causative organisms shown by blood culture and anatomopathologic examination of the uterine lesions confirmed the diagnosis.

Clinically this case was more hemorrhagic than septic. In spite of the blood transfusions hemorrhage was massive and recurred so often as to endanger life. The intensity of the cardiovascular collapse with each hemorrhage was impressive.

Temporary medical treatment was tried and after its failure, radical operation was necessary.

The pathogenesis of this case warrants discussion. First each hemorrhage was followed by a period of calm. It appears that the thrombosis of the vessels produces purulent foci accompanied by necroses of the uterine submucosa and mucosa.

A fresh massive hemorrhage occurred only when the lytic phenomena produced a vascular phase stronger than the thrombotic phase.

The hemorrhage, being so massive and difficult to control by ordinary means (ice, ergometrine) proved that the vessels were widely dilated and that the tissues which they supplied were so infiltrated by leucocytes as to produce a severe infection and a complete loss or great diminution of the ability of the vessel to contract.

This pathogenic mechanism calls to mind certain infectious and hemorrhagic phenomena observed at times at the site of amputations.

It is fair to say that the vascular thromboses in the hemorrhagic zone were necessarily infected and that if in general they did not appear to go beyond the depth of the myometrium, they were primarily infected thromboses and eventually developed into abscesses. This explains satisfactorily the febrile episode which preceded or accompanied these hemorrhages. These febrile episodes were the result of bacteria or toxins being thrown into the patient's blood stream. The predominance of vascular or septic phenomena will determine whether the syndrome of Couvelaire will be chiefly hemorrhagic or chiefly septic. In the one as in the other, the primary lesion is a uterine wound, without placental retention, in the process of septic necrosis with extensive infection of the mucosa, submucosa, and myometrium. In the authors' opinion the infected thromboses which are consistently observed are the primordial lesions. BLACKWELL MARKHAM, M.D.

**Puerperal Scarlatina (Puerperalscharlach)** WILLI SCHULTZ *Geburtsh. & Frauenh.*, 1949, 9: 251

The author discusses an epidemic of scarlet fever and other streptococcal infections which occurred in a small maternity hospital in Hamburg, Germany, in 1936, that is, before the era of antibiotic treatment and chemotherapy.

Thirteen women were affected. Puerperal scarlatina developed in 8 patients, puerperal erysipelas of the vulva in 1 patient, necrotizing mastitis with erysipelas in the area of the breast developed 5 weeks after delivery in 1 patient, 3 other cases concerned 2 nurses and a midwife, one of whom had a typical case of scarlet fever, and the other 2, tonsillitis caused by hemolytic streptococcus. Two of the 8 patients with puerperal scarlatina died.

As to the clinical course, the puerperal scarlatina started between the second and the seventh day after delivery. The exanthema began in the area of the vulva and perineum and spread to the abdomen and thighs. The Schultz-Charlton test was positive. As is known of surgical and puerperal scarlatina in general, there was no tonsillitis or other throat involvement present in the patient in whom the birth canal was the portal of entry.

To stop the epidemic, the hospital was closed and thoroughly disinfected three times. However, after each reopening new cases occurred. Only after the fourth wave of diseases of this type was it found that the midwife was a carrier of virulent hemolytic streptococci. She was dismissed from the hospital, and no new cases occurred after her leaving. The author states that "for external reasons" he was not able to publish a report of this interesting epidemic earlier than 13 years after its occurrence.

WERNER M. SOLMITZ, M.D.

## MISCELLANEOUS

**Physiopathology of the Uterine Contraction (Fisiopatología de la contracción uterina)** JOSÉ RAMÍREZ OLIVELLA *Rev. cubana obst.*, 1948, 10: 103

Disturbances of uterine tonus (hypotonus and hypertonus) may affect the useful force of the contractions of labor. The functional disturbances of the contractions may be due to insufficient, or to excessive contraction. Disturbances due to insufficient contraction result in inertia which may be primary or secondary. Primary inertia may be caused by pathologic changes in the uterus (fibrosis, sclerosis, overload of fat, etc.) or to a defect in the stimulation of the muscle fiber which may be anatomically normal. Treatment consists of fractionated doses of pitocin (2.5 units every 15 minutes), calcequinine intramuscularly, sparteine sulfate (15 to 20 centigrams), or of any other gentle stimulant of uterine contraction. Secondary inertia is the result of muscular fatigue caused by struggling against an obstacle, its treatment consists of spasmolytics to obtain uterine rest for a period of 1 or 2 hours, followed by stimulation by oxytocics.

The functional disturbances due to excess of contraction are more numerous. Polysystole occurs as the first phase of the struggle against an obstacle, and causes fetal suffering. It is treated with spasmolytics. Subinert contractions, which result from an increase in the frequency of the former with decrease of the interphasic period, require the same treatment. Uterine tetanus is a more advanced phase

of the preceding conditions, leads to contracture or secondary inertia, causes severe fetal suffering and requires deep general anesthesia and treatment with spasmolytics. Uterine contracture constitutes the highest degree of contraction dystocia in which pains and fetal heart beats disappear, labor stops, the patient becomes exhausted, and the impossibility of spontaneous birth makes surgical intervention imperative. Exceptionally the low, but always risky, route may be used. Only with use of the high route, with the uterus in view, is it possible to decide whether cesarean section or hysterectomy is indicated.

The functional disturbances of uterine contraction with functional asynergy include the syndromes of Schickelé, Demelin, and Bandl. If discovered in time, the syndrome of Schickelé may be easily overcome by the administration of spasmalgin, which contains papaverine, pantopon, and sulfuric ether of atropine, the dose is one ampule every 20 minutes up to three doses, and the series may be repeated two or three times. When the syndrome is not discovered in time and the cervix is truly edematous, radiating incisions of the cervix are necessary. Early diagnosis of the syndrome of Demelin is necessary since its initial phases are easily overcome by spasmolytics, once there are anatomic changes, treatment must be surgical. In the syndrome of Bandl, treatment depends upon the type of fetopelvic disproportion and the condition in the individual case, it may consist of symphysiotomy, abdominal cesarean section, or fetotomy.

Many of the dystocias of uterine contraction can be avoided by prophylactic treatment. In a revolutionary concept of the prophylaxis of spasmodic pictures, especially of the uterine cervix, the Strasbourg School, with Schickelé at its head, considers that the persistent presence of the amniotic sac is a frequent cause of spasmodic disturbances of uterine contraction, and has initiated two new methods: the medical parturition of Kreis, based on early rupture of membranes and the use of spasmalgin in the presence of good fetopelvic proportions, and the directed parturition of Voron and Pigeaud which differs from the former only in the addition of the use of oxytocics, such as hypophysis extracts in 2 unit fractionated doses, or quinine sulfate in fractionated doses of 0.50 gm. to reach the total dose of 1.5 gm., and of antispasmodics, including spasmalgin and chloral hydrate.

RICHARD KEMEL, M.D.

**Is the Hegar-Sellheim Internal Pelvic Examination Unnecessary?** (Ist die innere Beckenuntersuchung nach Hegar-Sellheim ueberfluessig?) A. MAYER. *Geburish & Frauenh.*, 1949, 9, 307.

Several outstanding obstetricians in Germany lately declared that pelvimetry is obsolete, and they rely entirely on the test of labor in determining whether cesarean section is indicated. The author criticizes this new trend severely and emphasizes the importance of correct internal pelvic measurement. A "functional diagnosis" is justified only in borderline cases. The aim of modern obstetrics

should be to diagnose a narrow pelvis during pregnancy.

A disadvantage of the "functional diagnosis" is that it gives information only about the inlet. If the inlet is normal but the outlet narrow, the time for section has been missed and the life of the baby may be in jeopardy. On the other hand, neglect of pelvic measurement and reliance on the functional diagnosis often lead to unnecessary cesarean section. The author refers to several instructive cases in which section was done for an alleged narrow pelvis although the internal measurements were perfectly normal.

External pelvimetry is of little value. Gracile innominate bones and the vertical position of the iliac alae may give quite low external measurements although the pelvic lumen is entirely normal.

WERNER M. SOLMITZ, M.D.

**The Action of Folliculin and Progesterone on the Water Metabolism in Pregnancy** (L'azione della follicolina e del progesterone sul metabolismo idrico in gravidanza). TIMOTEO NOBILE. *Ginecologia*, Tor., 1949, 15, 53.

In this study the author has used four groups of 6 pregnant guinea pigs each, all of which were at least in the second half of their pregnancy. The first group served as controls. All animals in the other three groups were given an intraperitoneal injection of 10 c.c. of Ringer's solution daily for 3 days, but the third group received in addition 5 mgm. of progesterone daily for 3 days, and the fourth group received 20,000 units of folliculin daily for 3 days. The animals were killed by bleeding after 12 hours of fasting and 24 hours after the last treatment. This was immediately followed by determination of the hematocrit values (with the use of centrifugation for 1 hour), of the protein values of the plasma, (with use of the refractometric method), and of the dry residue of the maternal and fetal organs, by means of double weighing on pieces of tissue that had been left for 90 minutes in the incubator at 110 degrees.

The study showed that in all treated animals there was greater imbibition of the fetal tissues than of the maternal tissues. This is in perfect agreement with the needs of the organism in the process of formation. An interesting fact is that while there are organs, like the liver and the brain, which show only minimal changes in their water content, there are others, like the skin, muscles, blood, and kidneys, which undergo important changes in their water content under the stimulation of the hormones. A peculiarity is that some organs, like the skin and the blood, undergo changes in which a maternal loss of water is compensated by a proportional imbibition of the same fetal tissues. The same cannot be stated about muscles and kidneys which, in the mother, maintain nearly constant values after any treatment, while in the fetus they undergo decided imbibition under the three treatments. However, the peculiar behavior of the uterine tissue should be

noted, it is influenced by Ringer's solution and to a higher degree by folliculin, but only temporarily, or not at all, by progesterone. This shows that the more highly differentiated tissues, whether maternal or fetal, do not undergo important changes in their water content because the function of these cells should not be disturbed. The true water reservoirs of the organism are the skin and the blood, therefore skin and blood changes occur easily in the mother as well as in the fetus.

Progesterone and folliculin act in general to facilitate imbibition of the fetal tissues without simultaneously causing a general water loss in the maternal tissues, this loss occurs only in the skin and the blood. In cases in which water loss in the maternal tissues is not accompanied by fetal imbibition, the water must have been eliminated by the excretories.

While the injection of Ringer's solution does not cause changes in the water values of the blood, there is nevertheless a reduction in the corpuscular mass, expressed by the hematocrit data. This reduction can be interpreted as a loss of water from the protoplasm of the red cells. In subjects treated with progesterone there is an increase in the dry residue of the blood, i.e., a dehydration in the absolute sense. On the other hand, folliculin acts to reduce the aqueous mass of the entire blood while the corpuscular mass increases in volume.

The plasma proteins increase after treatment with Ringer's solution but remain unchanged under subsequent hormonal action. RICHARD KEMEL, M.D.

## The Action of Extracts of the Anterior and Posterior Hypophysis on the Water Metabolism in Pregnancy (L'azione degli estratti di ipofisi anteriore e di ipofisi posteriore sul metabolismo idrico in gravidanza) TIMOTEO NOBILE *Ginecologia*, Tor, 1949, 15 71

In the present study the author again used four groups of pregnant guinea pigs (6 animals in each group), all of which were at least in the second half of their pregnancy. The animals in the first group served as controls. All animals in the other three groups were given an intraperitoneal injection of 10 c.c. of Ringer's solution daily for 3 days, but those in the third group received, in addition, 100 international units of anterior lobe extract daily for 3 days, and those in the fourth group received 3 units of pituitrin daily for 3 days. The animals were killed by bleeding after 12 hours of fasting and 24 hours after the last treatment. This was immediately followed by determination of the hematocrit values, using centrifugation for 1 hour, of the protein values of the plasma, using the refractometric method, and of the dry residue of the maternal organs and, when possible, of the fetal organs, using double weighing on pieces of tissue that had been left in the incubator at 110 degrees, for a period of 90 minutes.

The study showed that in all treated animals the fetal tissues presented a higher degree of imbibition than the maternal tissues. The injection of Ringer's

solution caused imbibition of the tissues performing the function of water reservoir (skin and muscle) and left unchanged the water content of the tissues with special functions (liver), or of highly differentiated tissues (brain). The action of extracts of both the anterior and posterior lobes of the hypophysis has a repercussive effect even on the tissues that are most refractory to imbibition, and causes an increase in the water content of these tissues. The action of the two extracts on the water metabolism of the blood, in experiments, does not correspond to that observed in the clinic. In experiments, there is no such antagonism between the anterior lobe extract and the posterior lobe extract as that which seems to be present in the clinic. The hematocrit values (expression of the corpuscular mass) decrease under therapy with anterior lobe extracts, but there is no simultaneous change in the water values of the entire blood. The hematocrit values in patients treated with posterior lobe extracts decrease simultaneously with a decrease in the water values of the entire blood. The plasma proteins increase quantitatively under the action of injection of Ringer's solution and, finally, under the action of both anterior and posterior lobe extracts.

RICHARD KEMEL, M.D.

## Contribution to the Study of Reports of Pulmonary Tuberculosis and Pregnancy (Contributo allo studio dei rapporti tra tubercolosi polmonare e gravidanza) E. ROBECCO and A. BERNABO SOLORATA *Ginecologia*, Tor, 1948, 14 277

One hundred cases of pulmonary tuberculosis complicated by pregnancy are reported by the authors. In the report, these 100 cases are classified as to the outcome of the pregnancy. Five patients had premature deliveries, 69 were delivered at term, 6 patients aborted spontaneously, and 20 were aborted therapeutically.

Ten of the 69 women who were allowed to go to term died within 1 year after delivery, (14.5 per cent of the cases). In 10 other women (14.5%) the pre-existing lesions grew worse or new foci appeared. In 5 of the 69 cases the babies died of tuberculous meningitis.

Of the 20 patients who had therapeutic abortions, 5 (25%) died.

Of the 11 patients who had premature delivery and spontaneous abortion combined, 1 (9.09%) died and 1 became more ill.

A greater number of patients died or grew worse among those with tuberculous cavities, with ineffective pneumothorax, or with the usual forms of active tuberculosis, especially if pregnancy was allowed to go on to term. In the cases with hemogenous apical and extra-apical tuberculosis, with ineffective pneumothorax, and with arrested forms of the disease, the greater percentage of both the mothers and children survived if pregnancy was allowed to go on to term.

Thirty-nine of the authors' cases had had pneumothorax, unilateral or bilateral. In 22 of these

cases, the pneumothorax was termed effective. In 4 of these 22 cases (including 2 of premature delivery) the condition grew worse after delivery and 1 baby died. In 16 cases the pneumothorax was termed ineffective. Among these cases there were 7 of therapeutic abortion and 3 of premature delivery. Of 6 patients in this group allowed to go to term, 5 died within 1 year after delivery and in 1 the condition grew worse. Of the 7 patients therapeutically aborted, 2 died. Of the 3 with premature delivery, 1 died. From these figures the authors conclude:

1. In cases of effective pneumothorax, the greater number of patients go to term with the condition growing worse in a small percentage.

2. In cases of ineffective pneumothorax which are allowed to go to term, the mortality percentage is high.

3. In cases of ineffective pneumothorax with treatment by therapeutic abortion, the percentage of mortality is small.

The advisability of performing pneumothorax during pregnancy should be decided by the collaborating physiologist and obstetrician. The authors are of the opinion that the gravid tuberculous patient treated by effective unilateral or bilateral pneumothorax, if the cardiovascular, renal, and general condition permit, can easily go to term if the collapse has been performed before or during pregnancy.

In case of ineffective pneumothorax or active contralateral lesions, each case must be considered individually as to the possibility that collapse may favorably modify the course of the disease. A bilateral therapeutic pneumothorax should be done if the lesions are comparatively new or there are definite exacerbations of a pre-existing lesion on the opposite side.

In 19 cases of inactive and arrested pulmonary lesions allowed to go to term, the condition grew worse after pregnancy in 3 and 1 patient died from rapid, diffuse tuberculosis. The authors agree with the

consensus of opinion when they advise that pregnancy should not be interrupted in these cases. The danger of activating old foci or giving rise to new foci is too great.

Of the 69 babies born at term, 5 died within a few months after birth. The authors are of the opinion that babies born of tuberculous mothers should be submitted to prophylactic treatment and kept for a time in special institutions for such treatment.

#### CONCLUSIONS

Therapeutic abortion should be done in cases of pulmonary tuberculosis when pneumothorax has been ineffective.

In cases of nodular apical and extra-apical tuberculosis, pregnancy usually goes to term without harm to the patient and abortion should not be performed in these cases.

Effective unilateral and, rarely, bilateral pneumothorax allow pregnancy to go to term with a very small mortality rate.

In cases of ineffective pneumothorax in premature deliveries the mortality is high. In cases of ineffective pneumothorax treated by therapeutic abortion the mortality is low.

In cases of effective pneumothorax, unilateral or bilateral (cardiovascular, renal, and general condition permitting), pregnancy proceeds favorably to term if collapse has been done before or during pregnancy.

All forms of active tuberculosis predispose the patient to a fatal outcome within a few months after delivery.

Cases of inactive and arrested pulmonary lesions complicated by pregnancy are in danger of reactivation of old foci and the production of new foci.

Babies born of tuberculous mothers should be followed up for 1 year and then checked periodically thereafter by roentgenography. They should be treated prophylactically in antituberculous dispensaries.

BLACKWELL MARKHAM, M D



# GENITOURINARY SURGERY

## ADRENAL, KIDNEY AND URETER

**Hyperfunctioning Tumors of the Adrenal Cortex, with a Report of 8 Cases** WALTMAN WALTERS and RANDALL G SPRAGUE *Ann Surg*, 1949, 129 677

In recent years the combined efforts of internists, pediatricians, chemists (particularly the steroid chemists), physiologists, and surgeons have resulted in substantial additions to knowledge of the syndromes associated with hyperfunctioning lesions of the adrenal cortex. Methods for the assay of urinary steroids have been developed which are helpful in diagnosis and in determining the results of treatment. For patients presenting clinical syndromes known to be associated with hyperfunction of the adrenal cortex, the problem of differentiating between tumor and hyperplasia has been simplified, though not entirely solved, by methods of urinary assay. Thanks to the greater availability of some of the adrenal steroids in natural and synthetic forms, the physiologic effects of several of the hormones in this group have been elucidated by both animal and clinical studies. As a by-product of these studies, it is now possible to explain many (though not all) of the symptoms and signs presented by patients with hyperfunctioning lesions of the adrenal cortices. Metabolic studies and identification of the urinary excretory products of the adrenal steroids have further clarified the pathologic physiology of these lesions.

The clinical pictures associated with hyperfunction of the adrenal cortex are extremely protean in nature and presumably depend upon the type and the quantity of steroid hormones produced, the age and sex of the patient, and perhaps on other factors.

For patients presenting clinical syndromes known to be associated with hyperfunction of the adrenal cortex the problem of differentiating between tumor and hyperplasia has been simplified, though not entirely solved, by methods of urinary assay.

The purpose of the complete article is to present a group of 8 cases of proved tumors of the adrenal cortex which exemplify some of the problems encountered in diagnosis and surgical treatment. These cases supplement the 10 cases reported in 1934 and the 7 cases reported in 1938.

At the time of these earlier reports, methods for assay of urinary steroids were either unknown or were in an early stage of development, and little was known of the effects of pure adrenal steroids.

Desoxy corticosterone has its effect upon salt-and-water metabolism, compounds A, B, E, and F, of Kendall, have an effect on carbohydrate and protein metabolism, and the first two, on fat metabolism. Androstenedione and adrenosterone, estrone and progesterone have androgenic, estrogenic, and progestational effects, respectively.

Edema, hypertension, and congestive heart failure may result from retention of salt and water, and loss of potassium may lead to profound muscular weakness.

Overproduction of hormones having physiologic effects, like compound E and compound F, may explain the diabetes mellitus, the negative nitrogen balance, the muscular weakness, the osteoporosis, the thinning of skin, and the ecchymosis, and the effect of lymphoid tissue may explain the leucopenia which is characteristic of Cushing's syndrome.

Virilism, hirsutism, baldness, amenorrhea, florid skin, hypertrophy of the clitoris, acne, masculinization of the voice in women, and alteration of the habitus in the direction of masculinity might result from the production of an excessive amount of androgenic material by an adrenocortical tumor—and likewise the occurrence of sexual and somatic precocity in children.

Overproduction of estrogens and of compounds having an action like that of progesterone may explain the vaginal bleeding and sexual precocity in girls who have tumors of the adrenal cortex and the occurrence of impotence and gynecomastia in men.

Lastly, and of extreme importance, is the fact that a patient with a hyperfunctioning tumor of the adrenal cortex and virilism is likely to excrete a large amount of 17-ketosteroids in the urine, and, on the contrary, if evidence of virilism is minimal or lacking, as in Cushing's syndrome, the excretion of 17-ketosteroids may not be elevated.

**Addisonian Crisis** JOSEPH J KRISTAN *J Urol*, Balt., 1949, 61 178

The author reports a case of latent adrenal cortical insufficiency in which the diagnosis was made and treatment instituted only after nephrectomy had been done for renal tuberculosis. The possibility of concurrent complicating diseases masking the diagnosis of cortical insufficiency should be considered in all patients with urogenital tuberculosis, especially those in whom surgery is contemplated.

The patient whose case was studied was a 37 year old white male who gave a history of weakness, dizziness on changing position, and headache with nausea, suffered over a period of 7 years. Thrombin therapy, only partially alleviated his symptoms. On several occasions he had noted pink seminal fluid. Slight frequency was the only urinary symptom. Investigation revealed left renal tuberculosis. Following a left nephrectomy, the blood pressure remained low in spite of multiple transfusions. Adrenal insufficiency was suspected. Cortical extract (cortate), 10 mgm at once and 5 mgm every 6 hours, was given. The blood pressure response was good but the patient appeared very ill, vomiting moderately. The immediate postoperative course was somewhat stormy but after 2 weeks the patient was discharged without further



cortical extract therapy The pathological diagnosis was ascending tuberculous pyelonephritis

Three days after discharge the patient became progressively worse and returned to the hospital in collapse The systolic blood pressure was 60 and 70 mm Hg Ten milligrams of cortate and salt, in amounts up to 9 gm, were given daily The blood pressure ranged between 70 and 120 mm Hg, and upon discharge cortate (7 mgm daily) was continued Two months postoperatively he was placed on  $7\frac{1}{2}$  mgm of desoxycorticosterone acetate and supplemental salt A marked improvement was noted One month later 15 pellets of desoxycorticosterone acetate (percortin, each pellet containing approximately 125 mgm) were implanted and good results were obtained

After a period of 1 year his symptoms recurred and oral administration of adrenal cortical extract failed to completely alleviate the symptoms After readmission to the hospital, exhaustive studies revealed hypotension and calcification of the right adrenal gland Moderate improvement was noted with 5 mgm desoxycorticosterone acetate and 4 gm of salt daily Following stabilization and determination of extract requirements, 9 pellets of percortin (each pellet containing approximately 75 mgm) were implanted, and supplemental salt was given daily

PETER L SCARDINO, M D

#### Renal and Osseous Lesions (Reins et lésions osseuses)

J A LIÈVRE *J urol méd*, Par, 1949, 55 8

The relationships between the kidneys and osseous disease are numerous, for, without doubt, the kidneys are the principal organ of excretion of mineral substances stored in the skeleton Likewise, the kidneys destroy these substances and, conversely, by their alteration retain them in the osseous reservoirs

Parathyroid osteitis is due most frequently to a solitary adenoma of one of the parathyroid glands This tumor is not very large, about the size of a hazel nut, but it is large in comparison to the normal thyroid gland The disease is characterized clinically by painful bones with asthenia, and progressive demineralization of the bones along with various visceral signs The urinary signs consist of renal lithiasis, polyuria, and nephritic symptoms

The first symptom of lithiasis is frequently renal colic which is nearly always discovered within the first year or two years of the disease, that is to say, it is the symptom which suggests the diagnosis The author has seen this symptom in 3 of 4 cases In one of his patients a bilateral calculus that was visible on roentgen examination was the first sign of the disease Occasionally, the roentgenogram does not show a distinct calculus, but a diffuse milary calcification in the renal parenchyma is shown Renal colic without demonstrable calculi in the kidney or in the urine is due perhaps to the increased secretion of calculous material

Polydipsia and polyuria are interesting findings because they may be isolated symptoms of the disease

In 1931 Lièvre noted that a mild to moderate polyuria is frequently observed in parathyroid os teitis It may accompany the progression of the disease or be an early symptom of the condition

The signs of nephritis and renal insufficiency consist of albuminuria, cylindruria, hyaline or granular, and calcium phosphate casts in the urine Edema is rare It may be a part of the edema of late cachexia, or it may be associated with edema of the lower extremity accompanying the gross bone lesions Renal hypertension is rare while azotemia remains of moderate degree for a long time, but in late cases it leads to the fatal termination of the disease

A renal form of hyperparathyroidism was described by the author in 1931 In this form of the disease, the renal symptoms are the first that appear There are two phases of the disease, the one consisting of polyuria and the other of renal insufficiency The clinical history reveals the typical symptoms that are characteristic of hyperparathyroidism When urinary symptoms are present, one should search for other clinical signs of hyperparathyroidism The proportion of calcium, phosphorus, and phosphatase in the blood as well as the amount of urinary calcium should be determined If one of these elements is abnormal in amount, the blood protein should be measured and a search for osteoporosis should be made

The clinical signs of hyperparathyroidism may be inadequate to make a diagnosis If this is so, is it advisable to do a difficult exploration of the neck? The author believes that if the patient has a persistent hypercalcinuria, hypophosphaturia, and constant elevated blood calcium determination after five examinations, the operation should be done There were more than 30 cases in which the diagnosis was finally established at operation The mechanism of renal lithiasis in the course of parathyroidism and parathyroid osteitis can be explained as the result of transportation of calcium phosphate through the framework of the kidney and the precipitation of this substance from the saturated urine The precipitation takes place in the calices as well as in the kidney tubules Diffuse impregnation of the calcium takes place through the kidney, and in the advanced phase of the disease the calcium impregnates all the renal parenchyma Polyuria and pyelonephritis appear as an eventual consequence of the irritation of the mineral particles The impregnation of calcium easily explains the onset of sclerosis and renal insufficiency The polyuria may be due to the diminution in the concentrating power of the kidney, but it is more probable that it is due to the direct diuretic action of the parathyroid hormone

Renal colic and calculous excretions are observed frequently in the course of tuberculous osteoarthritis Coxalgia and Pott's disease are frequently associated with nephrolithiasis Roux, in 1937, discussed this subject He believed that the metabolic disorders, acid urine or urinary calculi, urinary infection, and excessive elimination are the causes of the lithiasis in cases of this type The author believes the cause to

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be a general metabolic disorder, an osteoporosis, connected rather to the tuberculous lesion than to the immobilization of the patient. The "osteoporosis of immobilization," a term applied by American authors, is attributed to an absence of activity of the osteoblasts that have not recovered from the physiological stimulation that is usually present in the muscles and tendons. Renal colic and the passage of calculi are equally common in immobilization from other causes such as multiple fractures and serious fractures with prolonged immobilization, and in the course of infected fractures. Severe fractures of the vertebrae produce trophic changes in the kidney and motor disorders of the excretory passages.

Roux reported a case of renal lithiasis during the course of a severe gonorrheal rheumatism with diffuse osteoporosis. Mondor observed renal colic in the course of gonococcal coxitis, and Volkman saw this condition in a case of rheumatism immobilized for operative orthopedic correction. The author believes that all these conditions are osteoporosis of immobilization with excessive elimination of calcium phosphate by the kidney.

Osseous lesions are present in the disorders of calcium phosphate metabolism associated with chronic nephritis in the adult, but observations on this condition are not numerous due to the lack of research. There are, however, many clinical observations showing osteoporosis with destruction of the vertebral column.

In the young patient the osseous lesions are more apt to be secondary to the renal lesions (with azotemia, hypocalcemia, hypophosphaturia, and acidosis), but in the older patient a change in the bones is more frequent and the relationship between the renal and the bone lesion is more difficult to interpret. The role of the parathyroid gland in the course of chronic nephritis must also be considered, for the parathyroid gland may be hypertrophied in chronic nephritis. Perhaps the secondary hyperparathyroidism produces a vicious circle, with hyperphosphaturia and acidosis being a part of this cycle.

In the infant the osseous lesions can originate from the kidney. There is an arrest in the infant's growth with enlargement of the epiphysis, malformation of the knees genu valgum and genu recurvatum, and inflexibility of the diaphysis. When these signs appear, a search for renal insufficiency should be made. The patient may have polyuria of sufficient amount to cause one to think of diabetes insipidus. The urine is of low specific gravity and the kidney has lost its power of urinary concentration. Azotemia, which may be in an advanced stage before all these clinical signs appear, sometimes is found. Albuminuria is usually small in amount or absent. Cylindruria may or may not be present. The blood pressure is usually normal. The disease is fatal unless a curable lesion of the urinary passage is discovered since it has been proved that the secretory disorder is the cause for the disease.

The author describes the syndrome of Toni-Debre-Facot, a group of mysterious cases that present os-

seous lesions, osteoporosis, rickets, cessation of growth, and a renal type of glycosuria. The rickets is characterized by a final osteomalacial type of osseous degeneration. The glycosuria is more unusual since it is produced without hyperglycemia. The symptoms, with albuminuria, labile temperature, hypophosphatemia, disorders of amino acid and lipid metabolism are difficult to interpret. In certain cases hepatomegaly and visceral accumulation of cystine are found. It is believed that the syndrome is due to an anomaly of function of the renal tubules from which the glycosuria and perhaps the osseous lesions have their origin.

The author finally describes a morbid entity characterized by osseous lesions and a nondiabetic glycosuria. The bone lesions consist of zones of pseudo-fractures of the Looser-Milkman type with renal glycosuria. The glycosuria is probably due to an abnormality of the re-absorption of glucose and phosphates by the tubular mechanism of the kidney. The disease is thought to be due to the failure of the uriniferous tubules to form hexophosphate that is synthesized by the fermentation of phospholactate. The author describes the syndrome as consisting of a renal phosphoglucoside diabetes with the following characteristics: appearance in adults of painful bone lesions, asthenia, osteoporosis, fractures and pseudo-fractures of the Looser-Milkman type, fibrillations, and muscular tremors. The glycosuria is without hyperglycemia (a type of renal diabetes), phosphaturia is generally low, but at times there is an alkaline phosphaturia which may be high. The disease carries a grave prognosis.

CONRAD A. KUEHN, M.D.

Consideration of Paraneuritic Tumors (Considérations sur les tumeurs paranéphrétiques) HENRIQUE MANOEL A. RUPP *J urol méd*, Par, 1949, 55, 2.

The author defined retroperitoneal paraneuritic tumors as those neoplasms that have their origin in the retroperitoneal space. The origin of these tumors, whether from the fibrous capsule or the cellular adipose tissue around the kidney, cannot usually be determined before surgery or autopsy. The proximity of these tumors to the kidney and the urinary tract, with their effect upon the structure and function of the organs, thus presenting a diagnostic and therapeutic problem for the urologist. Because of the late symptoms associated with the growth of the tumors, they are usually discovered by mechanical urological disturbances.

The author reported 3 cases upon which the study is based.

Although these tumors are of various kinds, they are rare. Rupp reviewed the collected cases of various authors who studied 166 retroperitoneal tumors. In this group of cases there were 32 histological types. Because of this great variety the histological classification of these tumors, the author suggested that they be studied more for in a general fashion there is no agreement.

authors concerning the pathologic findings associated with this type of tumor

The problem of recurrence is one of great importance in paranephritic tumors. Among the 3 cases reported by the author there was 1 recurrence. The 2 other cases had not been followed up long enough to determine if a recurrence would develop at a later date. During the first operation in 1 case the tumor was easily extirpated and the kidney was conserved. When the tumor recurred, its removal was very difficult for the kidney was involved and adherent to the wall as well as to the diaphragm. A nephrectomy was necessary. Ten months after the second surgical intervention the patient had a right subcostal mass that was very adherent to the pleura and no further operation could be done. The recurrence in this case could have been from the nodules that were undiscovered at the time of the second operation. It is almost impossible to remove all of the small nodulations that have the appearance of fatty tissue which is usually found in this region and completely clean out the retroperitoneal space. The nodulations may be the source of the usual recurrence of these tumors.

The recurrence may present a different histological structure from the original growth. In the author's case the primary growth was a neuroganglioma, and the recurrence was a histiosarcoma.

Many theories have been advanced to explain the etiology of these tumors. Haussmann and Budd, searching for an explanation of these tumors, drew upon the embryology and related each type of tumor to a stage in the embryological development.

In the embryo the genitourinary tract has an intimate relationship to the ectoderm. At the time the vertebrae and the muscles are formed, these structures are pushed forward. Following this movement, small nodules of ectoderm may be included. This may explain the future formation of tumors. This is the same idea suggested by the Cohnheim theory. These small fragments of embryonic cells always develop in response to unrecognized trauma or physiologic irritation. Lindensfeld inoculated small pieces of mucosa of the pelvis and the ureters under the renal capsule. In 70 per cent of 25 experiments he obtained positive results. Solitary cysts of the kidney were formed in the area of these inoculated pieces of mucosa. He concluded from a genetic and clinical viewpoint that solitary cysts of the kidney differ only in their location and may be either intraparenchymatous, subcapsular, or pararenal.

It is almost impossible to determine the origin of these paranephritic tumors and their original location prior to autopsy or surgical intervention.

In discussing the symptomatology of paranephritic tumors the author quoted the classical description of Lecene. He described them as being abdominal tumors, developing slowly and progressively, unrecognizable or almost so, not producing a change in the general health for a long time, tumor hard or soft, possessing a lumbar location in the retroperitoneal region and in relationship to the intestine, and not

generally found except in relationship to diseases involving the urinary apparatus.

Röntgenological study is an aid in determining whether the tumors are intraperitoneal or retroperitoneal, and the relationship of the tumors to the neighboring organ is also of value in determining the possible surgical removal of the tumors.

The urologist is interested in the relationship of the tumors to the kidney and their influence upon the renal function. He is also concerned with the differential diagnostic problem created by these tumors and the best surgical approach for their removal.

A simple roentgen picture will show changes in the renal outline, a change from its normal position, elevation or immobilization of the dome of the diaphragm, and, in some cases, a concavity of the psoas outline. Windholz gives as a common sign a clear zone as compared to the surrounding tissue. This shows the existence of the tumor. Perirenal air insufflation demonstrates the renal shadow, especially the upper pole of the kidney. This is of value in outlining small suprarenal tumors and also the large tumors that surround the kidney, but there is the danger, more or less theoretical, of emboli or infection when this procedure is used.

Urography and pyelography are effective examinations in correctly revealing these paranephritic tumors. The kidney, a relatively mobile organ which is fixed by its pedicle, suffers many modifications of its position due to these retroperitoneal growths. This is shown by torsion of the kidney around its vertical posterior or horizontal axis. The location of the tumor is very important in the mechanism of this torsion. If the pedicle is short, the kidney remains fixed and is usually turned around on its pedicle, which produces a certain degree of rotation. If the pedicle is long, the mass may displace the kidney laterally and anteriorly downward.

The ureter, in general, is deviated laterally and anteriorly, inscribing an arc.

After urography, the relationship of the tumor to the abdominal contents should be studied by means of barium given by mouth and enema.

The diagnostic problem involves the location of the tumor mass, whether it is intraperitoneal or extraperitoneal. For the extraperitoneal mass, it is important to know whether it is a renal or a pararenal tumor. If it is pararenal, its origin, location, relationship to the kidney and other vital structures is important. It is necessary to make a clinical and roentgenological examination of paranephritic tumors because the diagnosis is always made by exclusion.

The subjective urinary symptoms are of little value because they are absent in most cases or come late in the course of the disease. Yet, they do serve as a means of elimination and exclusion.

Renal tumors, renal cancer, kidney cysts, hydro-nephrosis, and polycystic kidneys are eliminated from the diagnosis by the urinary symptoms they present and in addition they present a special roentgen sign in each case. Splenomegalia has a tendency

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to develop inferiorly and to the inside, and on contact with the lumbar region shows a notched border. Cysts of the pancreas are rare, they are situated in the epigastric region and give typical alteration in the digestive tube. Cysts of the mesentery are in general movable, accompanied by partial obstructive symptoms and at times produce blood in the stools. Perinephritic abscesses, perirenal hematomas, chronic cholecystitis, and retroperitoneal appendicitis are eliminated by their modifications of the general health and by the acute character of their clinical course. A retroperitoneal tumor, even benign, causes death by cachexia or by compression of vital structures, and by its frequent transformation into a malignant tumor. These are the reasons for surgical removal.

X-ray therapy is used solely for inoperable tumors or as an adjunct to postoperative treatment. Its success depends upon the sensitivity of the tumor cells. X-ray therapy is of little value in lipomas.

Surgical treatment gives the best results, but there is some dependence upon the relationship of the tumor to the kidney and other vital organs. It is advisable to determine the renal function before surgical intervention, for it is frequently necessary to do a nephrectomy.

The principal difficulties encountered during surgery are those associated with freeing the tumor from the mesentery, aorta, vena cava, diaphragm, pleura, and the iliac vessels. The difficulties of surgery depend directly upon the relationship of the tumor and its size to its adherence to the surrounding structures and the difficulty in producing lines of cleavage. The surgical approach is usually transperitoneal. Franck employed the paramedian transperitoneal incision in 84 per cent of his cases. If one considers that the preoperative diagnosis is rarely made, the transperitoneal approach seems to be the best one. For small tumors on the internal border of the kidney or on the superior renal pole, and if the exact point of origin and adherence to the surrounding vessels is unknown, the author prefers the transperitoneal or the anterior lateral approach of Fey.

It is logical to suppose that the surgical approach depends upon the topography of the kidney. In the larger tumors a lumbotomy with the possibility of enlarging the incision above and below, with or without opening the peritoneum, seems the best operative incision. Various authors suggest different incisions, such as the lumboiliac and transverse incisions, but the choice depends upon the preoperative diagnosis and the relationship of the tumor to the surrounding organs. When the choice of the incision is lumboiliac or transverse, the peritoneum should be opened in order to inspect the abdominal content. After excision of the tumor, the retroperitoneal cavity should be carefully inspected so that small tumor nodules do not escape detection.

In conclusion, the author stated that a minute clinical and roentgenological examination of the urinary apparatus and gastrointestinal tract permits the preoperative diagnosis of retroperitoneal para-

nephritic tumors with relative ease. The anatomic relationship and the topographical location of the tumor give information concerning the surgical approach. A lumbotomy is indicated for the recognized tumors. The mortality is very high in spite of the technique employed. The most exacting treatment of this condition should be made in order to decrease the complications and permit the best prognosis.

CONRAD A. KUEHN, M.D.

### The Problem of the Perirenal or Capsular Tumors of the Kidney (Zur Frage der perirenal Geschwulste—Nierenkapselgeschwulste) EWALD LEBBIN *Chirurg, 1949, 20 10*

Tumors of the retroperitoneum are often considered as one entity although this author and several others feel that they should be differentiated according to their origin. Although they all produce somewhat similar clinical pictures, those which arise from the perirenal tissues appear to have special significance. Included in the perirenal tissues are the structures which are enclosed in the renal fascia exclusive of the substance of the kidney and of the adrenal gland. Thus the tissues of origin are the fibrous capsule of the kidney and its few muscular fibers, the fatty tissue surrounding the kidney, and the fascial capsule which contains this structure.

The tumors of these structures appear to be very rare, Lubarsch reporting but one in a series of 30,000 to 40,000 autopsies. The author reports 4 cases observed in a period of 6 years in approximately 4,000 autopsies. The first of these they designated as a perirenal dysontogenetic fibromyolymphangiolioma with inclusion of pseudorenal canaliculi. The second case revealed a bilateral increase in the fatty tissue surrounding the kidney which was termed a tumor formation of the adipose renal capsule. The fourth case was one of a huge fibrolipoma of the perirenal area weighing 15 kgm, and 25 cm in diameter. With exception of Case 4, all of the other tumors were found at autopsy and had not been subjected to clinical therapy.

WILLIAM C. BECK, M.D.

### Tumors of Renal Pelvis (Ueber Nierenbecken tumoren) ALFRED GUETGEMANN *Chirurg, 1949, 20 1*

In the author's experience, malignant neoplasms of the renal pelvis are far more common than benign ones. Papillary tumors of the renal pelvis appear to have a tendency to grow down the ureter, and if this structure is not removed at the primary operation, they seem to recur in the ureter. Secondary removal of the ureter is often a most difficult procedure, and the dissection, which must be carried out to include the intracystic portion of the ureter, may be most difficult in cases of recurrence.

In the Urological Clinic, in Bonn, a surprisingly high percentage of renal pelvic tumors have been observed. In 13 of 88 cases, renal neoplasms were found. As in most series, these were largely in men in the fifth to seventh decade of life.

All of the lesions were diagnosed by the finding of unilateral hematuria and changes on either excretory

or retrograde urography. The latter is not without danger as in one case, it is believed, a ureteral metastasis was initiated by the retrograde catheter. The cystoscopic examination was important, not only in the finding of a unilateral hematuria, but also in revealing papillomatous material protruding from the ureter. Bleeding may be initiated by brisk palpation over the kidney, or by the catheter probe. The author states that any papilloma near the ureteral orifice should be investigated for the possibility of a similar tumor in the renal pelvis. The urographic study may reveal a filling defect, or an abnormal emptying of the renal pelvis.

(The pathological study of the tumor is of utmost importance. Serial sections may reveal that a tumor which appears to be benign in one area may be infiltrating in another. Certain of the seemingly benign neoplasms of this type may also show metastasis in the ureter so that clinically, at least, they are malignant.)

The authors find that in the case of tumor of the renal pelvis it is imperative to remove the entire ureter. In 21 cases which were followed up for a sufficiently long period, there were 20 recurrences, some years or even decades after the original operation. The treatment of recurrences with roentgen therapy or intraureteral radium is so poor that the author relegates it to the hopeless case.

Actually, however, the prognosis is not as bad as this might indicate. Of 12 cases followed over a sufficient period, 7 were alive and free of metastasis at 5 years, and 2 at 10 years. WILLIAM C. BECK, M.D.

### BLADDER, URETHRA, AND PENIS

**Biopsy and the End Results of Bladder Tumors**  
(La biopsia ed il destino dei tumori vescicali)  
A. FRANCESE *Arch. ital. urol.*, 1948, 22, 417

Primary tumors of the bladder occur with moderate frequency. The most important, undoubtedly, are those which originate from the epithelium, and these, usually, are classed as villous tumors or papillomas.

Before the observance of these tumors by means of modern endoscopy for diagnosis and treatment, they were always considered of grave prognosis on account of the ease with which they recurred after they had been excised. Early diagnosis can now be made and electrocoagulation easily carried out under direct vision in the majority of cases, and in cases of recurrence the tumors can be combated with measures less serious than by attack through hypogastric incisions.

These tumors occur, usually, in middle age and more often in males than in females. They occur most frequently in the trigone. They may be single and develop in a circumscribed area of the bladder, or they may occur at many points and occupy a large area of the bladder.

In order to determine the clinical course of vesical tumors and in order to discover any agreement between the histological picture of the tumor at biopsy

and the postoperative course of the tumor, the author carefully studied 101 vesical tumors which were treated in the Tumor Clinic of Turin during the years from 1936 to 1946.

The cases observed were divided into three large groups. The first group consists of those cases in which there was an exact agreement between the microscopic report of the biopsy and the postoperative course. In the tumors of the second group of cases there was an exact disagreement between the biopsy and the postoperative clinical course, and in the third group the biopsy report was doubtful.

In the first group there were 64 cases, in 28 of which both the biopsy report and the postoperative course showed the tumor to be benign, while in the remaining 36 cases, both the biopsy report and the postoperative course showed the tumor to be malignant.

In the second group there were 19 cases, in 3 of which the biopsy showed that the tumor was benign and yet the postoperative course was that of a malignant tumor. In the remaining 16 cases, the biopsy showed that the tumor was malignant and yet the postoperative course proved it to be benign.

In the third group there were 18 cases in which the biopsy was doubtful. In 10 of these cases the postoperative course was that of a malignant tumor and in 8 the postoperative course showed that the tumor was benign.

The first group was comprised of the largest number of cases. The 28 cases which appeared benign at biopsy followed a benign postoperative course following biopsy. In those cases in which the new growth appeared somewhat extensive and infiltrating, partial resection was performed, and the area excised was studied and found to have atypical structural characteristics in perfect accord with the histological preparation made at the time of biopsy. In this group the most interesting evidence produced was the preponderance of the malignant form of the tumor over the benign type. This is in agreement with the statistics of other authors.

In the second group, several facts are to be considered to explain the discrepancy between the biopsy report and the clinical course after operation. In cases in which malignancy was not revealed by the first biopsy, it is probable that on account of the numerous villous processes of the tumor a section of the base of the tumor which might have shown the malignancy was not included in the specimen removed. After electrocoagulation following biopsy, the thickness of the tumor was lessened and the base of the implant was more easily accessible and included in subsequent biopsy sections. Characteristic invading malignant cells were then demonstrated in the connective tissue stroma. In those cases in which the biopsy was malignant and the postoperative course was benign, the apparent discrepancy is explained by the fact that the malignant tumor was completely removed by the initial electrocoagulation therapy. When a second biopsy was taken later, the biopsy tissue appeared normal and

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contained no signs of the pre-existing tumor because it had been thoroughly destroyed.

In the third group of cases, in which the biopsy was doubtful at the initial examination, the biopsy was repeated two or three times without revealing absolute proof that the tumor was benign or malignant. In the doubtful cases in which the postoperative course proved to be that of a benign tumor, it is probable that any malignancy that might have been present was in the initial stage and was completely destroyed by the electrocoagulation treatment following biopsy. In the doubtful cases in which malignancy was not proved until after repeated biopsies, the discrepancy is explained by the fact that a portion of the base of the tumor showing atypical cells was not included in the biopsy specimen. The malignancy in the tumor persisted in spite of repeated electrocoagulation treatments.

From these interpretations, the importance of obtaining a portion of the base of the tumor in a biopsy section is made evident. Sufficiently large pieces should be taken from different parts of the tumor, care being taken to avoid necrotic areas. A careful and painstaking histological technique should be employed. Repeated biopsy examinations at 2 or 3 month intervals should be carried out in cases of persistent or recurrent tumors to avoid overlooking possible malignant tumors and to determine the need of extensive electrocoagulation therapy.

BLACKWELL MARKHAM, M D

## GENITAL ORGANS

**Retropubic Prostatectomy** R LICH, JR, O GRANT, and J E MAURER *J Urol* Balt, 1949, 61 930

The authors present a comparative study of 65 retropubic and perineal prostatectomies, both of these operations are extravascular surgical procedures. They note that Millin's technique of retropubic prostatectomy has been received in the United States with interest in spite of the adverse criticism accorded similar techniques by Von Steckum in 1909, and by Jacobs and Casper in 1933. The authors believe that the antibiotics of today have afforded the necessary surgical courage to invade the vulnerable space of Retzius. They describe the radical anatomy, and both the conservative and radical retropubic techniques of prostatectomy. The operations are well illustrated.

The average age of patients undergoing perineal prostatectomy was 68.8 years, the age of those having the retropubic prostatectomy was 68.1 years. Vesical catheter drainage averaged 10.1 days in cases of perineal, and 6.0 days in cases of retropubic prostatectomy. In the last 26 retropubic operations, the catheter was removed earlier, which reduced the average period of drainage to only 4.9 days. The postoperative sojourn for the perineal operation was 17.9 days as against 12.3 days for the retropubic operation, patients having the latter operation experienced a more comfortable and more active postoperative convalescence. Forty-three (66.1%) pa-

tients in the perineal group required blood transfusions while only 8 (12.3%) patients of the retropubic series required blood replacement. In the retropubic series the average postoperative period necessary before the urine was microscopically (not culturally) normal was 31 days, while in the perineal group this result was accomplished in 27 days. Seven patients of the perineal series suffered temporary stress incontinence of less than 19 days and another patient suffered incontinence of almost 3 months' duration, while in the retropubic group there were only 3 instances of stress incontinence (in 2 cases, 5 days and in 1 case for more than 2 weeks' duration). Latent hemorrhage occurred in 2 patients of the retropubic series, while bleeding occurred once in the perineal group. There occurred one instance of suprapubic fistula in a patient with an unusually large diverticulum following the retropubic technique. Chondritis of the symphysis pubic occurred twice in the retropubic, while none was seen in the perineal group.

The incidence of cancer of the prostate in the perineal series was 8.2 per cent, in the retropubic series cancer was observed in 5.1 per cent. Radical retropubic or perineal procedures were carried out when the diagnosis of cancer was made at operation. In 3 cases of the retropubic series, cancer was unsuspected and was revealed after histologic examination of the specimen, it seems to be more difficult to detect carcinoma during the retropubic than during the perineal prostatectomy. This fact seems to constitute a distinct disadvantage of the retropubic operation.

One death occurred among the patients who had perineal operations. There were no deaths in the retropubic series.

Retention of potency after retropubic prostatectomy is high and it approaches that of transurethral resection, while impotence is the rule after perineal prostatectomy. ROBERT TURELL, M D

**Varicocele** RAYMOND O OLSON and ERIC P STONE. *N England J M*, 1949, 240 877

The authors present a critique of the varicocele syndrome and the results they obtained from a new operation done on 25 patients. The pathologic physiology was reviewed and attention was drawn to the concept of dual venous drainage of the deep and superficial systems (Fig 1).

The clinical picture was described in detail. It was stated that a coexistent hernia may be present in 25 per cent of the cases. In most instances it is possible to evaluate the symptoms and to establish whether they are due to the varicocele, a coexistent varicocele and hernia, or to one of the ill-defined syndromes of orchialgia or chronic epididymitis.

Of therapeutic importance is the fact that the textbooks have as yet not assimilated the new literature and still offer a pessimistic outlook. Usually the symptoms are ascribed to overcongestion from unfulfilled sexual desires, scrotal fixation in psychoneurosis, and other poorly defined causative factors.



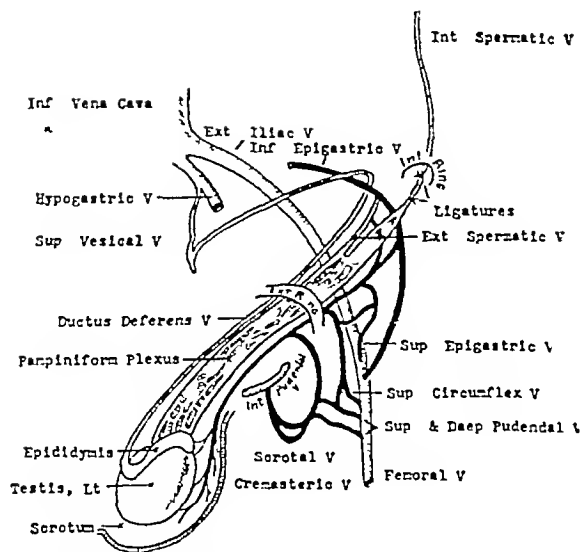


Fig 1 (Olson, Stone) Diagram of the venous drainage of the scrotal contents (adapted from Javert and Clark). Primary system—internal spermatic, ductus deferens and external spermatic veins (in white). Secondary system—superficial epigastric, superficial internal circumflex and cremasteric veins, and, through scrotal tributaries, the superficial and deep pudendal and the internal pudendal veins (in black).

As a consequence, surgery is considered unwise. The authors took issue with these views and pointed out that the role of psychoneurosis in this condition has been overemphasized and the pessimistic attitude toward surgical treatment is not warranted. They pointed out that a patient with typical varicocele symptoms can be effectively relieved by the high ligation technique which is attended by very little risk of operative complication, the low ligation operative procedure has been abandoned.

The technique of the high ligation procedure is as follows:

Through an oblique inguinal incision the external oblique fascia is split through the external ring to allow better exposure and a more effective herniorrhaphy. The spermatic cord is completely freed to the level of the internal ring. It is believed that this step allows for better eventual testicular suspension. The cremasteric fascia is opened longitudinally, and the internal spermatic vein isolated. Usually, one large vein, approximating a pencil in size, is found and is ligated at the internal ring, as is a secondary smaller vessel if present. In this series 15 patients had one vein, and 10 presented two veins which in all cases were found to anastomose retroperitoneally. A segment of the vein from 2 to 5 cm in length is excised, and the proximal end is allowed to retract retroperitoneally. Careful search is then made for a hernial sac. If found, it is dissected free, and the sac is ligated. Testicular suspension, which is next carried out, is

considered very important for the final result. Three techniques are followed: the distal vein stump is pulled proximally and sutured through the cremasteric fascia to the internal oblique muscle, the cremasteric fascia is closed transversely, and a further tightening of the lax spermatic cord is obtained by suture of the conjoint tendon under the cord to the shelving inguinal ligament. This lifts the cord by the mere presence of tissue beneath it. The external oblique muscle is then resutured above the cord. Silk suture material is used throughout the procedure. Postoperatively, the patient wears a suspensory for 2 weeks. He is allowed to be ambulatory on the first postoperative day and is eligible for discharge on or after the sixth postoperative day.

ROBERT TURELL, M.D.

#### Malignancy in Cryptorchidism WILLIAM A. CARROLL, *J. Urol*, Balt., 1949, 61: 396

Recapitulation of the reported incidence of cancer in cryptorchidism reveals a marked variance in submitted statistical analyses and conclusions. To study the problem, the author submitted a questionnaire to each active and associate member of the Western Section of the American Urological Association and to each member of the American Urological Association.

An examination of the statistics, which showed a high incidence of cancer in cryptorchids when compared to the incidence of undescended testes in general, revealed a similar pattern was followed in assembling the data: (1) individual series with a small number of malignant tumors, (2) compilation of reported series supplemented with estimated or hypothesized figures from reliable sources for the missing data required for statistical purposes.

Four groups of figures were necessary for either of these two approaches to statistical tables: (1) total male hospital admissions or estimated total male population, (2) total or estimated total number of patients with malignant testicular lesions, (3) total number of patients with cancers in undescended testes, (4) total or estimated total number of patients with undescended testes.

A careful consideration of these four prerequisites to the statistical tables revealed numerous assumptions, estimations, and, according to the author, fallacious conclusions. It was apparent that the subject did not lend itself to acceptable statistical review. Hence the author submitted his questionnaire.

Of the 662 replies, 76 per cent of members of the American Urological Association and 81 per cent of members of the Western Section of the American Urological Association had never seen a malignant undescended testis. One hundred and twenty-six members of the American Urological Association and 33 members of the Western Section, American Urological Association, reported a sum total of 285 malignant tumors in cryptorchids seen by them.

On the basis of this study, the author concluded that malignant testicular tumors are rare, cancer in cryptorchidism is still more rare and should be class-

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ified according to its anatomical location, the incidence of cancer in cryptorchidism from the actual cases reported is so minute that the malignancy potential cannot be used as an indication for either orchiectomy or orchectomy PETER L SCARDINO, M D

## MISCELLANEOUS

**Streptomycin in Urogenital Tuberculosis** A C ABERNETHY and H H EDELBROCK *J Urol*, Balt., 1949, 61 410

Ten patients with genitourinary tuberculosis who had failed to respond to other forms of therapy were treated with streptomycin. The findings in these cases are submitted by the authors as a preliminary report. The effectiveness of streptomycin having been demonstrated both in vivo and in vitro, the authors were stimulated to use streptomycin as an adjunct to other accepted forms of therapy.

The therapeutic regimen consisted of the administration of streptomycin, 0.3 gm intramuscularly every 3 hours with a maximum total dosage of 400 gm, 1 dram of choline chloride daily, when tolerated, and surgical removal of the tuberculous organ when possible.

Ten cases of genitourinary tuberculosis were reported in detail. Under treatment, 3 tuberculous sinuses closed. Of the 4 patients with apparent renal tuberculosis, 1 patient was treated surgically, in 1 the process appears to be arrested, 1 is definitely improved, and the fourth patient expired. There were 3 patients with involvement of the ureter. One of these died, and autopsy showed that no healing had taken place, in 1, the ureter was removed, and in 1 the ureter appeared normal by excretory urogram following therapy.

Of the 7 patients with tuberculous cystitis, 1 died and showed no evidence of healing, in 4 the process (cystoscopically) appeared arrested, and 2 were subjectively improved.

In 2 patients with testicular tuberculosis in a solitary remaining testis, there was evidence of arrest of the process.

It was difficult to evaluate the response of tuberculous prostatitis to the therapy employed, however, all patients were clinically improved. Pyuria cleared in 7 patients, was improved in 1 patient, and was unchanged in 1. None of the patients had been followed more than 20 months.

On the basis of this experience, the authors conclude that streptomycin will produce improvement in the general status of the patient and clear the urine of tubercle bacilli, albeit a temporary effect. The use of choline chloride is not well understood. The toxic effects of the therapy were relatively minimal. All patients developed transient dizziness. One patient sustained some hearing loss and another, destruction of vestibular function.

PETER L SCARDINO, M D

**Urinary Tract Calculi** J C KIMBROUGH and J C DENSLOW *J Urol*, Balt., 1949, 61 837

The authors discussed the incidence, etiology, diagnosis, and treatment of urinary calculi occurring in 15 recumbent patients with bone injury, as observed at the Walter Reed General Hospital, Washington, D C. During the period of investigation of these patients, there were about 800 other hospitalized patients who had been immobilized for long periods of time because of bone injury. A great many of these patients had suffered injuries during the past World War. The shortest period noted for calculi formation was 74 days and the longest period was 1,200 days, with an average of 362 days or mean time of 272 days. Etiologically, urological infection was not important, but a reduced fluid intake, urostasis, and focal infection (osteomyelitis) were of great importance.

The long period of immobilization required to produce urolithiasis suggests that the condition may be due to damage of the renal epithelium by some prolonged active process or disturbed calcium metabolism.

Proper prophylactic care against the formation of urolithiasis is outlined in some detail, but the authors stated that it is difficult to carry out an adequate regimen of fluid intake, diet, movement, and chemotherapy for all immobilized patients in a large service such as theirs. The authors believe that good results are possible if patients susceptible to urolithiasis are selected and preventive measures are applied.

The preferred treatment of these calculi is removal by dissolution or spontaneous passage. Caution is exercised during manipulative procedures. When these measures fail, operative therapy is instituted without further delay.

ROBERT TURELL, M D





# SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

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The gross form of a part seems to have an intrinsic determinant, but in later development of the limb is increasingly affected by extrinsic factors and reciprocal adaptation. An inherited alteration in timing or an environmental interruption in the development of operation can readily be related to defects in a constantly changing structure.

Minute study of normally developing embryos from 8.5 millimeters to 53 millimeters shows an orderly and rapid adaptation of undifferentiated mesenchyme into the structure characteristic of the mature hip joint. This makes incredible the concept that the posterior superior border of the acetabulum fails to form normally because of an inherited defect in one bit of this mesodermal mass.

Hereditary and extrinsic factors can surely alter the normal rate of growth and interfere with chronological development by delay or stimulation of growth. Adaptive variations to pressure and position recognized in postnatal growth must admittedly be even more potent in the more rapid tempo of early prenatal growth. The recognized deformities characteristic of congenital dislocation of the hip, i.e., a shallow socket, enlarged head to fit it, increased anteversion, and subluxation can all be logically accounted for by following through these basic facts.

Study of the "healthy side" in a large group of unilateral dislocations showed pathologic changes in 80 per cent of these so-called normal hips, which strongly suggests that the defect is not isolated to one hip but is of the pelvis as a whole.

The author believes that congenital dislocation and congenital dysplasia of the hip may be regarded as the result of faulty development due to environmental factors extrinsic to the hip joint. An inherited fault in the timing of development may produce these extrinsic changes. Interference with the normal dynamic reciprocal relationship of the hip joint components may produce the secondary adaptive changes which lead to this deformity. The known embryology of the hip joint refutes the theory of primary inherited failure of development of a part of the acetabulum. FRANCES E. BRENNER, M.D.

**The Morphology of Congenital Coxa Vara (Zur Morphologie der Coxa vara congenita)**  
LINDEMANN *Zschr Orthop*, 1948, 78, 47

Congenital coxa vara is not a disease entity. It is a hypoplastic malformation of the skeleton. There are 2 types: the primary type develops in the fetal period and may lead to large defects of the femur; the other type develops in infancy and is caused by an inherent weakness or hypoplasia of the subcapital epiphysis, greater trochanteric epiphysis, and ischio-pubic epiphysis. This deformity was observed in 2 twins.

Primary congenital coxa vara was observed in a 19 months old boy whose only complaint was a limp favoring the affected extremity. The roentgenogram showed absence of the ossification center in the femoral head of the affected side, with flattening of

the acetabulum, and thickening of the femoral neck, but no dislocation. Another child, 6 months old, showed shortening of the femur, clubfoot, and flattening of the acetabulum and the proximal upper femoral epiphysis on the same extremity. Roentgenograms were taken every year and at the age of 12 the appearance of the originally deformed hip was essentially normal. The treatment consisted only of continuous nonweightbearing on the affected side. The author points out that primary coxa vara congenita may heal spontaneously.

GEORGE I. REISS, M.D.

**Congenital Dysplasia of the Hip Joint Relationship Between Congenital Subluxation and Congenital Dislocation**  
*Bone Surg*, 1949, 31-A, 357

Congenital subluxation of the hip, as a distinct entity, has not been recognized in America as clearly as in Europe. The problems of congenital dysplasia of the hip are made clearer by an understanding of the pathogenesis of subluxation.

If in fetal life a shallow socket forms, or there is a primary dysplasia of the acetabulum, five possibilities for the future of the hip joint are present: (1) complete dislocation, (2) incomplete displacement between the femoral head and the flat socket with some articular contact persisting and without capsular interposition—the entity under discussion, (3) no displacement between femoral head and the shallow acetabulum, (4) a rare, extreme dysplasia and general malformation of hip structures, (5) the dysplastic hip displaying the rare phenomenon of spontaneous recovery.

Acknowledging the varying potentials for recovery or repair inherent in the dysplastic hip, the most important factor in influencing treatment is that of age. A favorable mechanical and functional position obtained and maintained before weight-bearing prevents secondary pathological changes. At this early age, subluxation is common, and dislocation rare. Subluxation often persists throughout life as an entity, and often coexists with dislocation of the opposite hip. These conditions possess a common etiology.

Residual subluxation exists in a hip previously dislocated, when only partial replacement of the head in the acetabulum is secured by open or closed manipulation.

Not all congenital displacements of the hip should be explained by a single mechanism. The author limits his study to those caused by aplasia (of genetic origin) of the posterior superior portion of the acetabulum. Other structures of the hip joint may share in the dysplasia. The sequelae are explainable on the basis of laws of bone growth, aseptic necrosis, and traumatic osteoarthritis.

A review of the literature presents evidence that many authors have recognized subluxation as a state distinct from classical dislocation of the hip, and not just as its precursor. Familial tendency to affections of the hip in this category is well known, but less

regularly has dysplasia of the "well" side been recognized in a child with a unilateral dislocation. Frequently symptoms referable to the dysplasia do not appear until adolescence or early adult life. The advanced osteoarthritis of middle age is frequently secondary to a hitherto "silent" subluxation.

Residual subluxation, i.e., incomplete reduction of a dislocated hip, remains a fixed condition especially because of the inadequate acetabular roof. The trauma of instability over the years leads to osteoarthritis roentgenographically identical with that present in congenital subluxation.

Faber, in 1937, reported studies on patients and families which led to his concept of a hereditary defect in the joint, common to dislocation and subluxation.

Surgical exploration of the hip in children under 4 years of age shows a high incidence of subluxation, with some portion of the head of the femur in contact with articular cartilage of the acetabulum.

FRANCES E. BRENNKE, M.D.

#### **The Synovial Membrane of the Knee in Pathologic Conditions** ROBERT SOEUR *J. Bone Surg.*, 1949, 31-A, 317

The gross changes of color and consistency in synovial membrane are familiar to all surgeons who open knee joints, but the pathologic changes and etiologic factors of these changes can only be determined by microscopic study.

Numerous studies have contributed to the now accepted facts that synovial membrane is (1) mesenchymal in origin, (2) active primarily in a manner similar to reticuloendothelial tissues, and (3) able to adapt morphologically to varying mechanical or pathological conditions.

The histological classification of Key, based on the nature of subjacent layers rather than on surface morphology, is adopted by the author, i.e., adipose type of synovium over articular fat pads, fibroareolar type where pressure and pull predominate, and fibrous type of synovium over tendons and ligaments. The author adds a muscular type covering the suprapatellar pouch. Studies have been based on biopsy of the infrapatellar fat pad which is affected early by pathologic change, and is readily accessible.

The histology described by Key was confirmed in the normal human and rabbit and is well illustrated in photomicrographs. Studies were then carried out in man and rabbits in three joint conditions, i.e., ruptured menisci, hemarthrosis, and chronic hypertrophic villous arthritis. The literature is extensively reviewed in each instance. Excellent photomicrographs follow the tissue changes over a long period of time in each instance. The histological changes observed in man are closely reproduced in animals experimentally by the use of irritants comparable to those initiating similar states in man. The descriptive terms used in evaluating these tissue changes are defined as follows: "synovial activity" means an increase in number and importance of folds and villi, irregularity of the free border and

desquamation, multistratification of the intima, disappearance of the adipose vesicles of the external layer and appearance of collagen bands, and sclerosis of vascular walls. "Infiltration" is defined as multiplication of free cells (normally rare), and appearance of new circulating cells. Using these terms, the changes arising in the synovial membrane in the presence of meniscal tears are mechanical, continuous, and progressive, with fibrosis predominating. In hemarthroses, the changes are of a chemical nature (endogenous proteins), rapid but short-lived, with early return to normal tissue. In villous arthritis, the phenomenon of Arthus is reproduced in a joint, therefore, an allergic response occurs intensely, diffusely, and over a long period of time.

These changes are so characteristic that biopsy of the infrapatellar fat pad is suggested as a precise means of establishing the etiology of a morbid process in the knee.

FRANCES E. BRENNKE, M.D.

#### **SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.**

##### **Further Studies in Articular Replacement** STEPHEN S. HUDACK and J. WALLACE BLUNT, JR. *Am. J. Surg.*, 1949, 77, 600

About ten years ago the authors attacked the problem of joint replacement on an experimental basis. Since fixation of replacement elements to bone causes stress concentration, and thus bone and tissue death, a new diffuse method of fixation of the stress-bearing elements was tried. A dynamic relation of the replacement element and the host tissue was achieved in dogs, and the idea of joint replacement without fastening at any specific points was feasible.

The text and illustrations demonstrate a type of internal prosthesis to be used in replacing the femur proximal to the subtrochanteric area and the humerus in its proximal third. An acrylic plastic model is made from dimensions gained from the patient's roentgenograms. This model is firmly attached to a long metallic intramedullary nail.

The operative technique and certain principles are explained. Wide excision of the whole synovial lining of the hip joint is stressed in order to denervate the joint and obtain a painless joint. Tendinous attachments about the trochanters are left attached to a shell of bone. Special attention to the intramedullary canal and the relation of the prosthesis to the general limb alignment are important.

Five cases of hip replacement are reported. In 1 case operation was performed for the correction of aseptic necrosis following nonunion of a femoral neck fracture. In another (bilateral) case, operation was done for Marie-Strumpell spondylitis with ankylosed hips. In 2 cases operation was performed for arthritic disease of the hips. The prosthesis was used in one hip to replace resection for chondrosarcoma. The single humeral prosthesis was used to replace resection for chondroblastoma.

The patients are reported to have gained acceptable joint motion with considerable relief of discom-

fort In most instances, patients were followed up for less than 1 year, therefore the present report is not intended as an end result study Speculation is made as to just what will happen in time, for example, in regard to acetabular changes

KENATH H SPONSEL, M D

**Arthroplasty of the Elbow Joint** (Eine Studie ueber die Plastik des Ellenbogengelenkes) A VOGL  
*Zschr Orthop*, 1948, 78 21

In the 8 cases in which arthroplasties of the elbow were done the following criteria were followed The patient must be young, the muscles about the elbow must be intact and able to move the elbow joint, and there must not be an infection of the bones

A semicircular incision was made from 3 to 4 cm above the olecranon The triceps muscle was cut along a line from a lateral point above to a medial point below The olecranon was dissected free from the humerus The head of the radius was excised The distal end of the humerus was shaped into a wedge to leave the lateral and medial sides intact The space between the olecranon and the humerus was kept fairly large A thin layer of tissue found between the fascia proper and the subcutaneous tissue was placed between the bone ends, the fatty side being turned toward the gliding surfaces posing membrane covered all of the gliding surfaces Fatty tissue is less likely to be destroyed by lack of oxygen, and therefore there is less chance of necrosis when this tissue is used than when fascia is used The triceps is resutured with its ends slightly apart The drains are removed between the third and eighth days and the cast is removed on the fourteenth day The physical findings and roentgenograms of the 8 arthroplasties are presented The results were uniformly good

**Tendon Transfers and Arthrodeses in Combined Median and Ulnar Nerve Paralysis** J WILLIAM LITTLER  
*J Bone Surg*, 1949, 31 A 225

Injuries involving both the median and ulnar nerves may result in great functional loss Excellent return after nerve suture, but the hand frequently is clawed and rendered almost useless through the loss of thumb opposition and finger extension The pulp atrophy which often accompanies nerve injury is a severe disability and makes the already impaired pinch mechanism ineffectual

This article demonstrates how the deformity can be overcome partially by appropriate tendon transfers and arthrodeses designed to restore muscle balance and to bring the thumb and fingers into a functional position An effort has been made to simplify the transfer of the tendons, as it is impossible to compensate for all the complex intrinsic muscle functions Frequently only the most important intrinsic functions can be considered The various tendon transfers and arthrodeses are discussed in detail Correct evaluation of the par-

tially paralyzed hand must be made and available tendon power must be concentrated where it will be effective in restoring useful function Proper arthrodeses will provide stabilization and make additional power available for transfer Not infrequently, it is necessary to fuse the wrist or the thumb, or both, in a position of function, and to transfer wrist extensor tendons if a good pinch and grasping mechanism is to be gained In badly crippled hands only a pinch mechanism may be possible, but to that end we should concentrate our effort, if we attempt more, potential power may be dissipated and a useless hand will result The article is accompanied by excellent photographs and drawings and contains many important practical considerations RUDOLPH S REICH, M D

**Pinning for Slipping of the Epiphysis of the Femoral Head** GUNNAR WIBERG  
*Acta orthop scand*, 1948, 18 4

The present report is based on 38 cases of slipped epiphysis In these patients, the condition was considered mechanically suitable for pinning with a flanged nail, as a method of maintaining position Thirty-six hips were pinned without previous reduction, one required closed reduction and another required open reduction Necrosis of the head occurred in 2 cases (one in which closed reduction had been done), and fracture of the femur secondary to the pinning occurred in 2 cases

The author theorizes that changing the position of the nail and adding trauma to the femoral head may contribute to the development of aseptic necrosis He believes also that the nail should not be driven deeply into the epiphysis, but should just enter the epiphyseal cartilage, thus causing minimal injury to the circulation of the epiphysis

The increased burden on the opposite, unaffected hip has been considered a factor in producing slipping on that side also This occurs in 15 to 25 per cent of cases The author permitted early weight-bearing on the side operated upon and thereby spared the "well" hip In a series of 24 cases, the opposite hip was involved in 20 per cent, suggesting that the increased burden is unimportant The author believes that gentleness in reduction is very important and that open reduction may be less traumatic than closed reduction An excellent result was obtained in his 1 case of open reduction

NEWTON C MEAD, M D

**Open or Bloodless Treatment of Clubfeet** (Blutige oder unblutige Klumpfuß Behandlung) ARNOLD SONNENSCHNEIN  
*Acta orthop scand*, 1949, 18 266

Early treatment of congenital clubfoot is essential for success Only occasionally is an elongation of the Achilles tendon necessary As a rule, adequate mobilization in a plaster of paris cast, followed by proper aftertreatment, produces in children a normal foot, but leaves a certain degree of deformity in adults Therefore open operation is indicated only when other measures fail

The treatment of clubfeet in infants consists of passive motions, namely, correction of the supination of the posterior portion of the foot, of abduction of the anterior part of the foot, and of the equinus position. Following correction, a flannel bandage is applied to the feet in a position of pronation until the next exercise. The treatment is instituted during the second week of life. A plaster of paris splint is applied in the sixth week, and 2 weeks later, after a greater correction of the faulty position of the feet, it is replaced by another splint. The splints are removed three times a day to allow passive exercises. A "redressment" is done in the third month of life. A manual stretching of the soft tissues brings the subluxated bones into proper position.

The astragalus can be reached only indirectly by action on the os calcis. The equinus position is temporarily disregarded. The cast remains in place 3 months. After removal of the cast an overcorrection is accomplished and an elongation of the Achilles tendon, if necessary, is obtained by tenotomy.

The author usually employs the subcutaneous section of the tendon in an oblique direction. The second cast is applied for 3 months.

After removal of the cast, splints are worn for 1 year and after that orthopedic shoes are used up to the sixth year of life.

In adults the manual treatment of clubfeet is followed by redressment and employment of an osteoclast. The manual redressment over a wooden wedge is followed by the application of a cast. After 2 months the osteoclast is used and a subcutaneous oblique tenotomy of the Achilles tendon is performed. The foot remains in the second cast from 3 to 4 months, after which time the patient begins wearing an apparatus or an orthopedic shoe.

Of 152 patients treated by the author, 108 were younger than 1 year. The results were perfect in 76 infants, satisfactory in 23, and unsatisfactory in 9.

The results were satisfactory in 32, and unsatisfactory in 12, of 44 patients from 15 months to 35 years old.

JOSEPH K. NARAT, M.D.

#### Operative Treatment of Clubfoot in Older Children and Adults. HENRIK STÖREN. *Acta orthop scand*, 1949, 18: 233.

The author draws upon his own experience and that of others in the formulation and execution of the method he uses to correct the severe neglected clubfoot. He disapproves of one-stage operations which often lead to partial gangrene or poor correction, and he believes that extensive wedge resection in the bony operation leads to a short, distorted foot. Another firm conviction is that the apparent inward torsion of the tibia in patients with clubfoot is really inversion of the calcaneus on the talus. When this apparent torsion persists after surgery, he believes that the inversion of the calcaneus was not corrected at surgery.

His program is carried out in two or three sessions with soft-tissue correction preceding the final stage bone operation. In this manner, he is able to keep

bone removal to a minimum, and thereby maintain all possible foot length.

The first stage is the soft-tissue operation on the medial side of the foot and leg. This includes division of the contracted fascia and ligaments, the plantar aponeurosis, and the posterior insertion of the plantar muscles. The tibialis anterior tendon is divided preparatory to transplantation to the dorsum of the foot, since it has become an adductor in the deformity. A longitudinal incision is made medially in the lower leg, and the tibialis posterior tendon and the flexor tendons are lengthened. This wound is then closed. It is necessary to fashion a flap or a double-end sliding graft to cover the operative wound on the foot and, in a few days, the skin defect more dorsally is covered with a Thiersch graft through a window in the cast. Calluses and bursae are not removed, since they disappear spontaneously.

The second stage of the operation is performed in about 4 weeks. The Achilles tendon is lengthened with preservation of the lateral calcaneal insertion, and other soft tissues are divided. The changes in the relative sizes of the contacting talus and the malleolar cleft may offer resistance to dorsiflexion which cannot be corrected in this operation. The heel is pulled down by means of a wire through the os calcis. This may be incorporated in the plaster or may be utilized for continuous traction, as required. A residual 10 to 15 degrees of equinus due to bony ankle deformity is overcome in the final bone operation. At this stage the posterior processes of the os calcis may be found underdeveloped. With correction of the equinus, the tibialis anterior tendon is transplanted to the base of the second or third metatarsal.

The final stage of frontal and horizontal wedge osteotomy is performed 4 or 5 weeks later. The exposure of the tarsal joints is accomplished without division of the peroneal tendons. The frontal wedge is taken into, or anterior to, Chopart's joint and, similarly, the horizontal wedge in or below the talo calcaneal joint. It does not seem to matter whether one does a full arthrodesis or takes the wedge outside the joint, provided the chiselling is in the right place and is sufficient to obtain full or slight overcorrection. For the equinus position which still remains, the wedge osteotomy of the calcaneus is made broader anteriorly and the frontal wedge is correspondingly adjusted. In this way the equinus foot is corrected without producing the rocking foot.

Twenty-one clubfeet in 15 patients have been operated upon by this method. Several series of photographs are included to demonstrate the principles of treatment. Follow-up examinations are made up to 8 years and the results appear most satisfactory, in fact, the preoperative and postoperative illustrations are quite striking by comparison. After correction, all patients wore ready-made factory shoes.

In the discussion, the author mentions two deformities that are not influenced by this operation.

# SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

first, in some cases a compensatory valgus position at the ankle joint may lead to an arthrosis, secondly, atrophy of the posterior calcaneal process may lead to difficulty in keeping shoes on, and less often to insufficient weight-bearing surface of the heel

KENATH H SPONSEL, M D

wire at each end being necessary. Torsion, dislocation, or fracture of the graft is prevented by this method. Furthermore, the transplanted bone need not be nearly as long as in grafting without nailing. The routine procedure is to make the transplant long enough to assure an area of contact between the graft and the fractured bone of 4 cm at each end. In many cases this causes a considerable defect in the tibia from which the graft is taken. If, however, the graft is supported by an intramedullary nail, a much shorter plane of contact is sufficient to secure correct healing.

Also in cases in which pseudarthrosis is not due to bone defect but to poor alignment, intramedullary nailing gives excellent results. In appropriate cases percutaneous nailing is possible, thus avoiding the dangers of open bone work which are especially great in war wounds.

WERNER M SOLMITZ, M D

## Removal of the Base of the Proximal Phalanx in Hallux Rigidus

ERIK SEVERIN *Acta orthop scand*, 1948, 18 77

The author reviews a series of 37 operations in 31 patients after a period of 3 to 8 years following surgery. All of the patients had suffered from hallux rigidus, and all were operated upon by the same procedure. The operation consists of the removal of one-half to two-thirds of the proximal portion of the proximal phalanx through a medial longitudinal incision. An osteotomy is made at right angles to the phalanx, and no periosteum is left in the area of resection. The surface of the metatarsal head is then trimmed, and all hypertrophic exostoses, except on the plantar surface, are removed. A small, soft tissue flap is turned over the resected surface of the phalanx if such tissue is available. The toe is then bandaged in neutral position except for a few degrees of plantar flexion. Movements are begun on the fifth day, and weight-bearing is allowed after the tenth day.

The functional results of this simple operation are excellent. Only one failure is noted in the series, 31 operations were followed by symptom-free activity, and all patients were doing normal work without difficulty. The one failure resulted from the formation of a long, lateral horn of bone from the remaining portion of the phalanx, which gave painful contact with the metatarsal head. Reoperation was successful.

It is important to remove from one-half to two-thirds of the proximal portion of the phalanx, otherwise insufficient joint space will remain, and painful contact may result. If too great a portion is removed, the toe may become flail and unstable. There is a tendency to dorsiflexion following the operation, and this can be overcome by bandaging the toe in slight flexion at the time of operation.

NEWTON C MEAD, M D

## FRACTURES AND DISLOCATIONS

### The Importance of Intramedullary Nailing for the Treatment of Pseudarthrosis (Ueber die Bedeutung des Marknagels fuer die Behandlung von Pseudarthrosen)

H NUSSELT *Chirurg*, 1949, 20 211

Since fractures of the long bones have been treated at an increasing rate by traction, the incidence of pseudarthrosis due to overextension has definitely grown. Treatment of pseudarthrosis due to bone defect by grafting only is often doomed to failure, especially in lesions close to a joint. Intramedullary nailing permits exact fixation and ideal support of the graft with a minimum of wiring, only one

### The Late Results of Operative Treatment of Recent Dislocation of the Patella

M FELLÄN *Acta orthop scand*, 1948, 18 157

The causes of dislocation of the patella may be congenital, as in defects of the femoral condyles or in the quadriceps muscle, the vastus medialis being deficient and the vastus lateralis being relatively too strong. The tibial tuberosity is sometimes placed too far laterally which gives the mechanical effect of a valgus deformity of the knee and tends to pull the patella laterally. Defects in the femoral condyles which lead to patellar dislocation are (1) a lack of the groove between the condyles and a corresponding failure of the patella to develop a sagittal crest and two articular facets to contact the two condyles, (2) the lateral condyle may be poorly developed. Operation, if necessary, should be done before too many dislocations have occurred, since many recurrences inevitably lead to permanent degenerative changes in the patella as well as in the rest of the joint.

More than 70 different operations have been devised for this dislocation. Obviously, none of these is entirely satisfactory. The patients in the series here presented were operated upon by the method of Krogius, in which the lateral tissues are slackened and the median parapatellar tissues are tightened without entering the joint. In nearly all cases this was accompanied by a transposition of the tibial tuberosity and occasionally by some other procedure such as osteotomy to correct the valgus deformity. In 13 cases in this series the underlying disease was dysplasia of the femoropatellar joint, in 1 case it was persistent genu valgum, in 11 cases the cause was purely traumatic, and in 6 cases the cause was uncertain.

There was a recurrence in 2 cases of bilateral, and in 4 cases of unilateral dislocation. All cases in which there had been no recurrence showed excellent results. The author believes that the prognosis is worst in patients with dislocations beginning early in childhood and in whom many dislocations have occurred. The poorest results from surgery were

observed in "permanent" dislocations, relapses occurred in 4 of 8 cases

Follow-up studies were made on 14 cases of recurrent dislocation of the patella in patients who were not operated upon. Osteoarthritis of a more or less severe degree developed in 12 of these, the 2 remaining patients obtained complete recovery.

Three patients with permanent dislocations had surprisingly good function despite their osteoarthritis.

The author believes that recurrent patellar dislocations should be operated upon as early as possible, and that permanent dislocations which would show poor results following operation, and which manifest no serious symptoms if left alone, should not be operated upon.

The Krogus operation combined (in suitable cases) with transposition of the tibial tuberosity gives good results. The prognosis is favorable when the outline of the femoropatellar joint is normal and no serious changes exist in the cartilage. The more marked the dysplasia of the femoropatellar joint, the greater is the risk of recurrence. NEWTON C. MEAD, M.D.

#### A Comparative Study of Methods of Treatment of Diaphyseal Fractures of the Leg. GUSTAF-ADOLF LANDOFF. *Acta orthop scand*, 1948, 18: 37.

It has appeared in the recent literature that treatment of shaft fractures by traction has given results less satisfactory than immobilization in plaster or by internal fixation. Good control studies of comparison of the various methods have been rare.

It is difficult to know the exact time at which a fracture may be considered healed. The author uses the formation of the callus bridge, as seen in the roentgenogram, as his index.

The present study deals with 301 cases of leg fracture in which adequate records and follow-up data were available. One hundred and thirty of the patients were under 20 years of age. Healing was faster in this group of patients than in those who were over 20 years of age. The adult group showed little difference in healing time regardless of age.

The site of fracture was unimportant. Fractures of the lower third of the leg healed just about as well as those of the middle third. The type of fracture, whether spiral, oblique, or transverse, had little effect on the healing time. With the use of traction on 5 comminuted fractures of the tibia the healing time appeared to be prolonged (24-7 weeks), but the series was small and the many factors involved render this figure valueless.

A comparison of the traction-treated fractures (oblique) with those treated by manipulative reduction and casts shows that those treated by traction took 3-7 weeks longer to heal. The factors causing this delay are not all understood, but even a small displacement of fragments was shown to have an unfavorable effect on callus formation. Any form of movement in the callus mass disturbs the formation and deposition of calcium crystals. It is well known that distraction has an unfavorable effect on

bone healing. Frequent roentgenograms (as required in fractures treated by traction) have a definitely inhibitory effect on the regenerative capacity of osteogenic tissue.

Traction over a long period of time seemed to be associated with delayed union, but these figures were unsuitable for statistical analysis.

Patients treated by primary open reduction and internal fixation (17) constituted a rather small group. Healing callus was observed in 12-4 weeks. Delayed open operation was usually required because of overtraction, or malposition uncontrolled by traction, and these patients were improved following operation.

The author concludes that weight traction is less suitable than plaster for closed shaft fractures of the leg. As a means of correction, weight traction may be excellent, but it should be used with discretion and indications for its use should be within narrow limits, the method being resorted to only in special cases, i.e., in cases in which there is definite shortening or in which repeated manual reposition plus fixation in plaster has failed. In obviously troublesome cases, open reduction sometimes combined with osteosynthesis ought to be considered at the very beginning of treatment. Open reduction does not delay union. NEWTON C. MEAD, M.D.

#### Isolated Fracture of the Tarsal Scaphoid. End Result of Scaphoidectomy. (Sulla frattura isolata dello scafoide del tarso. Risultato a distanza scafoidectomia.) M. SOLERO. *Chir. org. movim.*, 1949, 33: 45.

The author reports a single case of comminuted fracture of the tarsal scaphoid treated by scaphoidectomy. A follow-up study 5 years later revealed a mild varus deviation of the forefoot, but with a good plantar arch and an excellent functional result.

The patient was a man 35 years of age who injured his foot in a bicycle accident. Shortly thereafter, because of severe pain on weight bearing, he was admitted to the Ospedale Maggiore of Trieste.

The author gives a good résumé of the subject in the literature and describes the various methods of treatment. All authors report most favorable reports from their particular method of treatment whether it be arthrodesis, midtarsal resection, simple immobilization, or removal of the entire fractured bone.

Five years later, plantar footprints of the patient whose case was reported revealed no difference in the two feet. CARLO SCUDERI, M.D.

### ORTHOPEDICS IN GENERAL

#### Fundamental Concepts in the Treatment of Completely Arrested Volkmann Contracture (Conceptos fundamentales en el tratamiento del Volkmann completamente constituido). PEDRO V. PEDEMONTTE. *Arch. urug. med.*, 1948, 33: 123.

Volkmann's contracture is a lesion affecting the muscles and tendons and resulting in a disproportion

# SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

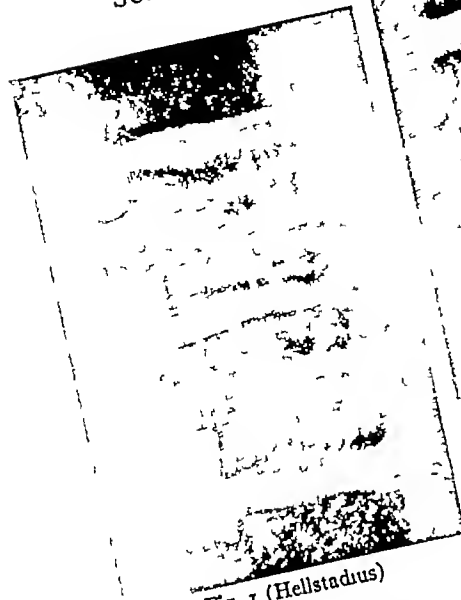


Fig 1 (Hellstadius)



Fig 2



Fig 3

between the bony and soft parts. This is illustrated by the act of hyperextending the wrist at which time the typical claw hand is created.

To correct this deformity Pedemonte performs an arthrodesis on the radius and ulna. The extent of the fusion is precalculated to permit extension of the fingers during extension of the wrist. This procedure eliminates the need for tendoplasty which in some instances assumes formidable proportions.

The author is emphatic in restricting this procedure to the arrested Volkmann's contracture. In cases in which contraction is still progressing he advises physical therapeutic and orthopedic measures. It is considered a mistake to employ arthrodesis until the disease has been completely arrested. This is determined more from clinical studies than from the time element.

STEPHEN A. ZIEMAN, M.D.

## A Contribution to the Question of the Origin of Anterior Paradiscal Defects and So-Called Persisting Apophyses in the Vertebral Bodies

ARVID HELLSTADIUS *Acta orthop Scand*, 1949 18 377

Previously the author has reported cases of dorsal insufficiency in which roentgenography showed a special characteristic lesion of the vertebral body, viz, a defect in the anterior part, adjacent to the intervertebral disc. He believes that this defect represents an impaction of the disc tissue into the vertebral body similar to the impaction of the nucleus pulposus into the central and posterior parts

which is commonly referred to as a Schmorl's node. The common mechanism of origin of the defects is impaction of disc tissue subsequent to a single or repeated trauma. About half of the cases occur in the teen-age group and are brought to light because of the symptoms. A table representing 17 defects in 16 individuals is presented. In 4 instances the lower vertebral border was affected. The author describes three conditions associated with these anterior paradiscal defects.

The first condition, and most common, is a discrepancy in the anteroposterior diameter of the adjacent vertebrae. The superior one is usually narrower than the one below, and the anterior-inferior angle of the upper vertebra impinges into the vertebra below (Fig 1).

Another associated condition is a rounding of the anterior-inferior angle of the vertebra which allows it to impress into the adjacent vertebral body (Fig 2).

A third, less common and less certain mechanism is that of persisting anterior vertebral apophysis. It is thought that the nonunion of the apophysis may be due to impression of the adjacent vertebral angle (Fig 3).

The author has looked for the condition in spondylolisthesis. Despite the unevenness of the adjacent vertebral angles he has not seen the paradiscal defects. He attributes this to the degeneration of the disc and loss of elasticity in this condition.

KENATH H. SPONSEL, M.D.



# SURGERY OF THE BLOOD AND LYMPH SYSTEMS

## BLOOD VESSELS

**Observations on Raynaud's Disease, a Report of 35 Cases** (Réflexions sur la maladie de Raynaud—à propos de 35 observations) P WERTHEIMER and R. GUILLET *Lyon chir*, 1949, 44 145

The authors report the results of surgical treatment of 35 patients with Raynaud's disease. There were 20 women and 15 men. Their ages at the time of surgical treatment varied between 23 and 70 years, and the duration of their symptoms before treatment averaged 10 years. The authors emphasize that the disease may have its onset at any age in life except infancy.

A total of 70 operations were done on 35 patients without a fatality. These included 15 periarterial sympathectomies, 35 stellate ganglionectomies, 1 cervical ramisection, 4 resections of the superior portion of the sympathetic chain below the stellate ganglion, 3 thoracic sympathectomies, 4 lumbar sympathectomies, 1 splanchnicectomy, 3 parathyroidectomies, 2 thymectomies, and 1 adrenalectomy.

All of the patients who underwent periarterial sympathectomy retained their sensitivity to cold. In 5 (33%) the progress of the disease was checked. Although the operation has the advantage of a simple, nontraumatizing procedure, the authors do not recommend it in the treatment of Raynaud's disease.

Three patients who had unilateral stellate ganglionectomy had obtained satisfactory results when observed 6, 4, and 2 years, respectively, after surgery.

Among the patients who underwent bilateral stellate ganglionectomy there were 10 who had single ulcerating lesions of the upper extremity. Three of these patients were cured, and in the other 7 patients the trophic lesions healed but the patients remained sensitive to cold. In 1 patient following stellate ganglionectomy, nerve blocks of the upper thoracic sympathetic chain produced appreciable vasodilatation in the upper extremity. This indicates that removal of the stellate ganglion produces only partial sympathetic denervation of the upper extremity.

Five patients with multiple severe ulcerations of the upper extremity underwent bilateral stellate ganglionectomy. The beneficial results which occurred were only temporary in the 3 patients who were adequately followed.

Three of 4 patients who underwent resection of the superior portion of the thoracic sympathetic chain below the stellate ganglion obtained good results, as did the patient who underwent unilateral cervical ramisection.

Operations on the endocrine glands did not alter the course of the disease appreciably in any patient.

The authors conclude that periarterial sympathectomy is not as effective as stellate ganglionectomy or

resection of the upper portion of the thoracic sympathetic chain in the treatment of patients with Raynaud's disease. The most effective procedure of any which they investigated was resection of the upper portion of the thoracic sympathetic chain, with or without stellate ganglionectomy.

FREDERICK W. PRESTON, M.D.

**Arteriotomy for Arteritis Obliterans of the Lower Extremities** (L'endartériectomie pour artérite oblitérante des membres inférieurs) LOUIS BAZI *J internal chir*, 1949, 9 95

The author presents an operation for the relief of acute or chronic arterial occlusion. The procedure is applicable to thromboses of the femoral, popliteal, tibial, and iliac arteries, and the lower part of the abdominal aorta.

The extent of the occlusion is first accurately determined by an arteriogram made on the operating table. The artery is then incised along the entire length of the occluded portion. The thrombus and adjacent necrotic portion of the arterial wall are then removed, and the artery is repaired with carefully placed sutures of fine silk. The operation could well be called an intra-arterial sequestrectomy. During the first 48 postoperative hours heparin is given intravenously and the blood clotting time is measured every 3 hours. The interior of the vessel becomes lined with a unicellular layer of leucocytes and later endothelium grows in from either end of the reconstructed portion. Lumbar sympathectomy is not done in conjunction with this operation.

The operative procedure requires exact hemostasis and careful attention to other details. Usually the procedure takes from 2 to 6 hours. The author attributes the success of the operation to the fact that a partially necrotic artery is replaced by a totally viable one.

Two important causes for operative failure are (1) leakage at the suture line which results in an extra-arterial clot that may form an intraluminal extension and cause the artery to become reoccluded, and (2) a reconstructed arterial wall which is too thin and therefore may allow aneurysmal dilatation which in turn may lead to further arterial occlusion or to rupture of the arterial wall.

FREDERICK W. PRESTON, M.D.

**Obstruction of the Superior Vena Cava: A Review of the Literature and a Report of 2 Personal Cases** FLOYD T. MCINTIRE and EDWIN M. SYKES, JR. *Ann Int M*, 1949, 30 925

The literature for the period from 1904 to 1946 was reviewed by the authors and 250 authentic cases of obstruction of the superior vena cava were found, 145 of these were verified at autopsy or surgery. Bibliographic data are tabulated according to etiology. Comparisons are made with Fischer's

collection of 252 cases prior to 1904, and composite figures are presented of the total incidence of important etiologic factors in 502 cases from the world's literature up to January, 1946, inclusive. The first authentic case report was by William Hunter in 1757.

In regard to the incidence of the syndrome under consideration, varying opinions are expressed in the literature. The authors are in accord with the opinion that varying degrees of superior vena caval obstruction occur not uncommonly, and much more frequently than is generally suspected. Common lesions such as aortic aneurysms, mediastinal malignancies, and chronic inflammatory diseases are responsible for the caval obstruction in a substantial majority of reported cases. The frequency of space-occupying lesions of the superior vena cava, the anatomical relations of this vessel, and the increasing compressibility of this vessel, and the increasing number of case reports in the literature constitute very suggestive evidence that the syndrome is not uncommon.

The applied anatomy of superior vena caval obstruction is presented by the authors and particular emphasis is given to collateral circulatory routes and the mediastinal lymphatic system. The importance of the relationship of certain mediastinal lymph nodes to the superior vena cava has not been sufficiently stressed in medical literature dealing with obstruction of this vessel. Two important chains of lymph nodes are intimately associated with the vessel the right anterior mediastinal, and the right laterotracheal chains. The former lies along the anterior surface of the superior vena cava and the right innominate vein, and consists of two to five nodes, the latter lies on the posterior aspect of the same vein and consists of three to six nodes, the largest and most inferior of which lies on the superior surface of the arch of the vena azygos. The right bronchial nodes and some of the nodes of the tracheal bifurcation are in fairly close association with the lower portion of the vena cava, both of these groups of nodes in turn drain into the right laterotracheal chain. Most of the structures of the right thoracic cavity, mediastinum, and part of the structures of the left thoracic cavity drain into either or both the right anterior mediastinal and the right laterotracheal chains. The frequency of neoplastic and inflammatory disease in this part of the body serves as a constant threat to these lymph nodes, with possible obstruction, partial or complete, of the superior vena cava from extrinsic pressure or invasion.

Trends in etiology in the past four decades are discussed. In the series of 250 cases studied by the authors, the sex is given in 166 of these. Seventy-nine and five-tenths per cent of the patients were males and 20.5 per cent were females. The sex incidence is explained on the basis of preponderance of aneurysms, bronchogenic carcinoma, and malignant lymphoma in the male. The highest incidence is from 30 to 60 years of age, probably corresponding

to the age incidence of the common etiologic factors, more particularly neoplasms and late syphilis, including aortic aneurysms. Malignant primary thoracic tumors, aneurysms, and chronic fibrous mediastinitis are responsible for the obstruction in from 75 to 80 per cent of the cases. Primary thoracic tumors, benign and malignant, account for 35.9 per cent of the cases. Approximately 93 per cent of these tumors are cancerous. Syphilis accounts for 34.8 per cent of the cases in the authors' series. Approximately 69 per cent of these are aortic aneurysms.

Nineteen cases of localized phlebitis with thrombus formation have been reported since 1904, of these, 16 were verified by autopsies. With regard to etiology, in 11 cases the condition was of unknown cause, in 3 the phlebitis was associated with cardiac disease, in 3 others it was caused by mediastinitis, in 1 case it was associated with silicosis, and in 1 the condition was classified as tuberculous endophlebitis.

Detailed consideration is given to chronic fibrous mediastinitis of idiopathic, or nonspecific, origin. Etiologic factors are indefinite, but it seems likely that a mild inflammation of the mediastinum in an individual with tendency to excessive cicatrization may slowly progress to form the typical dense mass of fibrous tissue. For the development of the scar tissue there must be some antecedent etiologic factor such as upper respiratory infection, influenza, bronchopneumonia, tularemia, trauma, rheumatic fever, plus occasionally a tendency toward the development of excessive amounts of cicatricial tissue.

The symptomatology and clinical findings of the syndrome under consideration, except for the primary pathology involved, is secondary to obstruction of circulation in the superior vena cava. This obstruction causes increased venous pressure in that part of the body which normally has its venous return to the superior vena cava, and collateral diversion of the blood stream. As a result of this obstruction and the coincidental change in venous pressure, dilated veins are often visible in the upper half of the body, and edema in the upper extremities, head, and neck is frequently noted. Often cyanosis and dyspnea are present. Headache and chest pain are commonly troublesome. Other signs and symptoms such as hoarseness, dysphagia, drowsiness, and occasionally convulsions are sometimes associated with this syndrome. These clinical findings in the presence of elevated venous pressure in the upper extremities, and normal venous pressure in the lower extremities are sufficient to make a diagnosis of superior vena caval syndrome.

The authors observe that the treatment of this condition is largely a matter of treating the primary disease. Symptomatic relief may be afforded by repeated phlebotomies, surgical intervention in selected cases may be justified in an attempt to relieve the obstruction, if it is due to external pressure. Two cases of chronic fibrous mediastinitis are presented by the authors, one verified by surgery,

## INTERNATIONAL ABSTRACTS OF SURGERY

both apparently a result of previous acute infection of the respiratory tract. In the first case the point of obstruction of the superior vena cava was demonstrated, by angiocardiograms, to be below the azygos opening, proving the lesion in this location to be compatible with life. The azygos is shown to be the important collateral system in caval obstructions below the azygos opening.

HERBERT F. THURSTON, M.D.

## MISCELLANEOUS

**Amputation for Gangrene Due to Occlusive Arterial Disease** SAMUEL PERLOW and HAROLD A. ROTH  
*Surgery, 1949, 25: 547*

The published statistics of mortality following amputation for gangrene of an extremity in the older age group vary from 4.7 to 39.1 per cent and higher during which series the authors' operative mortality rate was reduced from 25 per cent in 1936 and 1938, to 11.7 per cent in 1945 and 1947. The means by which this reduction was accomplished are presented in some detail.

There were 124 amputations above the knee, 19 below the knee, 6 through the foot, and 16 of the toes. Although all of the deaths followed amputation above the knee, it is believed they were due to the poor condition of the patients rather than to the level of the amputation. Of 22 patients undergoing minor amputations, 10 (45.5%) later required major reamputations. There were 7 of 14 (50%) diabetic patients who had reamputations, 2 of 3 patients (66%) with senile arteriosclerosis who had reamputations, and of 5 patients with thromboangitis obliterans, 1 (20%) was subjected to a second amputation. In the patients with diabetic and senile arteriosclerosis, minor amputations were successful

only in the presence of a pulsating vessel at the ankle or after preliminary sympathectomy. It has been concluded by the authors that all minor amputations should be preceded by a sympathetic ganglionectomy.

Ten of the 28 hospital deaths were due to cardiovascular accidents: cerebral hemorrhage, coronary occlusion, and so forth. Fourteen deaths were due to pneumonia, sepsis, and decubitus (before the era of penicillin). The average age of the patients at the time of death was 66.5 years.

Preliminary ligation of the femoral vein on the side of the amputation was carried out in 34 of these cases as a prophylaxis against pulmonary embolism. One of the patients died due to embolism originating in the opposite leg.

One hundred and seventeen amputations were performed under general anesthesia, 23 under spinal anesthesia, 22 under refrigeration, and 3 under nerve block. Refrigeration was used for the acutely ill or debilitated patients and poor risk diabetics. Moreover, it was found possible, by means of refrigeration and tourniquet, to effect a physiologic amputation for several days before actual removal of the limb, which enabled the surgeons to carry out adequate preoperative measures. Oxygen therapy, blood transfusion, and antibiotics were given to the poor risk patients preoperatively, and oscilometric readings were made to determine the level of amputation.

The authors express a marked preference for amputation below the knee and frequently perform a preliminary lumbar sympathectomy so as to improve the popliteal and femoral pulsations and thereby permit the lower amputation.

All major amputations are planned for a side-bearing stump. The technique for supracondylar and below the knee amputations is given in detail.

JANE C. MACMILLAN, M.D.

# SURGICAL TECHNIQUE

## OPERATIVE SURGERY AND TECHNIQUE, POSTOPERATIVE TREATMENT

Major Surgical Operations in the Presence of Bundle Branch Block PAUL H. PFEIFFER and JOHN S. LA DUE *Am J M Sc*, 1949, 217 369

A statistical study was made of 59 patients with bundle branch block who were subjected to radical surgery for the ablation of cancer. The bundle branch block of the elderly patient was usually associated with arteriosclerotic heart disease.

In this group there were 30 patients with right bundle branch block and 29 patients with left bundle branch block. In 49 per cent of the patients the diastolic pressure was 90 mm or higher. X-ray evidence of cardiac hypertrophy was demonstrated in 26 per cent of the patients. The majority of the operative procedures lasted between 2 and 4 hours. The immediate postoperative mortality was 10 per cent. In 5 patients there were signs of progression of the disease processes in the heart after operation. Practically all of the patients who showed the S-wave type of bundle branch block did not seem to be related to the operative or postoperative course.

Bundle branch block is not in itself a contraindication to major surgery, especially with good medical supervision. Evaluation of the patient's status is best made by study of the medical history, cardiac classification, and physical findings rather than the interpretation of the electrocardiogram.

BENJAMIN G. P. SHAFIROFF, M.D.

Experimental Study of Fatal Pulmonary Embolism (Contributo sperimentale allo studio dell'embolia polmonare mortale) F. URSO and G. TROIA *Arch ital chir*, 1949, 71 127

The authors produced pulmonary embolism in dogs by injecting 15 cgm of marble dust per kilogram of body weight. The particles were homogeneous and measured 150 microns, and they were injected in 10 c.c. of physiological solution. Death resulted in 51 per cent of the dogs in from 2 to 5 minutes without any embolus in the pulmonary artery. The particles were found in the peripheral branches by histologic study.

The dogs which did not die immediately were sacrificed and presented the same anatomicohistological picture.

Most likely, death was due to massive reflexes which began in the intima of the arteries and produced first paralysis of the respiratory center and then of the cardiac center (pulmonary shock).

That 49 per cent of the dogs were able to survive is taken to mean that there is a great variation in the intensity of these reflexes in different dogs.

In order to produce massive embolus with obstruction of the pulmonary artery it was necessary to in-

ject 6 gm of marble dust very rapidly into the external jugular vein.

The authors state that the marble dust is not similar to agents causing embolism in human beings since it is harder and less elastic than the usual agents. They believe that it is more irritating. If emboli that were more like those causing embolism in human beings were used, the death rate from peripheral emboli would be much lower.

These findings are in accordance with data from human pathological anatomy which showed that 70 per cent of the deaths due to pulmonary embolism are caused by mechanical obstruction of the pulmonary artery by massive embolism. The remaining 30 per cent are caused by small peripheral emboli.

LUCIAN J. FRONZUTI, M.D.

## ANTISEPTIC SURGERY, TREATMENT OF WOUNDS AND INFECTIONS

Studies on Burns The Effect of Heparin on the Circulating Blood Plasma and Proteins in Experimental Burns E. MEREDITH ALRICH *Surgery*, 1949, 25 676

Previous studies showed that when an animal is heparinized following experimental burns less swelling occurs in the burned area. Furthermore, it was demonstrated that lymph can be collected from a burned area by cannulization of a lymph vessel for a longer period in an animal which has received heparin than in animals not so treated. Because of these observations it was postulated that heparin, by preventing the coagulation of plasma lost into the tissues and thereby allowing it to return to the general circulation by way of the lymphatics, might decrease the amount of edema fluid in the traumatized area.

To study the effects of heparinization after experimental burns on the plasma volume and proteins, dogs were given a standard burn by immersing their hindquarters in water at 75° C for 5 seconds. Seventeen animals then received 10 mgm of heparin intravenously and 10 mgm subcutaneously each hour for 8 hours. A control group of 6 animals received no heparin. Five of the animals in the experimental group died within 30 hours after burning, presumably from the effects of overheparinization. Plasma volume, protein, and hematocrit determinations were made on the animals at standard intervals throughout the experiment. The results indicated a greater loss in plasma volume and plasma protein following heparinization during the first 12 hours after burning as compared with the nonheparinized animals. The reverse was found to be true in the period from 12 to 30 hours after burning. The early greater loss of plasma (both volume and protein) and its more effective recovery are explained by the absence of coagulation of the exudate in the tissues and in the lymphatics following heparinization. The

authors state that the high mortality in the heparinized group precludes the use of heparin at the present time in the treatment of clinical burns

C FREDERICK KITTLE, M D

**Some Observations on the Treatment of the Dorsal Burn on the Hand** FENTON BRAITHWAITE and J WATSON *Brit J Plast Surg*, 1949, 2 21

Severe burns of the dorsal surface of the hand, if improperly treated, may cause crippling deformities. The initially deforming posture, assumed by the patient to achieve maximum relief from pain, may become a fixed one as the persistence of the burn slough gives rise to infection, suppuration, edema, and fibrosis. The individual changes in each of the tissues and structures of the back of the hand are listed and discussed concisely by the authors.

The skin contracts as it heals by scarring. This contracture draws the metacarpals together, ultimately displacing the heads of those for the index, ring, and little fingers dorsalward and thus producing a convex palmar surface of the hand. The proximal displacement draws the skin of the dorsum of the proximal phalanx onto the hand and thus hyperextends this phalanx. Contraction and adhesions of the fasciae over and under the extensor tendons obliterate the superficial and deep dorsal spaces of Kanavel and render the tendon complex immobile. The hyperextension deformity shifts the axis of the interosseous tendons so that they increase the deformity instead of initiating flexion of the proximal phalanx. The collateral ligaments of the metacarpophalangeal joints contract and thus block flexion at these joints. The synovium of the joint itself contracts and further aggravates the hyperextension deformity. If the burn causes a loss of the insertion of the extensor tendon into the base of the middle phalanx the delicate balance of flexors and extensors may be lost. The extensors can extend the proximal phalanx and the flexors can flex the middle phalanx, but co-ordinated movement is impossible.

The treatment of an established hyperextension deformity is long and tedious and may be only partially successful. Arthrodesis of the proximal interphalangeal joints in a position of semiflexion is helpful. Prolonged physiotherapy and re-education are essential. If the period of immobility of the hand is very long the motor cortex seems to lose its concept of a patterned integrated movement. The best treatment is prophylactic.

Early cure should consist of complete excision of the burn slough and any granulation tissue present, and the application of a skin graft to cover the whole defect. This eliminates the need for prolonged splinting, although the proximal interphalangeal joints may require individual splinting, which will permit movement at the metacarpophalangeal joints. The best time for the excision of the slough and application of the graft seems to be from 12 to 18 days after the burning. The best base for the graft is the fascia enclosing the tendons.

BENJAMIN I LOUNSBURY, M D

**Recurrent Tetanus (Du tétanos récidivant)** RIVER J PICAUSOT and J RIVIER *Bull Soc Méd Exp Paris* 1949, 65 98

The authors call attention to the fact that in 1946 recurrences of tetanus were observed after intervals of several years without any evidence of reinfection. Three such cases are described.

The symptoms of the recurrent attacks presented no special features. The general symptoms were less marked and rapid generalization was unusual but classic contractures were almost always noted as well as paroxysmal exacerbations suggesting localized tonic-clonic epilepsy. One case illustrated the hepatoglomerulonephritis occasionally observed in tetanus. The course was usually benign, although 1 fatal case was reported (Chavany).

These cases constitute further indication that tetanus does not immunize the organism, and that the effect of antitetanic serotherapy, although powerful, is not lasting. It does not act on the sporular forms which survive in a weakened condition in an apparently cured organism. Some adjuvant cause may serve to activate the spores and thus favor recurrence. It is wise, therefore, to combine serotherapy with active immunization with an toxin.

The 3 patients observed all recovered promptly following the administration of antitoxin, although in 1 case only after an attack of urticaria.

EDITH SCHANACH MOORE

**Tetanus Treated as a Respiratory Problem** AFRAN C TURNER and THOMAS C GALLOWAY *Arch Surg*, 1949, 58 478

The recognition of the importance of respiratory obstruction due to tracheal and pharyngeal secretion in certain conditions and the ability to control it have led to a completely changed prognosis in many diseases. This has been true especially in bulbar poliomyelitis. During the year 1947 no patient with anterior poliomyelitis died at the Evanston Hospital, Evanston, Illinois, although there were 60 cases, 7 of which were of the bulbar type. Five of these required tracheotomy. One patient with myasthenia gravis, an accumulation of throat secretions, and impending asphyxia was treated with rapid relief.

Certain other states would seem to have the same common denominator of respiratory obstruction, anoxia, respiratory weakness, and danger of drowning from aspirated secretion. The authors thought that tetanus, with convulsions under control by curare, would present much the same picture and respond to the same measures. When a patient with severe tetanus came under their care they found, in fact, that she did respond so remarkably to the treatment on this basis that they believed it could be applied to most cases of severe tetanus with satisfactory results. The treatment was found to be relatively simple and seemed, in retrospect, to be so logical and dependable that they believe it should be adaptable to most serious infection with tetanus.

Curare has been used in the treatment of tetanus since 1894, as reported by Cullen. Tracheotomy was

## SURGICAL TECHNIQUE

advised for grave emergencies by Spaeth Isacson and Swenson used a respirator with apparent benefit but without recovery in 1 case of tetanus Tracheotomy was not done So far it has not been found in the literature that the three measures have been combined in any case The authors believe this may be necessary for the reason to be discussed

The combination of the three measures—curare by continuous intravenous drip, tracheotomy, and use of the respirator—is described in detail in a severe case of tetanus and seems to have these definite advantages

- 1 It changed a hazardous treatment requiring unremitting care to a relatively simple, manageable, and easily standardized procedure
- 2 It allowed the use of curare in a latitude of dosage that is comparatively safe
- 3 It guarded against the dangerous period of anoxia
- 4 It by-passed secretions in the upper respiratory passage and permitted aspiration of secretions in the lower airway, and it avoided atelectasis and secondary pulmonary infections due to obstruction

JOHN E. KIRKPATRICK, M D  
**Streptomycin in Nontuberculous Infections**  
 Buxton, R D SIMON, and F R SELBIE *Lancet*,  
 Lond, 1949, 1 729

Streptomycin was given in 67 cases of infection by organisms insensitive to the sulfonamides and penicillin, but sensitive to streptomycin Of these, 44 were cases of urinary infection, chiefly by *Pseudomonas pyocyanea* and *Bacterium coli*, 14 were cases of wound infection, chiefly by *Staphylococcus pyogenes*, and 9 were miscellaneous infections

A short course of treatment with a high initial dose was considered unlikely to give rise to toxic symptoms, and more likely to be effective in preventing the development of bacterial resistance than a protracted course of treatment with low dosage The patients with wound infections were given 4 grams daily for 2 days, and 2 grams daily for 2 more days In urinary infections, the dosage was 3 grams daily for a 4 day course

In wound infections, the results of streptomycin therapy were promising Provided that the wound was freely drained surgically, rapid improvement was obtained In urinary infections, streptomycin is likely to effect a cure in about a third of the cases, unless there is some mechanical obstruction to drainage which produces an inaccessible nidus of infection

Side reactions were encountered in less than a third of the cases, and in only 3, in which there was a severe vestibular disturbance, were they of any significance  
 SAMUEL KAHN, M D

**A Study of Vehicles and Adjuvants for the Sulfonamides and Penicillin**  
 EDWIN J. PULASKI, *Surg*  
 gery, 1949, 25 681

Numerous chemical agents were tested for their activity against gram-negative and gram positive

bacteria, and vehicles were investigated to determine which would hold these bacteriostatic agents in wounds in higher concentrations and over longer periods of time than has been possible An extensive group of compounds were surveyed for bacteriostasis: various acids, salts of acids, alcohols, amides, amines, antibiotics, organic bases, dyes, heavy metal salts, detergents, oxidizing agents, organic mercurials, organic arsenicals, sulfur compounds, phenolic compounds, quinolines, and sulfonamides The effect of these was measured by the zone of inhibition of organisms grown on blood and plain agar The action and efficacy of each of the compounds is discussed Those most bacteriostatic were sodium diacetate, p-chlorophenol, sulfamylon, furacin, and streptothricin The action of these varied, having acetate lowering the pH, p-chlorophenol having a cytotoxic effect, streptothricin interfering with cell metabolism and reproduction, while the actions of sulfamylon and furacin were not clearly understood

Topical antiseptics are necessary when the unlikelihood of securing adequate concentration by parenteral administration exists Various bases were tested for use as a vehicle and of these, one consisting of white petroleum jelly (10.0 per cent), lecithin (0.2 per cent), carbowax 4000 (10.0 per cent), methocel 15 CP (2.5 per cent), (22.5 per cent), and propylene glycol was found most satisfactory  
 C. FREDERICK KITTLE, M D

## ANESTHESIA

**The Pharmacologic Actions of Procaine Given Intravenously as an Analgesic Agent**  
 ROBERT M. ISENBERGER *Anesthesiology*, 1949, 10 343

This article represents a review of the systemic effects of procaine given intravenously Procaine has a special affinity for the sensory components of the nerve fibers because they are smaller (thereby exposing a greater surface area per unit of volume), and because they have a thinner myelin sheath Thus, the differential penetration of procaine occurs with complete blockage of sensation before the transmission of motor impulses is abolished

Used intravenously, this drug produces moderate analgesia, relief of pruritus, and an increased peripheral circulation in a variety of clinical conditions The action appears to be localized to the nerve and blood supply of the affected parts There is some evidence that the metabolites, para-aminobenzoic acid and diethylaminoethanol, retain some of the activity of the injected procaine Toxic reactions depend on the total dose administered, the speed of injection, and the concentration of the solution used When procaine is infused simultaneously with the intravenous administration of pentothal and the administration of curare in the dog, the analgesic, hypnotic, and relaxing action of pentothal and curare seem to be reduced The author has been unable to demonstrate analgesia in dogs from the intravenous administration of procaine in maximum tolerated doses  
 MARY KARP, M D

## INTERNATIONAL ABSTRACTS OF SURGERY

Intravenous Procaine Therapy W J WATT *New Zealand M J*, 1949, 49 127

This article reviews the current literature and records some experiences in the intravenous use of procaine. The method relieves postoperative pain satisfactorily, thus reducing the need for morphine with its attendant respiratory depression and vomiting. As a general anesthetic agent it produces complete freedom from unpleasant aftereffects. It has a particular advantage when used in combination with general anesthetic agents, especially in the prevention of cardiac arrhythmias which occur during cyclopropane anesthesia in thoracic and cardiac surgery. A discussion is given of the pharmacology of the drug and the toxic reactions which might occur with its use.

The following is the author's technique of administration: procaine is made up in from 0.2 to 0.4 per cent concentration with 5 per cent glucose solution. The procaine solution is administered at the rate of 100 drops (6.5 c.c.) per minute until the pain is relieved and then from 15 to 20 drops (from 1 to 1.3 c.c.) per minute to maintain relief from pain.

MARY KARP, M D

Our Experience with Endotracheal Anesthesia with Curare and Artificial Respiration (Unsere Erfahrungen mit der endotrachealen Narkose mit Curare und künstlicher Atmung) KARL MUELLER *Helvetica Acta*, 1948 15 292

For a period of 6 months, the author has used the method of anesthesia described herein in his surgical clinic. He considers it the method of choice for all major intrathoracic and transthoracic operations.

Artificial respiration is assured through airtight intratracheal intubation. No air nor anesthetic is forced into the stomach or esophagus, as occurs in mask anesthesia. The composition of the anesthetic mixture is known and is introduced directly into the lungs. The endotracheal or endobronchial tube permits the accumulated secretions to be sucked out as becomes necessary. The danger of aspiration is reduced to a minimum by means of certain supplementary precautions.

In operations on the lungs the author uses the Trendelenburg position with an inlying intratracheal catheter. The main bronchus on the side of the operation can be blocked off. If it is impossible to use a tampon on account of partial obstruction of a bronchus, the author intubates a main bronchus.

Artificial respiration can be adapted to the surgeon's demands and to the operative condition. The patient must breathe normally because unphysiological and excessive breathing lead to exhaustion of the patient. With artificial respiration, mediastinal flutter and irregular breathing play no part. Air emboli in the lung tissue can be avoided by slow, careful ventilation. For this the author uses oxygen only if one lung or part of a lung is to be removed. Anesthesia in this case is given intra-

venously. By this means the much feared anoxemia is avoided. In such procedures with slow, regular ventilation, whether it be with anesthetic mixture or oxygen alone, one has direct control of the heart action. The pulse rate is dependent upon the respiratory rate.

All striated muscle, except heart muscle, is relaxed by curare. Deep anesthesia is not necessary to block reflexes, e.g., cough reflexes. The patient needs only to be kept in a state of analgesia and amnesia. For this the author uses stichoxydol, a nontoxic, nonexplosive drug, kind to the mucous membrane, and quickly eliminated from the body. The gas is in a concentration practically harmless to the body and does not lead to any great amount of anoxemia. With a concentration of 40 per cent nitrogen monoxide and 60 per cent oxygen analgesia is obtained, with a concentration of from 40 to 75 per cent nitrogen monoxide unconsciousness is obtained. Deep anesthesia occurs first at between 85 and 90 per cent nitrogen monoxide. With the use of curare, the author seldom uses this concentration. Usually a light anesthesia can be prolonged for several hours without danger of pulmonary or other complications. The duration of the operation can be prolonged for a period of 7 hours. The patient usually wakes up with the tying of the last suture. Vomiting and nausea are absent.

After a preoperative hypodermic injection of scopolamine, atropine, and codeine, adults are intubated under a surface anesthesia of 2 per cent pontocaine through the mouth. Intubation under anesthesia allows better control in placing the endotracheal tube and at the same time assures free breathing. In narconal anesthesia (or similar barbiturates) spasm of the glottis occurs and this makes intubation impossible. After avertin preparation in children, intubation is carried out under deep ether anesthesia and this anesthetic is continued during the entire operation, abundant oxygen being supplemented. After intubation in adults, the author uses from 5 to 10 c.c. of narconal during induction and basal anesthesia. In old patients and those in poor general condition, narconal is withheld and the blood pressure readings are recorded.

In the system of the artificial respiration apparatus, a carbon dioxide absorber is used, it is arranged in a sliding pendulum fashion, the so called to and fro method.

By light pressure on the rubber respiratory balloon, the anesthetic mixture is forced into the lungs. On account of the elasticity of the balloon after release of the pressure on it, the unused residual mixture is returned after it has given off its carbon dioxide in the absorber. The used anesthetic in the lungs will then be replaced by a fresh mixture conducted through the apparatus. By means of this apparatus, an accurate regulation of oxygen nitrogen monoxide mixture is assured. This method is very economical. The same mixture can be used in the lungs several times. Furthermore, it retains



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its moisture and is warmed by the heat of the absorber through carbon dioxide absorption. In this way another cause for postoperative lung complications is avoided.

After carrying out intubation and suction of any secretions present, a continuous drip is led through a cannula into the long saphenous vein. This consists of physiological salt solution with an addition of from 5 to 10 c.c. of coramine to 1,000 c.c. of the solution. This tends to prevent the blood pressure depressant effect of narconumal and pentothal during induction and basal anesthesia. During the entire period of anesthesia, the fluid concentration of the blood is compensated for and the blood pressure is kept as constant as possible by the use of blood transfusions. During induction with narconumal or pentothal, the patient is given only oxygen and then nitrogen monoxide is slowly added until a light cyanosis develops. Curare is given intravenously through a skin incision, in the form of intocostarin, corresponding to tubarin. The author prefers intocostarin as this drug is the weaker of the two and the danger of overdosage is less. Tubarin is 3 times as strong as intocostarin. Ether intensifies the effect of curare. If the patient's respirations cease, the oxygen content of the anesthetic mixture is increased until the patient is in a state of light anesthesia. If necessary the patient is allowed to wake up, when a state of analgesia and amnesia exists.

The author is certain that pupillary reflexes are obtainable during the entire operation. Constant control of the blood pressure and pulse rate are absolutely necessary. The patient's color and appearance are not authentic measures for judging his condition. In spite of a rosy appearance, the patient may be in a state of anoxemia which may prove fatal. Blood pressure and pulse recordings are taken every 5 minutes. If the blood pressure drops and the pulse rate increases or if a hemorrhage occurs during the operation, the oxygen content of the anesthetic mixture is increased or oxygen alone is given. Immediately physiological salt infusion with coramine is given. As indicated, blood transfusions are given if there is considerable blood loss. With the tying of the last suture the patient awakens. Nausea and vomiting have not been observed. Patients seem well, but tired. There is no state of shock. The patients may cough after the endotracheal tube is removed. After intervention in cases of lung abscess or bronchiectasis, complete suction of the bronchial tree with the aid of a bronchoscope is recommended.

With this form of anesthesia, a 7 hour esophagotomy was performed. Of 45 patients operated upon, 6 were over 50 years of age and 4 were over 60 years of age. The greatest amount of intocostarin used in a case in which the operation lasted 5 hours and the weight of the patient was 67 kgm was 28 c.c. Prostigmine was used very rarely as an antidote for curare. No more curare than was necessary was

given. If apnea was desired, then the carbon dioxide content in the blood was lowered by hyperventilation so that the respiratory center was not stimulated. Anesthesia was prolonged by a small amount of pentothal for its immediate and brief acting characteristics. Spontaneous breathing occurs when the absorber is removed.

Tamponade of a main bronchus was carried out 4 times. In 2 patients aspiration was performed during the operation on the lung. In 1 case a large undiagnosed lung abscess emptied itself spontaneously and suddenly, so that the patient died 4 days later from a subsequent bronchopneumonia. Another aspiration was without grave consequences. In all of the other cases the postoperative course was uneventful as far as the anesthetic was concerned.

From his experience in these cases, the author concludes that his method of endotracheal anesthesia with artificial respiration and curare gives good results in chest surgery and the experience gained will serve as a sound basis for further developments.

BLACKWELL MARKHAM M D

**Anesthesia for Thyroid Surgery** STANLEY ROW-  
BOTHAM *Proc R Soc M, Lond*, 1949, 42 115

From the anesthetist's point of view, there are two types of thyroid disturbance in which thyroidectomy is indicated: the toxic and the obstructive. This symposium deals chiefly with the former. It is pointed out that the risks associated with operations on thyrotoxic patients have of late years undergone a change because of the introduction of thiouracil. There is a difference of opinion regarding basal narcosis and the anesthetic agents of choice. It is agreed that endotracheal intubation is preferable, and usually it is done by the blind technique after adequate topical anesthesia of the throat and larynx. Nitrous oxide and oxygen is favored, and Hewer advises infiltration of the neck with a 1 to 500,000 solution of adrenalin in normal saline to provide an ischemic field. The use of curare to inhibit the laryngeal reflex is suggested by Forrester.

In respiratory obstruction, a tube is always necessary and no premedication except atropine is given. The throat and larynx are sprayed with 10 per cent cocaine, and anesthesia is induced by pentothal followed by cyclopropane oxygen. Intubation is performed by direct vision.

MARY FRANCES POE, M D

**Continuous Peridural and Caudal Analgesia in Obstetrics** JOHN G P CLELAND *Current Res Anesth*, 1949, 28 61

The desire to produce continuous obstetrical anesthesia which could be attended by a nurse led Cleland to install two indwelling catheters placed peridurally. The first was inserted into the peridural space at the eleventh to twelfth thoracic level so as to obtain anesthesia sufficient to obtund uterine pain without muscle paralysis. The second was placed in the caudal canal to obtund pain at the



outlet without changing the normal resistance which produces rotation. Small repeated doses (from 8 to 12 c.c.) of intracaine which were injected into the upper catheter controlled the pain of dilatation, the injection of intracaine into the caudal catheter was reserved for the second stage of labor and repair.

The author's discussion of physiology is quite clear. The procedure requires the hand of an expert, but the results justify mastery of the technique.

MARY KARP, M D

#### SURGICAL INSTRUMENTS AND APPARATUS

**The Use of Fluorescein in Estimating the Blood Flow in Pedicled Skin Flaps and Tubes** WILFRED HYNES and ALASTAIR G. MACGREGOR *Brit J Plast Surg*, 1949, 2: 4

A wheal fluorescence test is described for testing the circulation in tubed skin flaps which are to be moved in stages from one place to another. The test is carried out on the seventh day after each stage of the operation and, if negative, is repeated every 3 days. As soon as it becomes positive it is safe to proceed with the next stage of the operation. By this procedure it is often possible to shorten considerably the intervals between the stages of the operation, and thus to minimize the formation of scar tissue under the flap and to divide pedicles with confidence.

An ultraviolet lamp is used, which is appropriately filtered so that the radiation is in the range 3130Å to 4070Å, with 95 per cent of the radiation concentrated at 3650Å. Since ointments and other materials containing a paraffin base fluoresce readily, a preliminary inspection of the skin tube is made with the ultraviolet lamp. Any areas of fluorescence are cleaned with an ether swab.

A rubber-shod intestinal clamp is placed firmly across the end of the tube which is to be divided. A series of intradermal wheals is raised at intervals of 2 to 4 cm along the length of the skin tube by injecting a 1 to 1,000 solution of histamine phosphate. The most proximal wheal is placed at a point on the pedicle, the circulation of which is being tested, the most distal wheal lies 1 cm from the intestinal clamp. Ten cubic centimeters of 5 per cent solution of fluorescein are injected and the room is darkened. Fluorescence under the ultraviolet light is detected at the proximal wheal, and its subsequent course along the tube is noted.

A positive test consists of fluorescence of all the wheals, although at the proximal end of the tube the wheal is brighter than at the distal clamped end.

In an earlier report, one of the authors (Hynes) had described an atropine absorption test for determining the blood supply of skin flaps and tubes. This test consists of injecting 1/25 to 1/50 gr of atropine (dissolved in 0.2 c.c. of water) into the fat of the flap. The injection is made 1 cm from an intestinal clamp previously applied at one end of the flap. Absorption of the drug into the general circulation, manifested by tachycardia, dryness of the mouth, and paralysis of visual accommodation, gives the measure of the blood supply of the injected area.

Both tests were used in a small series of cases in which skin flaps were moved in stages. From a qualitative point of view both tests seemed equally sensitive, but the authors prefer the atropine test for routine use in view of its greater simplicity. The fluorescein wheal test is reserved for patients who already have a tachycardia, or for those in whom two flaps are to be tested simultaneously.

THEODORE B. MASSELL, M D

# PHYSICOCHEMICAL METHODS IN SURGERY

## ROENTGENOLOGY

**Hemosiderosis of the Lung Due to Mitral Disease**  
EUGENE P. PENDERGRASS, EDWIN L. LAME, and  
HERMAN OSTRUM *Am J Roentg*, 1949, 61: 443

Hemosiderosis of the lung associated with mitral disease is a rare entity. Most of the cases reported to date have appeared in the European literature. Autopsies have been performed in only 17 cases.

Hemosideric nodules in the lungs are demonstrable in chest roentgenograms. These nodules may primarily suggest the diagnosis of miliary tuberculosis or pneumoconiosis. Hemosiderosis may be exogenous or endogenous. Exogenous hemosiderosis is seen in arc welders who inhale ironladen fumes, in silver finishers working with iron oxide, and in grinders of ferrous metal not exposed to silica. The endogenous hemosiderosis is generally found in those who suffer mitral disease with severe anemias, hemorrhage, hemosideric nodules, etc. Although difficult to differentiate, primary differential diagnosis should be made between miliary tuberculosis and pneumoconiosis.

The author presents 4 autopsied cases, all showing a chronic passive congestion, in 2 cases autopsy revealed a hemosiderosis and in the other 2, a siderofibrosis. Pathologic studies show the nodular aggregates demonstrable with the naked eye and identified as hemosiderous deposits. Iron pigment in these nodules vary in size from 1 to 3 mm in diameter. The size, distribution, and shape of the nodules govern the degree of roentgen visualization. These "focal clumps" of hemosiderin and macrophages, with or without fibrosis which are demonstrable in the cause fine nodulations which are demonstrable in the roentgenograms. These phenomena occur rarely in the presence of a chronic passive congestion in patients dying of rheumatic mitral disease. However, the condition may occur in patients with mitral disease who are living comfortably without clinical evidence of congestion of the lungs. The authors report 2 such cases in the living. One patient was followed for 13 years and the other, for several months.

**Accuracy of Roentgen Diagnosis of Benign Gastric Ulcer**  
C. A. STEVENSON and C. W. YATES *Radiology*, 1949, 52: 633

Experience has shown that a certain number of gastric lesions diagnosed roentgenologically as benign ulcer prove later to be carcinomatous. The diagnostic error is given in the literature as varying between 5 and 20 per cent.

The authors studied the extensive medical literature dealing with benign gastric ulcer and its relationship to gastric carcinoma, and gathered leading opinions concerning the various factors involved. A brief summary of these opinions is given in the first part of the article.

A series of 117 consecutive cases of gastric ulcers diagnosed roentgenologically by various examiners at the Scott and White Clinic of Temple, Texas, is analyzed. In 6 of these (5.12%) the ulcers were located in the upper third of the stomach, in 55 cases (47%) the ulcers were located in the middle third, and in 56 cases (47.86%) the ulcers were located in the lower third.

An adequate follow-up was possible in 91 cases for periods ranging from 10 months to 20 years. In 6 of these the lesions were found to be malignant at operation performed within from a few days to 6 months after the roentgen diagnosis. In 2 of the 6 cases the roentgen report suggested the possibility of carcinoma because of the large size of the ulcer. These 6 cases represent an error of 5.1 per cent in the series of 117 cases, or a corrected error of 6.6 per cent among the 91 cases in which adequate follow-up was possible.

The authors give short résumés of the 6 cases and use the respective roentgenograms for illustration. Even after reviewing the roentgenograms and fluoroscopic findings, it was impossible to differentiate between the ulcers erroneously diagnosed as benign and the proved benign ulcers.

The conclusion is therefore reached that in a small percentage of cases a differential diagnosis between gastric ulcer and early carcinoma is impossible by roentgenologic examination. It may be wise to operate immediately in cases of all roentgenologically diagnosed benign gastric ulcers in the hope of early removal of the carcinoma in the erroneously diagnosed cases.

T. LEUCUTIA, M.D.

**Roentgenologic Studies of the Abdominal Aorta in Individuals over 50 Years of Age, as an Aid to the Differential Diagnosis Between Benign and Malignant Ulceration of the Stomach**  
A. ELKELES *Brit J Radiol*, 1949, 22: 280

The relationship of benign gastric ulcer and carcinoma of the stomach to arteriosclerosis has been investigated by roentgenographic examination of the abdominal aorta in individuals over 50 years of age. The abdominal aorta was chosen as the test area since the stomach derives its vascular supply from the celiac axis and, according to postmortem statistics, this vessel is the earliest and most frequent site of general arteriosclerosis.

Benign gastric ulcers were accompanied by the highest incidence of calcification of the abdominal aorta (70%). Calcification of the abdominal aorta was present in 14 per cent of duodenal ulcers and in 23 per cent of control cases. A surprisingly low incidence of calcification of the abdominal aorta (1%) was found in patients with gastric carcinoma. These observations confirm previous reports, based upon findings at autopsy, which showed that gastric ulcer is frequently associated with generalized ar-

teriosclerosis and that arteriosclerosis and malignant neoplasms are, to some extent, mutually exclusive. The roentgenographic detection of a calcified aorta may thus be an aid in differentiation between benign and malignant gastric ulcers

ALLAN K. BRINEY, M D

**Response of the Gall Bladder to Benassi-Vitale's Water Test in the Course of Cholecystography after Gastric Resection** (Il comportamento della colecisti dopo prova idrica di Benassi Vitale durante colecistografia nei resecati gastrici) ROSARIO CORSEI *Radiol med*, Milano, 1949, 35 352

Benassi and Vitale have noticed that after the administration of water there is a slight reduction in size of the shadow cast by the gall bladder in cholecystograms. They concluded that water passing the duodenum slightly stimulates contractions of the gall bladder. Not only does the size of the shadow diminish but its intensity increases in a manner similar to that observed after the administration of fats. Probably the gastroduodenal stimulus created by the ingestion of water has a choleric effect and mobilizes rapidly the contrast medium within the intrahepatic biliary ducts. Concurrently, the tonus of the muscular layer of the gall bladder, the so-called peristole, is augmented.

The author employed the water test in patients who had undergone a gastric resection and found that the results were identical with those obtained in individuals with an intact alimentary canal.

This hepatocholecystic test is particularly valuable when the cholecystography fails to visualize the gall bladder, because a defective hepatic choleresis can be differentiated from an impairment of the ability of the vesicular mucosa to concentrate bile.

The integrity of the efferent lymph vessels of the gall bladder and the pancreatoduodenal lymph glands, in addition to the regulatory autonomic nerves, plays an important rôle in the terminal phase of the phenomenon. The rapid absorption of the water leads to an increase of the concentration of the bile and thus intensifies the shadow.

The author concludes that the oral administration of 200 c c of water in the course of cholecystographic studies serves as a test of the peristolic reflex of the gall bladder.

JOSEPH K. NARAT, M D

**The Roentgenologic Picture of Nonspecific Pyelitis** (L'immagine radiologica delle pieliti aspecifiche) PAOLO BIONDETTI *Radiol med*, Milano, 1949, 35 191

The 138 cases here reported were observed in the period from 1936 to 1948, at the Civil Hospital in Venice, Italy. From this material were excluded all cases associated with stone and with tuberculosis. In the few cases in which the outlines of the calyces were vague and foggy in outline so as to suggest tubercular involvement, the urinary search for Koch's bacillus was always negative and the condition was ascribed to congestion and swelling of the mucosal lining of the calyces involved. In 14 per cent of these

cases the descending pyelograms were always normal, in 40 per cent the picture indicated a dilated condition of the structures of the renal pelvis, and in 45 per cent the findings suggested a contracted state of the renal pelvic musculature.

The functional state of the kidney did not seem to have anything to do with the pyelographic findings, the dye appeared at the same time on both sides and the involved kidney did not afford any positive evidence of either oliguria or polyuria. Neither did the phase of the infective process seem to exercise any control on the findings, as the contracted and dilated states of the pelvis were more or less indifferently distributed in the early acute phases and in the late, more chronic, stages. The deciding factor as to whether the pelvis reacted to the infective involvement by hypertonic contraction or by hypotonic dilatation seemed rather to be the severity of the infection itself. The renal pelvis was usually contracted in the absence of fever and dilated when the process was so severe as to show a toxic febrile response. Thus, the dilated picture in the pyelogram was a fairly reliable indication of a severe infection.

On the other hand, the presence of contraction did not necessarily indicate the presence of a mild infectious involvement, in fact, the contracted condition was seen in about 15 per cent of cases in the apparently healthy, contralateral renal pelvis. It was also observed in the chronic conditions of the renal pelvis and in patients in whom the pelvis on both sides seemed to be perfectly normal. A mild residual cystitis seemed to be sufficient to produce the picture of renal pelvic contraction, indeed, disease of the neighboring organs, and even a hypertonic constitution in an otherwise healthy individual seemed sufficient to produce it. Of course, in the constitutionally hypertonic subject the contracted state of the renal pelvic structures tended to be equal on both sides, and the contracted condition tended to be more uniform, that is, there was less preference for the ampulla than for the calyces, or for one or more calyces than for the others in the same kidney. Nevertheless, the inequality of contraction is not a reliable indication of the seat of the pyelitis—whether it is unilateral or bilateral.

Ultimately considered, however, these contracted states are seen most often in combination with pyelitis, and a more severely contracted side does suggest that the process may be limited to that side. When considered with other clinical and laboratory methods of urinary examination the contours of the pyelographic shadow are thus of some value in diagnosis and of much greater value in judging the efficacy of treatment.

JOHN W. BRENNAN, M D

**On the Roentgen Aspect of Prostatic Atrophy** NILS P. G. EDLING *Acta radiol*, Stockh., 1949, 31 145

The author believes that the roentgen findings of widening of the prostatic urethra, and a small or absent shadow of the colliculus is characteristic of prostatic atrophy as seen on the urethrocytogram.

# PHYSICO-CHEMICAL METHODS IN SURGERY

In marked cases, the volume of the urinary bladder may be greatly diminished and there is incontinence of both the internal and external sphincters. In less marked cases there may be only widening of the prostatic urethra above the colliculus, without shrinking of the colliculus, or incontinence.

Five case illustrations are presented

VERN W. RITTER, M.D.

**Recent Advances in the Roentgen Diagnosis of Pathologic Conditions of the Spine** (Recentes aquisições no diagnóstico radiológico da patologia da coluna vertebral) HENRIQUE BASILIO *Rev. bras. cirurg.*, 1949, 18 63

The value of the standing position in x-ray studies of the spinal column is discussed by the author. The erect position of the patient offers advantages from the physiologic and technical point of view, especially if one is dealing with scoliosis, spondylolisthesis, or a hernia of an intervertebral disc. The importance of films taken in an oblique direction, particularly in patients with spondylolisthesis, is emphasized by the author. He highly recommends De Seze's new method of myelography, called discoradiculography, in which a new opaque medium (discolipiodol) is employed.

JOSEPH K. NARAT, M.D.

**An Arteriographic Demonstration of Collaterals Between Internal and External Carotid Arteries** F. MARK *Acta radiol.*, Stockh., 1949, 31 155

A collateral circulation between the external and internal carotid arteries has long been described by anatomists, but this is believed to be the first time it has been described in the literature dealing with intracranial angiography. A brief and partial review of the anatomical and pathologic literature describing this collateral circulation is presented. The anastomosis between the two is usually by way of the ophthalmic artery, either from the internal maxillary artery to the anterior branch of the middle meningeal artery and thence via the lacrimal artery to the ophthalmic artery, or from the external maxillary artery via the angular and posterior nasal artery to the ophthalmic artery.

Two cases of thrombosis of the internal carotid artery (bilateral in 1 case) are reported. In both patients a collateral circulation between the external and internal carotids by way of the ophthalmic artery was demonstrated by cerebral angiography. Three illustrations are presented, which show an absence of dye in the internal carotid above the thrombosis, and yet in each case the ophthalmic artery is visualized as leading to the carotid siphon and the middle cerebral artery.

The existence of this collateral circulation may be responsible for failures of carotid ligation in cases of arteriovenous aneurysms in the cavernous sinus, and in cases in which ligation of the internal carotid is carried out because of an arterial aneurysm.

JOHN W. HOPE, M.D.

**Cavity Form of Pulmonary Neoplasm** FRANK ISAAC and RICHARD E. OTTOMAN *Radiology*, 1949, 52 662

After stressing the importance of early diagnosis, the authors briefly review the literature on the cavity form of bronchogenic carcinoma. Based on autopsy material, its frequency is given as varying between 12 and 50 per cent.

Experience shows that the tumor which is more apt to lead to cavitation is the circumscribed, rounded type rather than the infiltrating, stenosing type. The former usually is located in the periphery of the lung, whereas the latter is encountered in the main bronchus. The cause of the cavitation is sought in the inadequate blood supply to the central or deeper portions of the rapidly growing tumor. It is interesting, however, that the condition occurs almost exclusively in primary carcinomas. Metastatic tumors can grow in the lungs to a very large size without showing signs of breaking down. Thus, it appears that infection also plays an important role. It is the authors' opinion that compression of the smaller bronchi within the tumor takes place first, with bronchiectasia distal to the compression. This leads to accumulation of secretions, infection and, finally, necrosis.

There are no characteristic signs by which cavity pulmonary neoplasm can be recognized clinically.

Roentgenologically, the lesion often resembles infected fluid cyst, pulmonary abscess, or ulcerating tuberculosis. The cavity frequently is eccentric and the contours of the inner wall have an irregular, ragged or "bumpy" appearance, corresponding to the irregular tissue necrosis within the tumor. This is especially well demonstrated by laminagraphy.

The authors report 5 cases and use typical roentgenograms and laminagrams to illustrate the salient points. In 3 of the 5 cases the diagnosis was made on the basis of the "bumpy" character of the cavity wall. The authors emphasize the importance of this sign but do not claim that it is pathognomonic. In the fourth case the diagnosis was quite obvious because of the destruction of the adjacent ribs. In the fifth case the diagnosis was not made during the lifetime of the patient.

T. LEUCUTIA, M.D.

**Probable Cyst of the Pericardium Associated with Disturbances of the Cardiac Rhythm** (Probabile cisti del pericardio associata a turbe del ritmo cardiaco) ADRIANO ASCARELLI *Radiol. med.*, Milano, 1949, 35 259

The author reports the case of a woman of 33 who developed attacks of palpitations which occurred especially with changes of position and were more frequent and more severe during menstruation and at times of fatigue and overwork. Roentgen examination of the chest revealed a shadow applied to the right side of the heart and presenting transmitted pulsations; the heart was only slightly displaced to the left and was not enlarged; the shadow was unrelated to the diaphragm but was closely connected with the anterior thoracic wall which, how-

ever, showed no bone lesions. The phenomenon of Jansson was not observed. The diagnosis was probable cyst of the pericardium, on the right side.

Cysts and diverticula of the pericardium are very rare and their course is prolonged and benign, which makes the diagnosis difficult. Jansson has reported a sign which he thinks is pathognomonic: the diverticular mass is vertically elongated by deep inspirations and shortened by expirations, especially when the patient is lying down. However, this is also observed in solid tumors of the mediastinum and the heart. The sign has a positive value, but its absence does not impair the diagnosis.

Although the unification of cysts and diverticula is justified from the clinicoroentgenologic point of view, there are criteria of differentiation from the anatomopathologic point of view: cysts do not communicate with the pericardial cavity and they contain more fluid than diverticula. However, by involution of their pedicle, diverticula may lose any communication with the pericardial cavity, which makes their differentiation from cysts difficult.

Pericardial cysts are subdivided into congenital, dermoid, lymphangiomatous, and inflammatory types. Pericardial diverticula are subdivided into properly called diverticula and hernias of the serosa. It is not always possible to distinguish roentgenologically between congenital and acquired cysts and between diverticula and hernias. Both cysts and diverticula may be single or multiple. Distinction between cysts and diverticula is possible only on anatomic examination, and not always then, therefore, the two disorders are clinically and roentgenologically united under the term of pericardial diverticula.

Subjective symptoms may be absent or consist of slight disturbances in the precordial region, oppression, stitches in the homolateral arm or shoulder, sometimes asthenia, dyspnea, cough, and fever. Objective symptoms consist of hypophonesis, a paracardiac shadow fusing with that of the heart, sometimes external fistula, and increased venous pressure because of an obstacle to the emptying of the caval veins. The clinical course is prolonged, periods of disturbances alternating with periods of well being. The prognosis is good.

Roentgenologically, the diverticula usually appear as opaque formations issuing from the contour of the heart and having an oval, semicircular, or, sometimes, polyhedral or polylobal form. More rarely they look like a pendulous, pyriform sac, with the inferior pole in the erect position. Their volume is very variable and remains constant after the first period of development. They are on the right side in 73 per cent of the cases and in the anterior mediastinum in 93 per cent. Their opacity is usually less intense than that of the heart and is practically homogenous. Pulsations are sometimes absent altogether, sometimes the transmitted pulsations are rhythmic but vary from case to case.

Differential diagnosis must be made from aneurysm of the cardiac wall, tumor of the heart and

pericardium, echinococcus cyst, left and right megacyst, persistence of the duct of Botall, intra-pericardiac and extrapericardiac aneurysm of the ascending aorta, mediastinal lymphogranuloma and lymphosarcoma, benign tumor of the mediastinum, and dermoid cyst.

In the reported case there were attacks of disturbance of the cardiac rhythm connected with sudden changes in the position of the body; these are consequently paroxysmal and postural arrhythmias. The electrocardiograms allowed the conclusion that the rhythmic center of the heart was constant and that the tachycardial crises were of sinus origin, i.e., a paroxysmal tachycardia of nonotopic site (node of Keith and Flack). As to the short duration of the crises, the sudden changes of position probably produced oscillations in the cyst which sent an impulse to the contiguous cardiac tissues. The venous pressure increased suddenly but temporarily on cessation of the stimulation, hence, the sudden but transitory tachycardia. RICHARD KEMEL, M.D.

#### Some Observations upon the Radiology of the Small Intestine in Old Age. H. J. JUNGSMANN and L. COSIN. *Brit J Radiol*, 1949, 22, 325

During routine gastrointestinal examinations for suspected peptic ulcer in old people, the authors noted changes in the roentgen pattern of the small intestine which appeared to be pathologic although there were no referable clinical symptoms. This prompted a systematic study of the small intestine in patients between 70 and 90 years of age.

The usual barium follow-through method, as modified by Ross, Golden and Chamberlin, was adopted. There was no special preparation and the patient's last meal was given 9 to 12 hours before the examination. The barium meal consisted of 4 oz. of pure barium sulfate suspended in from 4 to 5 oz. of normal sterile saline solution, so as to avoid the possibility of allergic reactions. Serial roentgenograms were made after 15 minutes, 45 minutes, 1 hour and 45 minutes, 2 hours and 45 minutes, and 4 hours. A preliminary lateral roentgenogram of the abdomen was taken to ascertain the degree of calcification of the abdominal aorta.

First, 8 normal young adults, 7 women and 1 man, were examined. The findings in this group corresponded very closely to those described by Ross and Golden.

The second group consisted of 18 males between the ages of 70 and 91 years. In these, very great variation from the normal was observed. Whereas the transit time of the barium through the small intestine was unaffected, the most important abnormalities concerned the alteration in intestinal tone. In 11 cases there was a definite increase in the tone involving either the midregion alone (distal jejunum and proximal ileum), or the midregion and the terminal ileum. The hypertonus appeared 1 to 2 hours after the meal and passed off during the later stages of the examination, but in 3 cases it persisted throughout the examination. Hypotonus was

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found in 3 cases. Segmentation or scattering was noted in 15 of the 18 cases. Three cases showed a marked hyperspasticity during the whole of the survey. The abdominal aorta was calcified in 14 cases.

The authors state that the roentgen findings observed in the small intestine of old people correspond completely with those Ross Golden described as typical of "nutritional disorders." However, the patients of Golden had symptoms referable to the gastrointestinal tract, whereas in the series examined by the authors there were no symptoms.

The conclusion is reached that these roentgen abnormalities of the small intestine represent manifestations frequently occurring in normal persons of advanced age. The most likely cause is arteriosclerosis of the abdominal vessels leading to anoxia of the nerve cells of Meissner's and Auerbach's plexus. The authors also advance the hypothesis that an indirect effect may occur through impairment of the nervous control of the gastrointestinal tract by the pontine centers in case of cerebral arteriosclerosis, with its resultant intermittent cerebral anoxia.

T LEUCUTIA, M D

### Medulloblastoma Nonoperative Management with Roentgen Therapy After Aspiration Biopsy

C B PIERCE, W V COME, J BOUCHARD, and R C LEWIS *Radiology*, 1949, 52 621

In view of the unsatisfactory results generally obtained in the treatment of medulloblastomas, the authors propose a modification of the management of these cases in an attempt to avoid the trauma incident to more extensive surgical intervention. After a careful clinical and ventriculographic orientation of the suspected tumor site, a twist drill aspiration biopsy is taken. The diagnosis once established, roentgen therapy is started immediately.

The twist-drill aspiration biopsy is a simple and safe procedure. At the Montreal Neurologic Institute it is performed in the dressing room immediately off the ward. The same instruments and equipment are used as for ventriculography. In addition, a No. 15 brain biopsy needle (using a No. 30 drill) is anasthesia, a twist-drill hole (using a No. 30 drill) is placed halfway between theinion and the mastoid process, just below the bulge in the occipital bone. Biopsy is done only if the intracranial pressure is high. The needle is inserted not to exceed a depth of 7 cm. The entire neurosurgical procedure, including shaving the head, can be done in less than 30 minutes.

The authors performed twist-drill aspiration biopsies in 16 cases of suspected cerebellar tumors, and diagnosed the following lesions: 5 medulloblastomas, 1 medulloblastoma proved at operation, 3 astrocytomas, 2 glioblastomas, 1 abscess, and 1 generalized encephalopathy. In 3 cases the biopsy remained negative, but on subsequent operations a tumor (1 medulloblastoma, 1 astrocytoma, and 1 glioblastoma) was found.

Upon histologic confirmation of the diagnosis, roentgen therapy is instituted. A tumor dose of not

less than 4,500 roentgens is given to the primary lesion in 4 weeks, usually through 3 portals. During the next 2 weeks the entire spinal axis is also irradiated. However, here a tumor dose of only 1,500 roentgens is administered through long narrow fields. During the first 4 or 5 days 100 roentgens only are given daily, to a single port, in order to avoid too much reaction. The following factors are used: 200 kv, 50 cm TSD, and Thoraeus filter, producing a beam with a high value layer of 2.0 mm of copper.

In the 5 cases of medulloblastoma diagnosed by the twist-drill biopsy procedure, the immediate results obtained from roentgen therapy were very impressive. In fact, it is this observation which prompted the authors to publish the present preliminary report. It is too soon, and the number of cases too small, to permit final conclusions.

T LEUCUTIA, M D

## RADIUM

### Reactions to X-Ray and Radium Therapy in the Treatment of Cancer of the Uterine Cervix

DANIEL G. MORTON and JOHN A. KERNER *Am J Obst*, 1949, 57 625

Radiation therapy for cervical cancer, when administered according to the usual technique employed at the University of California Hospital, carries with it a distinct morbidity and mortality. Radium alone produced little significant general reaction, but its use sometimes caused the induction or exacerbation of infection which occasionally was serious enough to cause death. Local destruction of tissue, and fistula formation were not of common occurrence when radium alone was used.

Roentgen therapy often caused a general reaction and, in some cases, produced so much prostration and general metabolic disturbance that death followed. Proliferative changes in the normal connective tissue structures were also observed, with consequent reduction in the vascularity of the tissues.

The incidence of complications was definitely greater in cases in which both radium and roentgen therapy were used, and increased as the dose increased.

Although the percentage of survivals of patients so treated has greatly increased, the incidence of reactions to radiation has also increased. Of 621 patients, 19 died as a consequence of irradiation, and 2 other patients probably died of the effects of radiation.

Bowel obstruction (not due to cancer) occurred in 38 patients, 76 developed colitis, proctitis, or rectal bleeding, and urologic complications developed in 48 of these, hip fractures occurred in 5 patients, and fracture of the symphysis in 1 patient, there were 16 fistulas which seemed to be the result of the radiation. Many of the patients who developed complications following radiation therapy were anemic, or had a fever before the institution of therapy.

The presence of these complications suggests the need for further study of this problem. Efforts to

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determine the radiosensitivity of tumors should be continued, since reduced amounts of radiation might lessen the complications.

Other methods deserving of further investigation or trial are the use of antibiotics, the role of palliative surgery in cases of radionecrosis without recurrence, continuous hospitalization during roentgen irradiation, and the determination of isotope curves for the method of treatment in use so that over-irradiation can be avoided on a more precise mathematical plan.

**Radium Therapy in Carcinoma of the Female Urethra** ROBERT E. FRICKE and JAMES T. McMILLAN. *Radiology*, 1949, 52: 533.

A review of the literature revealed that carcinoma of the female urethra is relatively uncommon. The anatomy and lymphatic drainage of the female urethra are discussed.

Treatment may be divided into four general types: cautery, excision, radium, and roentgen therapy. The smaller the tumor, and the more it is confined to the proximal portion of the urethra, the more applicable are cautery and excision in the treatment.

These methods can be used on the distal part of the urethra only at the cost of permanent incontinence. Radiation therapy may be used in conjunction with cautery and excision, although in the treatment of advanced lesions radiation therapy is usually used alone. Many types of radiation may be used. Radium seeds or radium needles may be implanted into the tumor. Radium tubes may be placed inside the urethra, or they may be placed inside the vagina either in contact with the anterior vaginal wall or in a vaginal applicator.

Thirty-five cases of carcinoma of the female urethra in which treatment with radium was given at the Mayo Clinic, from 1918 through 1942, form the basis of this article. The method of treatment which gave the best 5 year survival was a combination of excision or cautery with radium therapy. The technique of treatment was described in 2 cases. The average age of the 35 patients at the time the diagnosis was made at the Clinic was 52.4 years. A majority of the lesions were squamous-cell epitheliomas. Fifteen (44 per cent) of the 34 traced patients survived 5 years or more after treatment was started.



## MISCELLANEOUS

### CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

**The Role of the Nervous System as a Cause of the Immediate General Symptoms Following a Burn** (Il ruolo del sistema nervoso nell'insorgenza della sindrome generale immediata dopo scottature)  
MARCELLO PEREZ *Polislinico*, sez. chir., 1949, 56 1

The author observed the blood pressure, pulse rate, respiratory rate, and general muscular reactions of morphinized dogs under ether anesthesia during immersion of one lower extremity in water at 90° C for 30 minutes. The blood pressure became slightly elevated and the pulse and respiratory rates became markedly elevated. There were muscular reactions and the dogs whined. Multiple nerve block in the groin with 1 per cent procaine, previous to the burning, failed to modify the findings as compared to the controls. Section of the femoral artery and vein like soft tissues except the general symptoms noted wise failed to prevent the general symptoms in the controls. When, however, the peripheral sympathetic nerves were destroyed with 5 per cent phenol in dogs prepared as in the preceding group, the blood pressure and pulse remained stable. There were no muscular twitchings or whining, and the respiratory rate was elevated slightly.

It was concluded that the immediate general symptoms, following a burn are instigated by afferent nerve stimuli from the burned area and not by any toxin. The persistent moderate elevation of the respiratory rate was explained by a rise in the temperature of the blood returned from the immersed limb.

N CHRISTIAN MEYER, M D

**The Healing of the Wound as a Biologic Phenomenon** SAMUEL C HARVEY *Surgery*, 1949, 25 655

The variables and phases of wound healing are discussed. Wound healing is described as a "reaction to injury" that is such a fundamental biologic phenomenon that neither individual organisms nor the species could continue without its existence. The first phase of wound healing is concerned with the removal or neutralization of nonviable material, while the second has to do with regeneration. Both of these stages are dependent upon the persistence throughout life of primordial or cytoblastic cells of degrees of potentiality which exist in the embryo. These cytoblasts persist to a varying degree and are active throughout life even after growth of the organism has ceased. They serve by multiplication and differentiation to replace cells which have become nonviable or to form additional cells for specific growth in response to additional demand. This course is dependent upon the formation of a suitable "field" of induction.

The reaction to injury, and specifically the healing of the wound is a form of growth that, under normal

and uncomplicated circumstances, is primarily autocatalytic and proceeds at a given velocity. This process takes precedence in the body economy and cannot be materially expedited, however, it can be stopped or delayed by many complicating factors. The function of the surgeon is to establish and maintain the optimum conditions for the healing of the wound by avoiding or controlling the factors that are likely to interfere with this normal biologic process.

In the closed wound, for example, a sutured incision, there is an initial latent or lag period of about 4 days when the tensile strength is no greater than that of the suture material. After this the tensile strength increases rapidly but with a diminishing velocity until it reaches a maximum strength in from 12 to 14 days. These figures were obtained by experimentation on the stomach wall. In the skin, tendon, and bone the secondary phase of increasing strength extends over weeks rather than days.

It is pointed out that rough handling, excessive drying of the tissue, circulatory insufficiency, hematoma, serum accumulation, and unnecessary suture material delay the initial phase of healing. Deficiency of ascorbic acid causes the decrease of tissue collagen and the tensile strength is consequently less. Dietary deficiencies, notably protein, retard wound healing.

C FREDERICK KITTLE, M D

**Blastomycosis Special Study of Jorge Lobo's Variety (Blastomycosis)** Estudio especial da doenca de Jorge Lobo JORGE LOBO *Arq med cir Pernambuco*, 1949, 1 3

Five varieties of blastomycosis are described and are named as follows: Busse-Buschke's, Posadas-Rixford's, Gilchrist's, Lutz-Almeida's, and Jorge Lobo's. The last-mentioned condition, caused by the *Glenosporella lobo*, is characterized by keloid-like nodules which are the only representative of the cutaneous lesions. The micro organism responsible for the condition has double contours, a diameter of from 8 to 16  $\mu$ , and produces colonies in the form of concentric rings. All inoculated animals were found to be refractory.

Several photographs of the patients with these lesions are supplemented by photomicrograms. In 1 case described in detail, sulfadiazine did not produce satisfactory results, which necessitated an extirpation of the lesion.

JOSEPH K. NARAT, M D

**Congenital Dermal Sinuses** LESTER A MOUNT *J Am M Ass*, 1949, 139 1263

Congenital dermal sinuses are due to embryologic failure of the separation of the epithelial ectoderm from the neuroectoderm, which results in a connection between the skin and the central nervous system. Infections may extend down the tube and invade the meninges or central nervous system.



The author reports 5 cases. Two cases resulted in meningitis and subdural abscess. This has been far the most common result of complications in all previously reported cases. The third case, with a thoracic dermal sinus, resulted in an intramedullary abscess of the spinal cord. After drainage of the abscess the patient made a remarkable recovery.

Intracranial abscesses resulting from dermal sinuses have not been reported previously in the literature. The author, however, presents 2 cases in which the sinus started in the occipital area, extended into the posterior fossa, and ended in a cerebellar abscess. Recovery occurred in all cases after surgery.

JACK I. WOLF, M.D.

**Multiple Lipoma-Angiolipomas** KRISTIAN KROHN  
KLEM *Acta chir scand*, 1949, 97: 527

The author presents a résumé of 3 cases of multiple lipoma-angiolipomas and points out the difficulty with which these lesions are differentiated from other benign tumors even after histologic examinations. In one instance the appearance warranted a provisional diagnosis of glomus tumor, the proper diagnosis not being established with certainty until several biopsies had been procured.

This comparatively rare disease consists of multiple subcutaneous tumors of varying size, often painful and generalized in distribution. There appears to be a familial predisposition, and continued recurrence is rare. Microscopically, these tumors present an extremely varied picture of angiomas, lipomas, and combined forms of both. It is suggested that this condition is a variation of multiple lipoma.

DAVID H. LYNN, M.D.

**Malignant Disease in Infancy and Childhood**  
WILFRID F. GAISFORD *Arch Dis Childh*, Lond., 1949, 24: 1

The great advances in prophylactic pediatrics during recent years has resulted in malignant disease assuming an increased prominence as a cause of

death in children. It now ranks higher than some of the commoner infectious diseases of childhood. Between 0.25 per cent and 0.5 per cent of admissions to a children's hospital may be expected to be malignant tumors, in a cancer hospital, between 1 and 2 per cent of the total number of cases are in children. The five commonest sites are as follows: (1) blood, (2) brain, (3) eye, (4) kidney, and (5) bone.

It is not enough appreciated that a large percentage of malignant tumors occur during the first 5 years of life. The sites of malignant tumors in childhood are different from those in adults. Moreover, many childhood tumors are peculiar to this age period and are not seen in later life. Steiner has emphasized that the histologic findings and the clinical progress may be at variance, childhood tumors often exhibit both a dissociation between a malignant histology and a benign clinical course, and tumors appearing to be malignant clinically may show no histologic evidence of malignancy. A third peculiarity is the tendency to rapid progress and wide metastasis in childhood tumors.

Among autopsies of 3,000 newborn infants, Wells (1940) found 4 undoubted malignant tumors, all neuroblastomas. He collected 66 authentic cases from the literature.

Over half of the cases of Wilms' tumor are characterized by progressive swelling of the abdomen in infancy, with the presence of a mass on palpation. Boys and girls are almost equally affected, as are the two sides. It must be differentiated from suprarenal neuroblastoma which may present a similar mass in the abdomen. Recovery from neuroblastoma, even in patients in whom there had been liberal metastasis, has been reported. Retinal gliomas (retinoblastomas) are probably present at birth, and 75 per cent are unilateral. They are not seen after the age of 5 years. The prognosis is good if the affected eye is enucleated before glaucoma has occurred (Wilms reports 12 recoveries among 14 patients).

FRANK B. QUEEN, M.D.

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